Green Remediation & Renewable Energy Development on Contaminated Lands and Mining Sites

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OSWER Center for Program Analysis
Overview of Available Tools

- EPA’s approach to Green Remediation and Renewable Energy on Contaminated Land and Mining Sites
- Green remediation contract toolkit
- USACE MOU Update
- Renewable energy initiative and mapping
EPA is taking a multi-prong approach

- Developing tools, such as GIS-based RE and contaminated lands/mining sites mapping and State incentive sheets
- Model AOCs, comfort letters, PPAs and PLAs for RE development on contaminated lands and mining sites
- Provide technical expertise to assess siting issues such as geotechnical conditions/soil stability
EPA is taking a multi-prong approach

- Outreach and education
- Coordinate with interested parties
- Identify and work on pilot sites
- Measure results
Green Remediation Contract Toolkit
What is it?

- Quick reference guide to determine how to use the contract execution process to encourage the use of innovative approaches (e.g. green remediation technologies and practices) to site cleanup

- Guide EPA staff as they develop procurements to identify where in various contract mechanisms to include requirements or preference for innovative cleanup strategies
Green Remediation Contract Toolkit
What are some of the contract mechanisms covered in this effort?

- Remedial Action Contracts (RAC)
- Emergency and Rapid Response Services (ERRS)
- Superfund Technical Assessment & Response Team (START)
- Environmental Services Assistance Team (ESAT)
- RCRA Enforcement, Permitting and Assistance (REPA)
- US Army Corps of Engineers (USACE) contracts
- Site-specific contracts for Remedial Action
- Others….
Green Remediation Contract Toolkit
Who is the target audience?

- RPMs
- OSCs
- Contracting and Project Officers who support removal action, remedial response, and support services
Green Remediation Contract Toolkit Example
contract mechanism: RAC

- Matrix showing RAC contract process to support the use of innovative/green cleanup strategies
- Provides suggestions for how to incorporate GR language at various stages of the contracting process (e.g., from pre-award process through the contract performance)

