

Quick Guide: Greener Clean-Ups

Illinois



December 2010



Delta GO: Green Opportunities

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Key Resources

Greener Cleanups – Illinois EPA

Heather Nifong, Bureau of Land
(217) 785-9407 / heather.nifong@illinois.gov
<http://www.epa.state.il.us/land/greener-cleanups/>

Brownfields Assistance – Illinois EPA

Steve Colantino, Bureau of Land
(217) 785-3497 | steve/colantino@illinois.gov
www.epa.state.il.us/land/brownfields

Site Remediation Program – Illinois EPA

www.epa.state.il.us/land/site-remediation

Contaminated Site Clean-Up Information – USEPA, Technology Innovation Program

“Technologies for Remediation:” clu-in.org/remediation
“Green Remediation:” clu-om.org/greenremediation

Introduction

Why Greener Cleanups?

Cleaning up a contaminated or brownfield site for redevelopment makes economic sense, but you might ask why you should try to do it in a “greener” or more environmentally sensitive way. There are a number of advantages to greener cleanups that you will discover as you go through this guide. In a nutshell, greener cleanups can:

- Enhance low-impact development and greenspace creation priorities, making a site more desirable for redevelopment.
- Minimize collateral and ancillary environmental impacts, such as hazardous emissions, stormwater runoff, and noise.
- Help you meet current regulatory standards.
- Potentially save money by reducing the energy or materials needed to implement the clean-up strategy and by reducing waste disposal costs.
- Enhance your social responsibility and community relations profile.

With more than 294,000 sites nationally to be cleaned up at an estimated cost of \$209 billion, the aggregate environmental benefits are significant.

What is a Greener Cleanup?

Green Remediation is a relatively new term for common-sense strategies that reduce the demand placed on the environment from clean-up actions. Even though cleaning up contaminated and under-utilized brownfield sites is, in the end, positive for the community and the environment, the clean-up processes can potentially create collateral environmental damage such as air emissions, increased stormwater runoff, and wastes requiring landfill disposal. Incorporating green remediation techniques, such as using low-sulfur diesel in heavy equipment, can minimize collateral environmental effects. With pre-planning, greener remediation techniques can be integrated throughout the site investigation and clean-up process, reducing the overall environmental “footprint” of the clean-up activities. It is important to note, however, that incorporating green remediation strategies into the clean-up process is not intended to change the final clean-up strategy, only the way it is implemented.

How to Use this Guide

The purpose of this Guide is to provide economic development professionals with basic information about greener remediation strategies that can be incorporated throughout all stages of land revitalization. It describes key elements of greener cleanups as well as various best management practices and green remediation strategies. Those readers interested in finding out more about Greener Cleanups should visit the U.S. EPA website www.clu-in.org or their state remediation resource site.

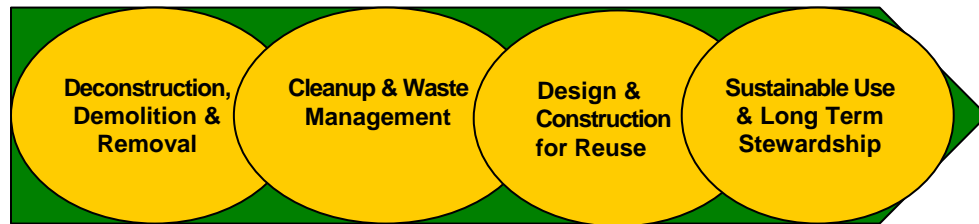
According to the U.S. EPA, Green Remediation is “the practice of considering all environmental effects of remedy implementation and incorporating options to maximize the net environmental benefit of cleanup actions.”
Source: clu-in.org/greenremediation/cfm

Strategies for Greener Cleanups

Close coordination between clean-up and reuse planning is required to implement greener remediation strategies because reuse goals affect clean-up standards and the final choice of remedial action. When considering a greener clean-up initiative, it is critical that the strategy:

- Complements the final site use.
- Meets Federal and State regulatory requirements.
- Protects human health and the environment.

