Greener Cleanups

Quick Guide for Indianapolis

September 10, 2009

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Key Resources

Indiana Brownfields Program – Indiana Finance Authority
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Voluntary Remediation Program –
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http://www.in.gov/idem/4127.htm

Indiana Department of Environmental Management
http://www.in.gov/idem/

Contaminated Site Clean-Up Information -
U.S. Environmental Protection Agency, Technology Innovation Program
"Technologies for Remediation": http://clu-in.org/remediation/
"Green Remediation": http://clu-in.org/greenremediation/

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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 cleanup strategy
- Enhance your social responsibility and community relations profile. With over 294,000 sites nationally to be cleaned up at an estimated cost of $209 billion the aggregated 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 cleanup processes can potentially create collateral environmental damage such as air emissions or stormwater runoff. 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 cleanup process reducing the overall environmental "footprint" of the clean-up activities. It is important to note, however, that incorporating green remediation strategies into the cleanup 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 green remediation strategies that can be incorporated throughout all of the stages of land revitalization. It describes key elements of greener cleanups as well as outlines various best management 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 site remediation resource site.

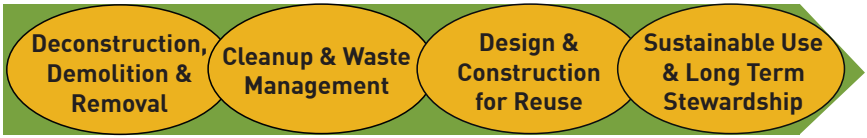
According to the U.S. EPA Green Remediation is "the practice of considering all environmental effects of remedy implementation and incorporating options to maximize the net environmental benefit of cleanup actions." Source: http://clu-in.org/greenremediation/cfm].

Strategies for Greener Cleanups

Close coordination between cleanup and reuse planning is required to implement green remediation strategies as reuse goals affect the cleanup standards and the final choice of remedial action. When considering a green cleanup initiative it is critical that the strategy:

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

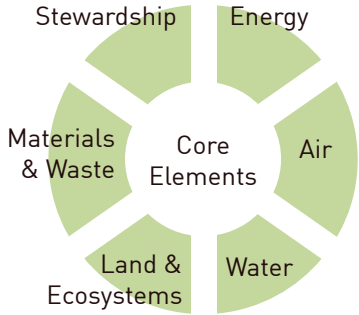
Even though this brochure focuses on greener site cleanup and management strategies, greening strategies can and should be used throughout the land revitalization process as illustrated below:



Deconstruction, Demolition & Removal	Cleanup & Waste Management	Design & Construction for Reuse	Sustainable Use & Long Term Stewardship
• 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 cleanup approaches that reduce resource use and impact on air, water, 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 • Use energy efficiency • Monitor engineering and institutional controls • Manage waste properly to prevent contamination

Source: Pachon, Carlos. "Green Cleanup 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 (accessed 31 Aug 2009).

Guidance on Greener Cleanups is being developed by both the Federal and state agencies; however, the U.S. EPA has developed a conceptual framework for green cleanups which includes six core elements. Each of the six elements should be evaluated when considering cleanup 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 cleanup technologies presented in this brochure are full-scale technologies that have been used on other 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 cleanup program. Passive strategies generally use less energy as compared to more intensive cleanup 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 cleanup 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, cleanup 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: http://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 as 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 cleanup standards.

The table on the following page illustrates the key qualities of the common 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	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.	Limited effectiveness on some Organics and Inorganics	More than 3 years for soil. More than 10 years for ground-water.	Low
Soil Amendments	Organic materials that can be applied *in situ* to enhance contaminant biodegradation by subsurface microorganisms and to decrease availability of contaminants.	Organics	1 to 3 years for soil. Up to 10 years for ground-water.	Low
Evapotrans-pirtion Covers (Landfill Cap Enhance-ments/ 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.	Limited effectiveness on Organics and Inorganics	More than 3 years for soil. More than 10 years for ground-water.	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.	Inorganics. Limited effectiveness on organics.	Highly site dependent	Average
Permeable Reactive Barrier	Permeable reactive barriers (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.	Highly site dependent	Highly site dependent	Highly site de-pendent
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.	Effective for some Organics. Limited or no effectiveness on certain organics and Inorganics.	Highly site dependent	Low to Average

see page 7 for footnotes

Although passive remediation technologies are generally less intensive from a materials, 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 using these strategies 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.
- The effectiveness of passive remediation technologies is highly dependent on site conditions.