<table>
<thead>
<tr>
<th>Pre-Award</th>
<th>Contract performance</th>
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<tbody>
<tr>
<td>• Planning &amp; procurement</td>
<td>• Writing a Work Assignment / Task Order</td>
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<tr>
<td>• Establishing contract type</td>
<td>• General category of consideration</td>
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<td>• Writing the SOW</td>
<td>• RI/FS, RD/RA, O&amp;M</td>
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<td>• Establishing contract terms and conditions</td>
<td>• Reviewing and approving work plans</td>
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<td>• Establishing evaluation criteria and selecting contractors</td>
<td>• Evaluating performance</td>
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<td>• Recognition of contractor performance</td>
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<tr>
<td>Stage of Contract Development</td>
<td>Potential Opportunity</td>
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<tr>
<td>Planning the Procurement</td>
<td>- Get group of RFPs, Project Officers and Contracting Officers together a year before RFPs issued to discuss how to draft contract to encourage innovative strategies. Consider additional conversations with USACE, DOD, and other agencies. Complete notes and share ideas. - Use this team as an advisory group for all pre-award activities, listed below. - Review contracts at other agencies for similar work to see how they are written. Talk to peers at other agencies (USACE, DOD, Interior, etc.) to get ideas. - Prepare new RFP language which suggests recommended innovative strategies that can be used in various stages during the contract activities (WHA, MS, LHA, and QAM). This may be incorporated at the contract level and may also be done at the Work Assignment (WAs/Task Order (TO) level).</td>
</tr>
<tr>
<td>Establishing Contract Type</td>
<td>- Consider performance-based contracts which provide incentives (positive or negative) to performance-based contracts permit contractor to decide on approach. Structure incentives to focus input on use of innovative strategies. Consider use of Award Fee contracts and establish Award. Terms contracts, if the region is willing to commit the resources needed to manage such contracts. - Region has the resources to manage this approach, structure multiple award RAC contracts so contractors compete for work, use of innovative approaches can generate a higher technical score at WAC level. - Make contract feasible for different types of TOs, delivery orders (DOs) or WAs can be issued. Use each type as appropriate for fostering use of alternative approaches to work. If feasible, structure contract to allow for a WAC or TO-specific monetary bonus. Back-end (WAC) work out and the implementation of new technologies. - Consider site-specific contracts where such vehicles will enable and incentivize innovative approaches. (NOTE: It may not be possible in all situations to make these performance-based, since contractor may need to comply with design specifications.) Region wants a revolution of full-service RACs and RAC (FM).</td>
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<tr>
<td>Writing the Contract Document</td>
<td>- Clearly establish requirements in DOD for contractor to consider or adopt innovative approaches where appropriate. - Using Work Breakdown Structure (WBS) build into task to identify areas where using innovative strategies is feasible. Write specific language under each task, as appropriate. (NOTE: This can also be used as a TOBS task.) - Provide an attachment showing possible innovative technologies that can be used in various stages during the contract activities (WHA, MS, LHA, and QAM).</td>
</tr>
<tr>
<td>Stage of Contract Development</td>
<td>Potential Opportunity</td>
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</table>
| Establishing Contract Terms and Conditions | - Provide for reduced burdens on contractor if they utilize innovative approaches (e.g., require them to meet contractual requirements, if possible and appropriate, such as certain reporting requirements). There should be specific terms on these allowances.  
- Protect contractors from legal liability, if possible, when using new, untested technology. (NOTE: UCC must be consulted.)  
- Establish standard reporting requirements for proposed innovative strategies. Include a requirement to evaluate the success of each new strategy.  
- Provide contingencies affecting the exercise of options/periods of performance or increases in levels of effort that address the contractor’s willingness to use innovative strategies (Award Terms Options). | Same as above, plus OIG advice for liability language. | Contracts will have built-in incentives. Contractors will be more willing to take risks; EPA will have data on alternative strategies. |
| Pre-Award Activities (Cont.) | - Require that technical proposals include various approaches for evaluating and utilizing innovative cleanup strategies. Develop evaluation criteria that consider an offeror’s use of innovative technologies. Assign higher scores to contractors who have a proven track record in this area and are willing to continue to try new approaches to the work. You’ve selected, in part, on the contractor’s commitment to environmental sustainability, including the implementation of an Environmental Management System (EMS). Recognize that higher costs may be a result of alternative strategies.  
- Require contractors to fill out Section H of DF 359 to describe their accomplishments and results in the use of alternative strategies.  
- When evaluating past performance, require specific references from officials who have direct knowledge of offerors’ experience with innovative approaches.  
- Use RIRO or other experts who can evaluate innovative approaches as members of RFIs or advice to help evaluate this part of proposal. | Same as above, plus experts for various innovative strategies. | Higher scores will be possible for offerors that have experience, expertise, and willingness to consider alternative approaches. EPA will have a cadre of contractors who are experienced in these areas and willing to take some risks. |
<table>
<thead>
<tr>
<th>Stage of Contract Development</th>
<th>Potential Opportunity</th>
<th>Vibe to work with to develop contract language</th>
<th>Result/Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building Contract Narrative</td>