Even though this brochure focuses on greener site clean-up and management strategies, greening strategies can and should be used throughout the land revitalization process as illustrated below:



- Reuse/recycle deconstruction and demolition materials.
- Reuse materials on-site whenever possible.
- Consider future site use and reuse existing infrastructure.
- Use clean fuels for equipment.
- Retain native vegetation and soils wherever possible.

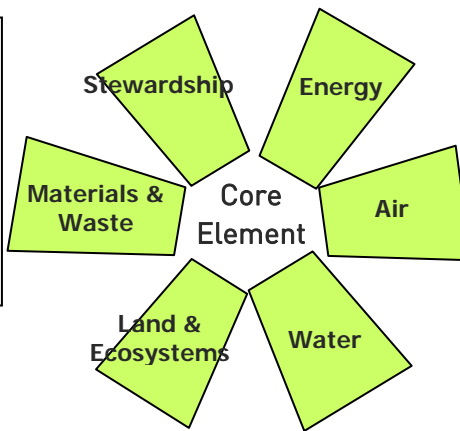
- Use clean fuels for equipment.
- Use renewable energy sources.
- Improve energy efficiency.
- Use clean-up approaches that reduce resource use and impacts on air, water, and land.
- Incorporate remediation activities that sequester carbon.

- Use Energy Star, LEED, and GreenScapes principles.
- Incorporate Smart Growth concepts.
- Use best management practices for stormwater.
- Create ecological enhancements.
- Use native landscaping.

- Reduce use of toxic materials in building and land maintenance.
- Minimize waste generation and recycle.
- Improve energy efficiency.
- Monitor engineering and institutional controls.
- Manage waste properly to prevent contamination.

Source:
Pachon, Carlos. "Green Clean-up Standards Initiative." Office of Superfund Remediation Technology Innovation, U.S. EPA, April 21-22, 2009. [http:// www.newmoa.org/cleanup/cwm/greener/materials/PachonGreenCleanupStandards.pdf](http://www.newmoa.org/cleanup/cwm/greener/materials/PachonGreenCleanupStandards.pdf).

Guidance on Greener Cleanups is being developed by many Federal and State agencies; however, the U.S. EPA has developed a conceptual framework for green cleanups that includes six core elements. Each of the six elements should be evaluated when considering clean-up options at a site. The core elements include:



Source: "Green Remediation Toolbox: Best Management Practice (BMP) Toolkit." U.S. EPA Contaminated Site Clean-Up Information. http://clu-in.org/greenremediation/subtab_b1.cfm (accessed 26 Aug 2009).

Remediation Technologies

The clean-up technologies presented in this brochure are full-scale technologies that have been used successfully at brownfield sites. The strategies have been segregated into passive remediation strategies and intensive remediation strategies. Energy use is a core element that should be considered as part of any greener clean-up program. Passive strategies generally use less energy compared to more intensive clean-up technologies. Even though passive strategies use less energy, we are not suggesting that only passive remediation strategies would qualify as a greener cleanup. In fact, many intensive clean-up strategies can be greened through more efficient operation and energy use, incorporation of renewable energy sources, and material recycling and/or recovery. In fact, significant cost savings can be realized through such operational efficiencies.

Selecting a final remediation technology is highly dependent on site-specific considerations such as contaminant type, clean-up standards, timing, or proximity to residents and businesses. The selected strategy, however, must always be protective of human health and the environment.

More information about both passive and intensive strategies can be found at the U.S. EPA's Contaminated Site Clean-Up Information website: clu-in.org/remediation

Passive Remediation Technologies

Passive remediation technologies are those that generally require fewer resources, such as water, materials, and energy, to implement compared to more intensive technologies, such as soil vapor extraction or thermal desorption. For this reason, passive technologies generally have lower capital and operation and maintenance costs than more intensive technologies. However, passive technologies generally require a longer time to achieve clean-up standards. The table on the following page illustrates the key qualities of the common passive remediation technologies.