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

[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-F-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 Technologies	Description[5]	Targeted Contaminant	Time	Relative Cost ($/cubic yard)
Thermal desorption	The application of heat to excavated wastes to volatilize organic contaminants and water.	Organics	Weeks to Few years	Medium (under $300)
Pump and treat system	Uses pumps to bring polluted groundwater to the surface where it can be treated more easily.	Organics and Inorganics	Many years to decades	High (under $1000)
Air sparging	The injection of air or oxygen through a contaminated aquifer to help flush the contaminants into the unsaturated zone.	Organics	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 semivolatile organic contaminants from the soil.	Organics	Few years	High (under 1,000)
Multi-phase extraction	Uses a vacuum system to remove various combinations of contaminated groundwater, separate-phase petroleum product, and vapors from the subsurface.	Organics	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.	Organics and Inorganics	Days to Months	Medium (under $300)

[5] "Remediation Technologies." U.S. EPA Technology Innovation Program. http://www.clu-in.org/remediation/ (accessed August 26, 2009).

Best Management Practicies

Incorporating greener best management practices into a site cleanup program is an important component of a Greener Cleanup 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.**

- Retrofit heavy machinery with diesel-emission controls and exhaust treatment technologies
- Keep engines serviced and in good repair
- Use low emission fuels such as ultra-low sulfur diesel
- Reduce equipment idling
- Use hybrid and alternative fuel vehicles whenever possible

Resources:

- Indiana Department of Environmenta Management (IDEM) – "DieselWise": http://www.in.gov/idem/5255.htm
- Indiana Office of Energy Development (OED) – "Bioenergy / Biomass / Biofuels": http://www.in.gov/oed/2415.htm

Water Conservation

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

- Minimize runoff through open space preservation
- Use engineered structures or landscape features to capture and, if necessary, reduce stormwater infiltration
- Store captured water in rain barrels or natural depressions

Resources:

- IDEM – "Indiana Storm Water Quality Manual": http://www.in.gov/idem/4899.htm
- IDEM – "Featured Topic: Using Green Infrastructure for Stormwater Management": http://www.in.gov/idem/5801.htm

Waste Management

Goal: **Reduce material use and waste generation; Reduce waste material that is sent off-site for disposal through reclamation or recycling**

- Complete a thorough review of previous site activities. Understanding the site history will save field time by limiting sampling and targeting laboratory analysis.

- Reduce time spent in the field. Timesavers include passive sampling techniques and direct push sampling whenever possible. Reducing field time saves money and reduces waste such as PPE, drill cuttings, and fluids.
- Reclaim and/or recycle site materials such as wood, glass, and metals
- Reuse demolition concrete as road base, fill, or other engineered material

Resources:

- Recycle Indiana – "Business" resources: http://www.in.gov/recycle/5691.htm
- Recycle Indiana – "Materials Xchange": http://www.in.gov/recycle/5633.htm

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)": http://www.epa.gov/nps/lid/
- Southeast Michigan Council of Governments – "Low Impact Development Manual": http://www.semcog.org/LowImpactDevelopment.aspx
- See "Water Conservation" resources above.

Long-term Stewardship

Goal: Reduce the overall environmental impact if the site development

- Incorporate operation and maintenance plans that minimize wildlife disturbance and protect natural conditions into the final reuse plan
- 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": http://www.clu-in.org/greenremediation/subtab_b1_stew.cfm
- Illinois EPA – "Greener Cleanups": http://www.epa.state.il.us/land/greener-cleanups/index.html

Resources for Indiana Practitioners

Indiana Brownfields Program

The following table[6] provides a brief overview of state resource available for assessment and remediation activities provided through the Indiana Brownfields Program (Program), housed within the Indiana Finance Authority (IFA). This information is current as of September 2009. For comprehensive information on these resources, including up-to-date status and requirements, visit the Program's website at http://www.brownfields.IN.gov or call the Program's EPA/Community Liaison & Outreach Coordinator at (317) 234-0235.

Incentives awarded as funding to reimburse actual expenses of recipient:

Incentive	Eligibility			Maximum Grant/Loan Amount/Rates	Match Requirements	Application Rounds
	Applicants	Contaminants	Activities			
Stipulated Site Assessment Grants (SAG)	Political subdivisions; eligible private entities may co-apply	Non-petroleum only	Phase I/II environmental site assessments; asbestos and lead paint surveys	$100,000 per applicant	Investment match within 2yrs of grant agreement; type & amt. vary, includes in-kind services	TBD
Stipulated Remediation Grants (SRG)	Political subdivisions; eligible private entities may co-apply	Non-petroleum only	Remediation	$400,000 per applicant	Investment match within 2yrs of grant agreement; type & amt. vary, includes in-kind services	TBD
Federal Matching Grants	Recipients of US EPA brownfield cleanup and revolving loan fund grants	Hazardous substances & petroleum	Remediation	Automatically funds 20% match required for US EPA brownfield cleanup & revolving loan fund grants.	Requires 5% local match of US EPA grant amount.	1 per year
Low-Interest Loans (LIL)	Political subdivisions; can re-loan to eligible 3rd party. Partial forgiveness for meeting certain criteria.	Hazardous substances & petroleum	Site acquisition; remediation; limited site assessment; demolition related to remediation	50% of available (non-obligated) funds; fixed interest rates (2.5% & 3%).	None	Rolling applications
Revolving Loan Fund (RLF)	Political subdivisions, non-profit and for-profit organizations; can re-loan to eligible 3rd party	Hazardous substances & petroleum	Remediation	$2.4 million (balance of US EPA revolving loan fund grant award)	None	Rolling Applications
Supplemental Environmental Projects	Political subdivisions as a result of settlement of an enforcement case by the Indiana Department of Environmental Management (IDEM)	Hazardous substances & petroleum	Phase I/II environmental site assessments; remediation; demolition; habitat restoration; site acquisition	Varies; paid directly to an IFA community/site-specific account.	None	No application process; result of settlement by IDEM