<td>- Clearly establish a preference for contractors that consider or utilize innovative approaches. Request a section in the contractor’s work plan to demonstrate how the contractor will use innovative technologies such as green/innovation during the various stages of the project.</td>
<td>RPMs are generally responsible for writing WAs, OBSs, and developing the IGDE. The advisory group of RPMs, POS, and OIs to be established could use the resources to help identify the latest innovative strategies.</td>
<td>The individual RPMs will provide the most detailed information and requirements on site level activities and can be used to outline specific requirements or criteria for implementation for the use of innovative cleaning strategies.</td>
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<tr>
<td>Written Milestone/Deal Close</td>
<td>- Request the contractors propose alternative approaches, where appropriate.</td>
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<tr>
<td>Project Costs/ROI</td>
<td>- Request the cycle analysis for various approaches offered, where appropriate.</td>
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<tr>
<td>Project Risks</td>
<td>- Be prepared to modify the statement of work (SOW) feedback, once an approach has been selected.</td>
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<td></td>
<td>- Using a work breakdown structure approach, go through SOW task by task to identify areas where using innovative strategies is feasible. Write specific language under each task, as appropriate.</td>
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<tr>
<td>Risk</td>
<td>- Given flexibility in the contract, develop specific monetary bonus/borrow terms to weed out and implement innovative strategies.</td>
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<tr>
<td>Goal (Quality)</td>
<td>- Call WBS/T to require the use of innovative approaches, like Tandem or optimization, on appropriate tasks related to RIS.</td>
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<td>- Suggest immediate alternatives screening evaluate at least one innovative approach or include additional factors focused on innovation within existing evaluation criteria for all alternatives evaluation.</td>
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<td>- Highlight sustainability or other green requirements as additional factor within the evaluation criteria for priority selection.</td>
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<td>- Require life-cycle cost analysis to include costs impacts of sustainability (energy consumption and waste reduction, increased durability, reduced operations and maintenance requirements, etc.).</td>
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<td>- Require any specific innovative approaches in a &quot;Creative Approach&quot;.</td>
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<td></td>
<td>- Include planning requirements to encourage time streamlining and sustainability.</td>
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<td></td>
<td>- When evaluating systems/project performance and results, require a report on opportunities to include innovative strategies in any system redesign.</td>
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<td></td>
<td>- Amend WBS/Ts, if necessary, in cases where innovative strategy would reduce time or cost, or innovate more protective.</td>
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</tr>
<tr>
<td>Stage of Contract Development</td>
<td>Potential Opportunity</td>
<td>What to watch for in development of contract language</td>
<td>Result of Outcome</td>
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<tr>
<td>-------------------------------</td>
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<td>-----------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
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</tbody>
</table>
| Reviewing and Approving Work Plan | - Evaluate any alternative approaches. Require that contractors state how they plan to use innovative technologies, such as green Remediation, during the various stages of the WA4U, and have them present the pros and cons of utilizing various approaches. They should document additional costs, scheduling impacts, and potential contingencies.  
- Negotiate with the contractor if their approach is not acceptable. Focus on the need for the contractor to be cost-effective and practical when proposing innovative technologies.  
- Evaluate any tradeoffs with traditional approaches before approving.  
- Ensure that the final work plan documents all agreements and understandings in negotiating the contract work while using practical innovative technologies. | RPMs are responsible for reviewing the technical approaches contained in work plans but the FOCOs must be involved in facilitating any negotiations. | Negotiation on technical approach and cost allows refinement and EPA approval of innovative approaches. |
| Evaluating Performance         | - Provide recognition of contractors that use innovative strategies during the annual evaluation of the NHD Contractor Performance System or any other performance evaluation. (There is no separate NHD category for this, but the PO can include this in the overall performance ratings.) If a contractor’s score is borderline between the levels, this may push them into a higher bracket.  
- If the contract is performance-based, measure performance and apply rewards accordingly.  
- If the contract is Award Fee type, evaluate the performance in accordance with established criteria, which can include the use of innovative strategies. (NOTE: Award Fee criteria can be changed unilaterally by the Government for future periods, pursuant to the clause set forth in EP AAR 1532.216-70). | RPMs complete monthly review and PO and COs are involved in annual review. | Financial incentives are persuasive way to encourage innovation. |
| Recognition of Contractor      | - Exercise contract options contingent upon satisfactory performance, which may include willingness to use innovative strategies.  
- Establish an annual Contractor Innovation Award for contractors that implement innovative cleanup strategies on a regional or national basis.  
- Write letters to contractor corporate officers commending them on their use of innovative approaches.  
- Send reports to all contractors on how well the government believes they have done in this area. | RPMs for individual contractor recognition/awards in each Region. National recognition would be granted by advisory group of RPMs, POs, and COs. | Recognition will encourage use and provide reference for contractors’ subsequent bids. |
Green Remediation Contract Toolkit
Next steps