Although passive remediation technologies are generally less intensive from a material, energy, and cost standpoint, there are a couple of caveats to keep in mind:

- Certain passive technologies, such as evapotranspiration covers and engineered wetlands, may require extensive ongoing maintenance and/or require long timeframes to implement, which can often increase total project costs. However, land/ecosystem and materials/waste impacts are still generally less negative when these strategies are used instead of intensive strategies.
- Because passive remediation technologies often take months, years, or even decades to complete, they may not be feasible for projects requiring quick turn-around times for development purposes.



Example of phytoremediation that reduces soil erosion to the river.
Source: City of Chicago Brownfields Initiative.

Passive Remediation Technologies

Passive Remediation Technologies	Description ¹	Targeted Contaminant ²	Time ³	Relative Cost ⁴
Enhanced Bioremediation	Helps microorganisms degrade contaminants in soil, ground water, or sludge.	Organics, especially PAH, other SVOCs, and BTEX	1 to 3 years for soil, up to 10 years for ground-water	Low
Phyto-remediation	Uses plants to remove, transfer, stabilize, or destroy contaminants in soil, sediment, and ground water.	Metals, pesticides, solvents, explosives, oil, PAH, landfill leachate	More than 3 years for soil, more than 10 years for groundwater	Low
Soil Amendments	Organic materials that can be applied in situ to enhance contaminant biodegradation by subsurface microorganisms and to decrease availability of contaminants.	Non-halogenated VOCs and fuel hydrocarbons	1 to 3 years for soil, up to 10 years for ground-water	Low
Evapotranspiration Covers (Landfill Cap Enhancements/ Alternatives)	Waste containment systems providing an alternative to conventional compacted-clay covers (caps), using one or more vegetated soil layers to retain water until it is transpired through vegetation or evaporated from the surface of soil.	Numerous	More than 3 years for soil, more than 10 years for groundwater	Average
Engineered Wetlands	Serve as biofilters capable of removing solid or dissolved-phase contaminants from ground water via passage of water through system, while using no external sources of energy.	Wastewater, metals, acidic wastes	Highly site dependent	Average
Permeable Reactive Barrier (PRB)	PRB employing organic material as reactive media, an in situ ground water treatment technology that combines a passive chemical or biological treatment zone with subsurface fluid-flow management.	VOCs, SVOCs including PAH, inorganics	Highly site dependent	Highly site dependent
Monitored Natural Attenuation	Relies on nature's biological, chemical, or physical processes to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in environmental media under favorable conditions.	VOCs, SVOCs including PAH, fuel hydrocarbons	Highly site dependent	Low to Average

¹ "Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites" (EPA 542-R-08-002). U.S. EPA Office of Solid Waste and Emergency Response, April 2008. <http://www.clu-in.org/download/remed/EPA-542-R-08-002.pdf> (accessed 31 Aug 2009).

² "Remediation Technologies Screening Matrix and Reference Guide." Federal Remediation Technologies Roundtable. http://www.frtr.gov/matrix2/top_page.html (accessed 31 Aug 2009).

³ Ibid.

⁴ Ibid.

Intensive Remediation Technologies

Intensive remediation technologies generally take less time to implement than passive strategies but are, on average, more expensive to implement. The following table provides an at-a-glance comparison of several common intensive remediation technologies, highlighting the key differences in their applicability.

Because intensive remediation technologies are often more invasive for both the community and the environment, special care should be taken to incorporate green best management practices, described in the next section.

Intensive Remediation Technologies¹

Intensive Remediation Technologies	Description ¹	Targeted Contaminant	Time	Relative Cost (\$/cubic yard)
Thermal desorption	The application of heat to excavated wastes to volatilize organic contaminants and water.	Non-halogenated VOCs and fuels	Weeks to few years	Medium (under \$300)
Pump and treat system	The use of pumps to bring polluted groundwater to the surface, where it can be treated more easily.	Numerous organics and inorganics	Many years to decades	High (under \$1,000)
Air sparging	The injection of air or oxygen through a contaminated aquifer to help flush the contaminants into the unsaturated zone.	VOCs and fuels	Few years	Low (under \$100)
Soil vapor extraction	A vacuum is applied to the soil to induce the controlled flow of air and remove volatile and some semi-volatile organic contaminants from the soil.	VOCs and some fuels	Few years	High (under \$1,000)
Multi-phase extraction	The use of a vacuum system to remove various combinations of contaminated groundwater, separate-phase petroleum product, and vapors from the subsurface.	VOCs and fuels	Few years	Low (under \$100)
Soil removal and off-site disposal	Digging up polluted soil so it can be treated or disposed of properly in a landfill.	Numerous organics and inorganics	Days to months	Medium (under \$300)

¹ Source: "Remediation Technologies." U.S. EPA Technology Innovation Program. <http://www.clu-in.org/remediation/>.