[6] "Financial Incentives Fact Sheet." Indiana Brownfields Program. http://www.in.gov/ifa/brownfields/files/BF_financial_incentives_fact_sheet.pdf (accessed August 26, 2009).

Services provided by consultants retained by the IFA:

Incentive	Eligibility			Maximum Grant/Loan Amount/Rates	Application Rounds
	Applicants	Contami-nants	Activities		
Petroleum Reme-diation Grants (PRG)	Political subdivisions (sites can be privately-owned)	Petroleum only	Assessment and remediation	Varies based on program-approved scope of work	Accepting sites onto wait-list
Trails and Parks Initiative (TPI)	Political subdivisions and non-profit organizations with recreational/ greenspace reuse plans	Hazardous substances & petroleum	Assessment	No maximum assessment award per applicant or project, but $ cap on type of assessment; varies based on program-approved scope of work	Rolling applications

Voluntary Remediation Program[3]

The Voluntary Remediation Program (VRP), part of the Office of Land Quality, Indiana Department of Environmental Management (IDEM), was established to provide any site owner or prospective owner with a mechanism to cleanup contaminated property. When the cleanup is completed, IDEM will issue a Certificate of Completion and the Governor's office will issue a Covenant Not To Sue. These documents provide assurance that the remediated areas will not become the subject of future IDEM enforcement action, and future liability is limited. Participation in VRP can facilitate the sale and reuse of industrial and commercial properties.

For more information, visit the VRP website at http://www.in.gov/idem/4127.htm or call (317) 234-0996.

[3] "Voluntary Remediation." Indiana Department of Environmental Management. http://www.in.gov/idem/4127.htm (accessed August 26, 2009).

Community Involvement Requirements in Indiana[8]

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

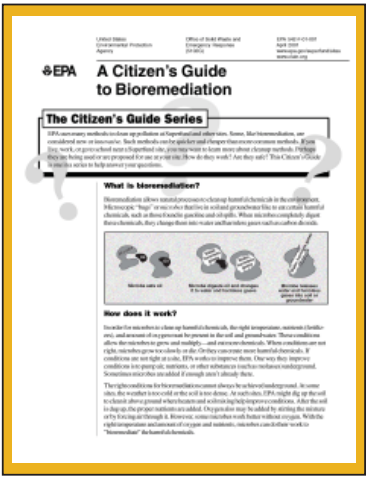
- The Indiana Brownfields Program generally has no public participation requirements, except for federally funded projects (e.g., RLF) where such requirements may exist and with which the program must comply.
- The Voluntary Remediation Program (VRP) requires public notice. Hearings and meetings are held at IDEM's discretion.

Public participation activities (hearing, meetings, etc.):

- While the Indiana Brownfields Program does not require such public meetings/notices, public participation is an important selection factor incorporated in all applications/request forms for receiving legal, financial, and technical assistance. Participants/sites utilizing federal funds (e.g. RLF) from the Indiana Brownfields Program comply with this requirement.
- VRP requires that all remediation work plans (100% of sites) be placed on a 30-day public comment period in the IDEM file room, and in a repository (typically a public library) in the community where the subject property is located before formal work plan approval is granted. Public officials in the affected community (mayor and county health department) are notified when VRP accepts a project into the program, and again when the work plan is placed on public notice. In addition, the VRP Community Relations Plan requires that all program articipants notify residents or community groups in close proximity to the subject property if impacts or activities at the site are likely to affect them.

Resources

To facilitate community involvement and outreach about remediation, the U.S. EPA publishes Citizens' 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 Citizens' Guides are available in English and Spanish at http://clu-in.org/products/citguide/


EPA

A Citizen's Guide to Bioremediation

The Citizen's Guide Series

What is bioremediation?

How does it work?