- Finalize contract tool kit for RAC
- Continue to develop tool kit for all contract mechanisms
- Continue outreach on how to use tool kit
In 2008, EPA renegotiated the long-standing MOU with the USACE after many years (1984!).

Includes the following sustainability language

- Section 4.4: “USACE and EPA are committed to incorporate, to the extent practicable, green and sustainable remediation technologies and practices, such as use of cleaner and/or more efficient energy processes, pollution prevention, and cleanup and beneficial land reuse practices that consider the lifecycle of the project, and that are protective of land, water and air resources throughout all phases of the Superfund cleanup process. Through the implementation of such remediation technologies and practices, EPA, USACE, and partners of EPA and USACE intend to further our goals to recycle wastes to the greatest extent possible, minimize or eliminate pollution at its source, and use energy and natural resources efficiently to reduce impacts on the environment. USACE will work with EPA to provide a report on the achievement of these goals at the annual joint EPA/USACE national meetings.”
RE-Powering America’s Land: Siting Renewable Energy On Contaminated Land and Mining Sites

- New Initiative launched by OSWER
- Goal: Encourage, support and facilitate the development of renewable energy production facilities on contaminated lands and mining sites
- Focuses on renewable energy development potential on Superfund, RCRA, Brownfields and Mining Sites
Many Superfund, RCRA, Brownfield, Mining Sites and other blighted properties offer:
- Offer thousands of acres
- Existing infrastructure - transmission lines, roads and railway
- NIMBY issues may be less prevalent
- Adequate zoning

Siting renewable energy on these sites may be a viable reuse option:
- Provides economic value for property that might otherwise lack significant value
- Furthers environmental sustainability by maximizing land use and optimizing renewable energy opportunities
- May have lower overall transaction costs compared to greenfields
- Reduces the stress on greenfields land for construction of new energy facilities
- Provides clean, emission-free energy for use on-site, locally, and utility grid
RE-Powering America’s Land
Benefits of Renewable Energy Development on EPA Tracked Sites

- Approximately 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
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
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- Cleanup goals have been achieved and controls put in place to ensure long-term protection for 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?

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

Wind Energy Potential
- Wind Energy Generation Potential on EPA Tracked Lands
  - 120,379 MW
- In 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
- Shows opportunities to site renewable energy on contaminated lands and mining sites in each state
- Using criteria, such as distance to electric transmission lines, distance to roads, renewable energy potential, and site acreage, we produced over 170 state-specific maps showing renewable energy development potential on EPA tracked sites
- Produced 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
  - Private industry
  - Communities
  - Local, state, and federal energy and environment officials
  - Anyone interested in renewable energy projects on contaminated lands and mining sites
Screening Criteria
Contaminated Lands Mapping

Clean and Renewable Energy Sources
- Biomass: Biopower
  - Residues from crops, forests and mills; methane; urban wood waste and dedicated energy crops
- Biomass: Dry-Mill Corn Ethanol
- Wind: Non-Grid, Community, and Utility
- PV: Non-Grid, Community and Utility
- CSP: Community and Utility
  - Sterling, Trough and Power Tower

Preliminary Screening Criteria
- Availability & quality of solar, wind, biomass
- Acreage
- Distance to electric transmission lines
- Distance to graded roads
- Slope and aspect of property
Renewable Energy on Contaminated Land and Mining Sites

The U.S. Environmental Protection Agency (EPA) is encouraging the development of renewable energy to identify and develop contaminated lands and mining sites that present opportunities for renewable energy development. These options provide information and resources for developers, industries, and those interested in renewable energy development on former contaminated land and mining sites.

Renewable Energy on Contaminated Lands Resources:

- **Renewable Energy Maps and Interactive Fact Sheets**: Maps showing renewable energy development potential on EPA-tracked sites, as well as interactive web-based profiles renewable energy development and contaminated land remediation initiatives in each state, developed in partnership with the American Renewable Energy Coalition.
- **Renewable Energy Interactive Fact Sheets**: Shows renewable energy potential and highlights environmental information as a layer in Google Earth. You can also view more information on the GE site.

To use the Google Earth tool:

- First, make sure you have Google Earth loaded on your computer. You can download Google Earth for free from the web.
- Third, make sure to check the box next to “Run on Google Earth” in Google Earth’s left navigation panel. Doing so will add a new layer of data to the Google Earth map.