Best Management Practices

Incorporating greener best management practices into a site clean-up program is an important component of a Greener Clean-up program. Many of the best management practices highlighted below have direct environmental advantages as well as community benefits. Best management practices can be required of the selected contractor through the Request for Proposal and/or contracting process. Site investigation and remediation contractors should be interviewed regarding their knowledge and ability to consistently implement best management practices.

Air Quality

Goal: Reduce harmful air emissions associated with on-site operations

- Reduce particulate matter emissions and other pollutants from diesel-powered vehicles.
- Use engine retrofit technologies designed to reduce emissions from existing diesel vehicle and equipment.
- Explore aftermarket equipment options that reduce fuel consumption.
- Use low-emission fuels such as ultra-low sulfur diesel.
- Reduce equipment idling.
- Use hybrid and alternative fuel vehicles where possible.

Resources:

- U.S. EPA: www.epa.gov/smartway/index.htm
- Division of Mobile Source Programs: www.epa.state.il.us
- Illinois EPA: illinoisgreenfleets.org
- Illinois EPA: illinoisgreenfleets.org/idling/truck-idling-brochure.pdf
- Partners for Clean Air: www.cleanair.org/overview.shtml

Water Conservation

Goal: Reduce and control stormwater runoff; reclaim treated wastewater for beneficial reuse

- Incorporate the concept of no "net loss" of water from the site.
- Incorporate more natural drainage systems and increased on-site water infiltration to help reduce the quantity of runoff and improve its quality.
- Design and construct the landscape topography to facilitate water holding and infiltration.
- Plant buffer strips of natural vegetation and woody plants to slow runoff.
- Use "rain garden" terraces to slow water runoff; store captured water in rain barrels.

Resources:

- Storm Water Best Management Practices Start at Home: urbanext.illinois.edu/lcr/storwater.cfm
- Multifunctional Landscaping: Putting Your Parking Lot Design Requirements to Work for Water Quality: urbanext.illinois.edu/lcr/landscaping.cfm
- Storm Water ... Keep It Clean! www.epa.state.il.us/small-business/storw-water

Waste Management

Goal: Reduce material use and waste generation; reduce waste disposal through reclamation or recycling

- Identify the components of job-site waste streams and establish plans to reduce, recycle, or reuse construction and demolition waste.
- Establish job-site recycling programs.
- Limit sampling and target analysis by having a complete understanding of site history and previous work completed.
- Incorporate waste reduction, reuse, and recycling into specifications and contracts.

Resources:

- Illinois Sustainable Technology Center – University of Illinois, Green Development and Construction Program:
www.istc.illinois.edu/main_sections/tech_assist/green_development.cfm
- Waste Management and Research Center, Illinois Construction and Demolition Debris Reuse/Recycling Options and Contacts:
www.istc.illinois.edu/main_sections/tech_assist/demolition-reuse.pdf
- Illinois Environmental Protection Agency recycling:
www.eps.state.il.us/land/hazardous-waste/household-haz-waste/recycling.html

Land & Ecosystems

Goal: Accelerate the reuse of degraded land while preserving wildlife habitat and biological diversity

- Use minimally invasive in situ technologies whenever possible.
- Use passive remediation whenever possible and effective.
- Minimize soil disturbance.
- Minimize migration of contaminants through effective source controls.
- Reduce noise and light disturbance.
- Use native plantings and low-impact development techniques whenever possible.