[8] "Indiana." U.S. EPA Region 5 State Brownfields Programs Overview. http://www.epa.gov/brownfields/pubs/region5_states.doc (accessed 26 Aug 2009).

Indiana Case Studies

The Project School Indianapolis.
Address: 1145 E. 22nd Street, Indianapolis
Former use: National Motor Vehicle Co. (1900-24)
Current use: The Project School Indianapolis
www.indianapolisprojectschool.org

The current home of the Project School Indianapolis manufactured the winning race car for the 2nd Indianapolis 500 Race in 1912. This brownfield site remained nearly dormant for decades, but in March 2008 the Project School Indianapolis, the property owner, and its board secured construction financing to complete the first floor redevelopment, windows and exterior finishing.

Doors opened for the innovative Mayor's Charter School in fall 2008. The City's Brownfield Redevelopment Coordinator and Land Bank Manager visited the school to discuss abandoned property issues with students. More than 70% of students stated desire to garden and grow food in the urban setting as an alternate reuse in the west lot of their school. Teachers have carried that desire forward, working with the City Brownfield Program to envision the current project phase: a multiple use site with playground area, edible schoolyard garden, greenhouse, picnic area, playground, etc.

The City of Indianapolis Brownfield Redevelopment Program drafted the RFP for The Project School to issue for bid solicitation for soil investigation sufficient to protect child exposure to soil, as well as to protect child and adult human health for edible crops to be grown in the garden. Based on the Project School's application and bid selection, funding was awarded and field work will begin in October. By combining in kind services, the investigation of soil conditions and the establishment of safe soils protocols will ensure the students can begin urban agriculture, recreational and other reuse of the site in Spring 2010!

Funding: $20,000 Neighborhood Brownfield Initiative Grant from the City of Indianapolis Brownfield Redevelopment Program (via HUD Community Development Block Grant), matched with $10,000 Local Initiatives Support Corporation.

Lessons learned: The original project redeveloping the automobile factory site into a school witnessed more construction finance hurdles than brownfield contamination hurdles. Redevelopment professionals should pay close attention to expectations of post redevelopment appraisals prior to converting to permanent financing. Additionally, close cooperation with federal, state, and local environmental and public health agencies is necessary to ensure safe soil conditions for urban farming reuse of brownfields.

Winter Avenue / "Triangle Park" Phytoremediation Pilot
Address: 2301 Enterprise Drive - Indianapolis
Former use: Industrial site adjacent to plating facility
Current use: "Triangle Park" Hybrid Poplar Phytoremediation – Urban Forestry Pilot

This project desired to meet requirements of state regulators to obtain redevelopment approval for nearby sites while cost effectively remediating residual ground water contamination. With approval of the state IFA Brownfields Program, the City developed a plan for natural phytoremediation to address lingering impacts from historic contaminating activity as an illegal dumping ground and discard area for industrial facilities previously operating at the site and nearby. The contaminants are volatile organics confined to the 11-foot upper aquifer – an ideal situation for phytoremediation due to the confinement of contaminants and the fact that there are no immediate redevelopment plans.

The City of Indianapolis Brownfield Redevelopment Program planted 53 hybrid poplars and is implementing an extended groundwater sampling plan to investigate progress of groundwater cleanup by the trees. Root growth and remediation "work" from the hybrid poplar trees are not anticipated to begin for another 8 to 12 months depending upon weather.

Funding: The city-owned site received an $8,000 Indiana Department of Natural Resources Urban Forestry Grant as well as $23,000 in HUD Community Development Block Grant funds for this phytoremediation pilot.

Lessons learned: Traditional dig & haul costs would have been much larger than the $32,000 encumbered to date. However, immediate redevelopment of the site was not at issue; had timing constraints been less relaxed, this option would not be desirable. One unexpected hurdle was a Marion County Tree Ordinance that required the city to gain a variance from its own Tree Board to plant the non native hybrid poplar species, justified by improvement to human health and the environment as part of the environmental cleanup objective.

Above: Industrial site prior to cleanup
Right: "Triangle Park" Hybrid Poplar Phytoremediation site

About the Delta Redevelopment Institute

The Delta Redevelopment Institute is a nonprofit environmental and economic organization that provides technical assistance to revitalize blighted communities. The Institute was formed in 1998 to work for a cleaner environment, healthier communities, and a greener economy in the Great Lakes Region. It provides expert services to business, government and community-based partners to create opportunities in blighted areas. The Institute redevelops brownfields, designs innovative development strategies, creates flexible financing, and advocates for policies that support a sustainable future.

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Disclaimer

The contents of this Guide are representative of the work of Delta Redevelopment Institute only and do not reflect the official positions of the U.S. Environmental Protection Agency or any other municipal, state, or federal government agency.

Find this Quick Guide on the web, here: www.deltaredi.org/publications.php

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