Tools for11223

**Tools and Guidance for Mine Site Development**:

- **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 hazardous and coal mine-scarred lands.
- **Good Samaritan Mining Initiative**: The Good Samaritan Mining Initiative is an EPA-wide initiative to accelerate restoration of watersheds and fisheries threatened by abandoned hard-rock mine run-offs encouraging voluntary cleanup by parties that did not own the properties and are not responsible for the properties’ environmental conditions.
- **Assessment Process for America’s Abandoned Mine Lands (APAML)**: Provides a second round of DRI, site classification, assessment, and information provided information about the development of wind energy at former mining sites for.
~ 5.2 million acres of EPA-tracked land are located in an area with the highest solar resource potential
- If developed for utility-scale photovoltaic and concentrating solar power
  → yield an electricity capacity more than 919,000 MW and a GHG emission reduction of approximately 2,169 MMTCO2E

~ 580,000 acres of EPA-tracked land are located in an area with the highest wind resource potential
- If developed for utility-scale and community-scale wind power,
  → it would yield an electricity capacity more than 17,000 MW and a GHG emission reduction of approximately 39 MMTCO2E
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

<table>
<thead>
<tr>
<th>Resource Type</th>
<th>In Service Deadline</th>
<th>Credit Amount</th>
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<tbody>
<tr>
<td>Wind</td>
<td>December 31, 2009</td>
<td>2.00/kWh</td>
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<tr>
<td>Closed-loop Biomass</td>
<td>December 31, 2010</td>
<td>2.00/kWh</td>
</tr>
<tr>
<td>Open-loop Biomass</td>
<td>December 31, 2010</td>
<td>1.00/kWh</td>
</tr>
<tr>
<td>Geothermal Energy</td>
<td>December 31, 2010</td>
<td>2.00/kWh</td>
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<tr>
<td>Landfill gas</td>
<td>December 31, 2010</td>
<td>1.00/kWh</td>
</tr>
<tr>
<td>Municipal Solid Waste</td>
<td>December 31, 2010</td>
<td>1.0e/kWh</td>
</tr>
<tr>
<td>Qualified Hydropower</td>
<td>December 31, 2010</td>
<td>1.00/kWh</td>
</tr>
<tr>
<td>Marine and Hydrokinetic (150 kW or larger)*</td>
<td>December 31, 2011</td>
<td>1.0e/kWh</td>
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- 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
Successes

Former Bethlehem Steel 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 generate 250,000-290,000 kW-hr/yr
  - enough to power about 25 households
  - prevent 250 – 275 metric tons of CO₂ from being released into the atmosphere every year

- Enough power to operate the new on-site treatment plant.
- The treatment of acid-mine drainage will be a zero-net energy operation
- Power generated by the hydro plant will be fed back into the Xcel Energy grid through a net metering agreement and will be used to offset the cost of power usage required for water treatment
SeQuential Biofuels Station in Eugene Oregon (petroleum Brownfields site)

- Installed 244 solar panels on the roof of fueling islands, providing 30 – 50% electrical power for the station
- Installed a "living roof" of 4,800 live plants, growing in five inches of soil on the roof of the convenience store
  - cools the building during the summer
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
Next Steps

- **Mapping tools**
  - State sites
  - Landfill methane
  - Coalbed methane
  - Transmission capacity

- **Partnerships**
  - Continue to develop key partnerships between Federal and State organizations, and private entities

- **Resources**
  - Brownfields funds
  - Office of Solid Waste and Emergency Response (OSWER) – National Renewable Energy Laboratory (NREL) Interagency Agreement

- Document ongoing and future successes

- Technical and Regulatory Guide to Siting REs on Contaminated Lands
Contacts

Contacts for Contract Toolkit

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Stephen Hoffman
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More Information

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

- Further information:  
  cleanenergy@epa.gov
Green Remediation Technology

Solar Panels at Pemaco

Rose Marie Caraway
USEPA Region 9, San Francisco, CA
Pemaco Superfund Site

- Maywood, California, 1.4 acres
- Former custom chemical blender 1950-1991, on site storage of chemicals in drums, UST’s and AST’s
- 1997-EPA removed 29 underground storage tanks
- 1998-1999 EPA installed a soil vapor extraction system and treated 144, 400 lbs of soil

The plant is located approximately 6 miles south of downtown Los Angeles in the City of Maywood. The company operated as a custom chemical blending facility from 1940s until 1991. Hazardous chemicals were stored onsite in 31 underground storage tanks, 6 aboveground tanks, and over 400 drums. Chemicals were delivered onsite via both truck and rail.
Pemaco Superfund Site