Resources:

- U.S. EPA – “Low Impact Development (LID):” www.epa.gov/nps/lid
- Southeast Michigan Council of Governments – “Low Impact Development Manual:” www.semco.org/LowImpactDevelopment.aspx
- Low Impact Development, (LID): www.lowimpactdevelopment.org/index.html
- Also see “Water Conservation” resources listed above

Long-Term Stewardship

Goal: Reduce the overall environmental impact of site development

- Incorporate operation and maintenance plans into the final reuse plan that minimize wildlife disturbance and protect natural conditions.
- Reduce emission of greenhouse gases from long-term remediation and monitoring strategies.
- Consider renewable energy systems for long-term power needs.
- Use passive sampling techniques for long term monitoring.
- Outreach to and solicit input from the community on remediation activities and long-term site activities.

Resources:

- U.S. EPA Technology Innovation Program – “Greener Cleanups Core Elements: Long-Term Stewardship:” www.clu-in.org/greenremediation/subtab_b1_stew.cfm
- Illinois EPA – “Greener Cleanups:” www.epa.state.il.us/land/greener-cleanups/index.html

Resources for Illinois Practitioners

Voluntary Site Remediation Program (SRP)

www.epa.state.il.us/land/site-remediation

The SRP clean-up program provides Remediation Applicants (i.e., any persons seeking to perform investigative or remedial activities) the opportunity to receive IEPA review, technical assistance and no further remediation determinations from the Illinois EPA. Generally any site not required to clean up under any other program (e.g., Resource Conservation and Recovery Act (RCRA), Superfund) is eligible for the Illinois Site Remediation Program. This program is designed to be flexible and responsive to the needs of the Remediation Applicants. The goals and scope of actions at these sites are normally defined by the Remediation Applicants, and greener cleanups are encouraged.

The Illinois EPA is authorized to issue No Further Remediation (NFR) letters to the Remedial Applicants who have successfully demonstrated, through proper investigation and, when warranted, remedial action, that environmental conditions at their remediation site do not present a significant risk to human health or the environment. The NFR letter signifies a release from further responsibilities under the Illinois Environmental Protection Act. This program's activities are paid by the parties requesting the Illinois EPA's oversight.

Illinois EPA's Greener Cleanups Website

www.epa.state.il.us/land/greener-cleanups

Illinois EPA has developed a series of tools to help site owners, developers and their consultants in incorporating greener clean-up practices. This effort applies to every clean-up program in the Bureau of Land, though specific tools have been created for LUST sites.

The five guiding principles for Greener Cleanups in Illinois are:

1. Ensure every cleanup protects human health and the environment.
2. Integrate site reuse plans into the clean-up strategy.
3. Conserve raw materials such as soil and water; salvage building materials and other resources.
4. Conserve energy by reducing energy consumption and using renewable energy sources to power clean-up activities where possible.
5. Consider the environmental effects of treatment technologies when choosing a site remedy by comparing options for contaminant disposition, evaluating resource demands, and assessing long-term stewardship responsibilities.

The website includes downloadable resources on how to maximize the environmental benefits of site remediation.

Financial Resources

The following table provides an overview of resources available in Illinois for assessment and remediation activities.