- Soil and groundwater contaminated with Chlorinated solvents (TCE) and other chemicals.
- 2005 ROD: Vapor and Groundwater P&T system and Electrical Resistance Heating (ERH) in source zone.
- Enhanced In Situ Bioremediation: stand alone for dissolved phase plume and polish for source zone if needed after ERH Treatment.
EPA conducted a removal in 1997 and Chemicals in tanks included alcohols, xylene, toluene, acetone, hexane, and other volatile organic compounds.
Activities to Date

- 2004 - Remedial Investigation/Feasibility Study
- 2005 - ROD addressing public comments signed
- 2005 - Construction on remedy began
  - Vapor and groundwater well installation
  - Installation of conveyance piping to treatment plant
- 2006 – Design of ERH System
  - Construction of treatment plant
  - Installation of ERH electrodes and temperature monitoring well locations
Activities to Date

- Maywood Riverfront Park completed June 2006
- Feb 2007 EISB Field Pilot
- April 2007 Groundwater Treatment System turned on
- May 2007 Vapor treatment turned on
Activities to Date

- September 2007 turned on electricity to the ERH well field
- April 2008 turned off electricity in the ERH well field after 200 days of heating
- October 2008 sampled “hot soils” in the ERH well field (post-treatment sampling).
“B” zone TCE groundwater plume (~85' to 95' bgs) – extends 1200’ downgradient from site

Shallow Groundwater
(25 - 35 feet below ground surface) shallow plume extends 200 ft to southwest

32 Chemicals of Concern including vinyl chloride, benzene, PCE, TCE, and 1,4 dioxane in shallow groundwater plume extends 1100 feet southwest of site

22 contaminants which include:

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Concentration (ppb)</th>
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</thead>
<tbody>
<tr>
<td>TCE</td>
<td>22,000</td>
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<tr>
<td>Vinyl chloride</td>
<td>780</td>
</tr>
<tr>
<td>Cis 1,2 DCE</td>
<td>14,000</td>
</tr>
<tr>
<td>Acetone</td>
<td>20,000</td>
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</tbody>
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Dimensions of Treatment Building

- The south-facing steel roof is 81’-4” long x 27’-11” wide. The roof pitch is 4:12 and the ridge is 20’ high.
- Collateral load for solar panels is 4.00 LB/SF.
System Design

- Carefully inventory all electrical equipment in your facility
- Determine the power consumption of the equipment and hourly usage within a 24 hour period
- Size a PV system that will match that energy usage based on the number of "peak sun hours per day" for your locale

www.calsolareng.com
Pemaco

- Installed 3.4 kW photovoltaic system on July 3, 2007
- Produces about 5,600 kWh / yr
- Offset about 3.3 tons CO₂ per year
  - 2.5 acres trees
  - 7,600 car miles

Photo of the Pemaco building. It houses the Flameless Thermal Oxidation System and water and soil treatment plant. Maywood, CA in Los Angeles County.
Installation

- 2 sets of Mounting tracks on south facing roof
Installation

- 4 days to install
- 20 solar panels
Installation

- battery backup power will be used for the computers, backup lighting, and the Treatment System in the event of a power failure to keep critical loads operating.
Electrical Control Room
Electrical panel installed inside control room. Xantrax Grid Tie Solar Inverter owner’s manual.
utilizes most power
Energy Usage

Monthly usage of electricity in the treatment plant. Solar energy has already been used by the system.

<table>
<thead>
<tr>
<th></th>
<th>Oct '07</th>
<th>Nov '07</th>
<th>Dec '07</th>
<th>Jan '08</th>
<th>Feb '08</th>
<th>Mar '08</th>
<th>Apr '08</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total kWh used</td>
<td>159,660</td>
<td>129,817</td>
<td>139,406</td>
<td>113,023</td>
<td>113,359</td>
<td>111,687</td>
<td>120,234</td>
</tr>
<tr>
<td># of days</td>
<td>32</td>
<td>29</td>
<td>33</td>
<td>31</td>
<td>32</td>
<td>30</td>
<td>29</td>
</tr>
<tr>
<td>Approx avg kWh used per day</td>
<td>4,989</td>
<td>4,476</td>
<td>4,224</td>
<td>3,645</td>
<td>3,542</td>
<td>3,722</td>
<td>4,146</td>
</tr>
</tbody>
</table>
Cost of System

- Xantrax Grid Tie Solar Inverter photovoltaic system $30,227
- Average $9,000 rebate for system
- By July 5, 2008 (one year operation)
  Solar panels generated 6172 kWh or 514 kWh per month.
Energy Estimates

- Examples from electrical bill shows the following:
  - 5440 kWh payment to SCE = $2497.08
  - ~.46/kWh so generating 6172 kWh for year
    saved approximately $2839 for year or
    $236.44 per month in energy charges.
Lessons Learned

- Building placement and roof alignment
- Southern exposure important in layout of panels on roof
- Minimize shadowing
- Solar panels generated 5906 kWh/year as of June 21, 2008 or ~521 kWh/month
- Solar panels generated 6172 kWh as of July 5, 2008 (operating one year).

Placement of building on your site might change how you orient construction build-out on your site so that you get the best orientation to facilitate receiving the most energy into your system.
Lessons Learned

- Average usage of electricity inside the treatment plant is equal to 126,741 kWh/month
- Check eligibility of solar system for state sponsored rebates
Site Security affected decision on what type of system to install
Maywood Riverfront Park - Opened in April 2008!
Contact Information

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Remedial Project Manager/Environmental Scientist
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415 972 3158
Groundwater Pump & Treat Pilot Study Using Alternative Energy

K. David Drake,
USEPA Region 7, Kansas City, KS
Project Overview

- Short-term pilot study evaluating cost savings of alternative wind power.
- Project duration of one year funded at $300,000.
- Multiple organizations participating: EPA; Army Corps of Engineers, University of Missouri-Rolla, Bergy Wind Systems, Inc.
Study Goals

- Quantify the reduction of power requirements by comparison with historic power use data.
- Calculate the mass of VOCs removed during the demonstration period.
- Identify system enhancements and recommend new follow-on studies.
System Details

- 10 kilowatt wind turbine with grid-inter-tie system.
- 100 foot lattice tower with guy wires and warning lights.
- Groundwater circulation well (GCW) for water conservation.
Figure 4.1 System Configuration (WTK, 2003)
A Green Technology

- Renewable wind energy powers the system with potential net-metering and solar/battery enhancements.
- Conservation of groundwater using GCW approach.
- Fossil fuels conserved and emissions reduced.
Figure 3-3: GCW Elements
(Elmore & Graff, 2002)
Why Nebraska?

- Favorable wind conditions - 14.4 mile per hour mean intensity.
- Favorable Geology - highly transmissive Pleistocene sand and gravel deposits.
- Many contaminated sites.
Wind Energy Facts

- Most rapid growing source of electricity and projected lowest cost within a decade.
- 1/3 rd. of the U.S. has Class 3 or higher wind intensity (Class 2 is the minimum).
- Wind energy potential is proportional to velocity cubed \((2 \times v = 8 \times \text{power})\).
Nebraska Ordnance Plant Site

- 17,000 acres in east-central Nebraska, Saunders County.
- 1942 - 1956, munitions production and storage for WWII and Korean Conflict.
- Four VOC and explosives plumes.
Site Groundwater Facts

- 23 billion gallons of groundwater over 6,000 acres.
- 4 groundwater plumes (2 with explosives and 2 with VOCs)
- Todd Valley, ancestral Platte River Stream Channel, 81 - 157 feet of alluvial overburden Pleistocene deposits.
Historic GCW Facts

- 12 inch diameter well, 24 inch boring.
- 50 gallons per minute pump rate, 26 million gallons annually.
- Annual power usage of 28,000 kilowatt hours.
- Annual power cost of $1,800.
Estimated Versus Actual Savings

- 36% of GCW power demands expected to be met by alternative energy, 26% actual.
- Estimated annual savings of $780 and the generation of 12,000 kWh, actual savings of $547 and 8,422 kWh generated.
- Total capital costs of $38,000 recovered in 69 years of operation versus 49 years estimated.
30 Year Environmental Gains

- 169 tons of greenhouse gasses eliminated.

- $16,400 power savings (not inflation adjusted and $0.065 per kWh assumed).

- $22,740 power savings (not inflation adjusted and $0.09 kWh assumed).
Thank You

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Thank You

Links to Additional Resources

Feedback Form