Funding Source	Eligibility			Maximum Grant/Loan Amount/Rates	Match Requirements	Application Rounds
	Applicants	Contaminants	Activities			
Illinois Municipal Brownfields Redevelopment Grant Program	Municipalities	Any	Site assessments, soil and groundwater sampling, environmental consultant oversight, laboratory services, clean-up activities, and participation in the Site Remediation Program	\$240,000 maximum to each municipality	70/30 match required; grants must be spent down in 3 years	This program is currently inactive due to lack of funding.
Illinois Brownfields Redevelopment Loan Program (State program)	Units of local government and private parties; sites must be enrolled in the Site Remediation Program	Hazardous substances, pesticides, or petroleum	Limited investigation, remediation, and demolition	\$120,000 max for Site Investigation per site; \$500,000 max for any single loan application; \$1,000,000 max for any single project; Maximum loan term of 5 years; fixed loan rate is 1/2 the market rate, but not less than 2.5%	None	Ongoing
Brownfields Cleanup Revolving Loan Fund (State and Federal program)	Municipalities that have received a USEPA demonstration pilot grant or an Illinois EPA targeted brownfields site assessment grant Sites must be enrolled in the Site Remediation Program	Hazardous substances, no petroleum	Clean-up activities; environmental consultant oversight services; Won't pay for petroleum cleanup or site investigation activities	\$500,000 per site; Maximum loan term of 5 years; fixed loan rate is 1/2 the market rate, but not less than 2.5%	None	Ongoing
Bank Participation Loan Program (in Chicago)	Private commercial and industrial entities	Will review on case-by-case basis	Cleanup	\$250,000 for commercial; \$350,000 for industrial	Match by banks at 75% of prime rate, for terms from 3-15 years	Ongoing
Underground Storage Tank (UST) Fund	UST owners and operators who have reported a petroleum release and have registered their tanks with the Office of the State Fire Marshall (OSFM)	Petroleum	Site investigation and cleanup, laboratory services, and engineering oversight; Will not pay for tank removal, tank upgrade costs, legal fees, work performed prior to reporting the release	\$1,000,000 per occurrence, minus deductible determined by OSFM (ranges from \$10,000 to \$100,000)	None	Ongoing
Environmental Remediation Tax Credit	Taxpayers who have not caused or contributed to contamination at the site, but who pay for cleanups under Site Remediation Program	Will review on case-by-case basis	Investigation and cleanup	25% of remediation costs in excess of \$100,000 per site unless located in an enterprise zone (in which case there is no threshold); Maximum annual credit of \$40,000 per site; maximum total credit of \$150,000 per site	None	Ongoing

Source: www.epa.state.il.us/land/brownfields/financial-help/chart.html

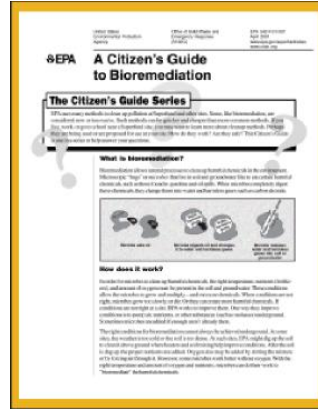
Community Involvement Requirements in Illinois

Public participation requirements (notice, comment periods, etc.):

- The Illinois EPA Site Remediation Program requires public participation at sites intended for use as schools.
- Public participation at other sites is recommended on an ad hoc basis.

Resources:

To facilitate community involvement and outreach about remediation, the U.S. EPA publishes Citizen's Guides, which are 2-page fact sheets that explain, in basic terms, the operation and application of the most frequently used innovative treatment technologies. The Citizen's Guides are available in English and Spanish at clu-in.org/products/citguide.



Illinois Case Studies

Exelon City Solar: Reduced Waste Disposal

Address: 1201 West 120th Street, Chicago, IL
Former use: Abandoned foundry and manufacturing
Current use: Solar energy plant
www.exeloncorp.com/PowerPlants/exeloncitysolar



On Earth Day 2009, Exelon announced plans to build the largest urban solar installation in the United States – a 10-megawatt solar power plant on a brownfield site in Chicago's West Pullman neighborhood. The facility began operating in early 2010. The 32,000 solar photovoltaic (PV) panels installed at the site now produce enough electricity to power 1,500 homes, displacing approximately 31.2 million pounds of greenhouse gas emissions per year. This is equivalent to taking more than 2,500 cars off the road.

The Exelon City Solar facility is situated on a 41-acre site that been used for industrial purposes for more than 100 years and had stood vacant for the prior 30 years. Over that time, the on-site structures had fallen into decay and potential environmental impacts went unaddressed. The fenced property was not only an eyesore, but a drain on property values. The challenge was to identify a reuse that would be compatible with the property and spur economic growth. The City of Chicago and the West Pullman neighborhood development group were able to find a reuse for the site that would minimize the amount of materials, including soil, requiring off-site disposal.

Several greener remediation best practices were used to minimize waste disposal. First, limiting future property uses to those that did not require additional cleanup was key. The utility-scale solar farm does not allow public access and has minimal onsite worker activity. Based on the identified reuse, site-specific risk assessment was used to determine clean-up goals that would allow the intended reuse to proceed, while still being protective of human health and the environment. The remedy also included engineered barriers and land use controls on the site to ensure the risk-based clean-up goals would remain protective of future site users. During site redevelopment, innovative construction practices were used to limit the amount of soil excavation and disposal required. In addition, existing on-site materials, such as soil, concrete, and other construction materials, were reused whenever feasible, thus reducing the amount of wastes requiring disposal and replacement. The result is a state-of-the-art solar power plant benefitting the community, the City, and the region.

In addition to cleaning up the site and reducing greenhouse gas emissions, the facility development also provides benefits to the community and local economy. More than 200 construction jobs were created, with at least half of all work hours filled by Chicago residents. Many of the contractors were minority-owned or woman-owned businesses. Many of the construction materials were manufactured by local businesses. Facility operation, maintenance, and security provide the equivalent of seven full-time jobs. Plus, returning the property to the tax rolls increases tax revenues for local governments and increase area property values.

Funding: Exelon self-funded the construction of this \$62 million facility. The remediation approach used for the site saved the City of Chicago money by reducing intensive waste-producing clean-up approaches. It also saved time by reducing time-intensive remediation practices that typically require long-term operation and monitoring. The strategy saved the City an estimated \$20 million in remediation costs, when compared to typical remediation and vertical development that requires significant site preparation.

Lessons learned: Exploring potential reuses and construction practices that minimize waste production can result in successful remediation and redevelopment of a brownfield site.

For more information, contact: Dave Graham, P.G., Chicago Department of Environment, dave.graham@cityofchicago.org.

Sylvan Slough Natural Area: Bioremediation Success

Address: Mississippi Riverfront, Rock Island, IL

Former use: Bulk oil distribution and other industrial facilities

Current use: Educational preservation area

The Sylvan Slough Natural Area began as an effort by the City of Rock Island to clean up three blighted industrial properties ravaged by fire and neglect. The 5-acre site held three large buildings once home to a variety of industries, including an egg-cracking facility, a slaughter house, and the fifty-year home of Midway Oil, a bulk oil distributor. Weeds were growing unchecked, and the grounds were covered with abandoned semi trailers, cars with missing parts, tires, broken furniture, trash bags, and other signs of illegal dumping.

Many greener clean-up strategies and techniques were incorporated into the site remediation and reuse. The buildings were surgically deconstructed to form the architectural features of the natural area and to allow salvaged material to be reincorporated into the landscape. Materials suitable for reuse onsite were separated from materials hauled to a landfill. Fill material was placed in basements. Brick was ground up and used as permeable paths, and precast panels were removed intact to be used as risers and walkways.

Contamination on the site was primarily petroleum compounds. More than 4,000 cubic yards of soil from approximately 3 acres of the site was remediated using the Windrow Biopile Composting Method. Tainted soil was excavated and mixed with aged wood chips and horse manure to biodegrade the contaminants through composting. The mixture was wrapped in black plastic and "cooked" by the sun. Remediation of the initial 400 cubic yards of soil was completed in 6 months, with remediation of the remaining approximately 3,600 cubic feet completed in approximately two

years. The clean composted soil was then spread as topsoil to prepare the site for native prairie plantings.

The Sylvan Slough Natural Area also incorporated a unique blend of bioswales, permeable paving, native plantings, and other initiatives designed to educate the public about reduction of stormwater runoff.

Funding: The total cost for the cleanup was approximately \$250,000, funded in part by a \$100,000 U.S. EPA Brownfield grant, \$20,000 in City funding and other state and nonprofit sources. While similar costs would be needed for soil excavation, landfill transport and disposal, and clean fill import, the bioremediation approach used at the site reduced the City's liability associated with landfill disposal of hazardous materials. It also provided rich soil for subsequent site development.

Lessons learned: Successful partnerships between private and public entities can result in benefits for all, including the public. Exploring potential reuses and construction practices that minimize waste production can result in successful remediation and redevelopment.

For more information, contact: Sally Heffernan, City of Rock Island, heffernan.sally@rigov.org.