Industry Perspective on Greener Cleanups

PHARMACIA & UPJOHN COMPANY LLC
Greener Cleanup Case Study

USEPA Clu-In Webinar

September 28, 2016

Presentation Outline

- Approach to Sustainable, Greener Cleanup
- Pharmacia & Upjohn Company LLC Site
  Site Background and Selected Remedy
- CMI Greener Cleanup Design/Execution and Best Management Practices (BMPs)
- Project Recognition – Greener Cleanup

Why Sustainable, Greener Cleanup?

- Pfizer's core value of "Respect for Society"
  - Communities want properties returned to beneficial use
  - Experience has shown that, given the option, communities are receptive to safe and sustainable solutions
- Value Proposition:
  - Reduce environmental footprint
  - Increase social responsibility and community acceptance
  - Obtain regulatory acceptance
  - Reduce remedial construction and long-term costs
  - Gain economic benefit to the community
  - Achieve cleanup!

Some General Principles

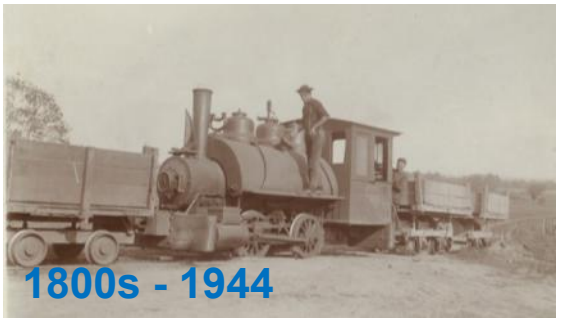
- Start with Conceptual Site Model and plan with end in mind
- Identify and engage appropriate stakeholders early in the process
- Consider environmental footprint and greener cleanup design through-out life cycle of investigation, remedy, and OM&M
- To the extent possible, preserve and enhance the assets of the property and create opportunities for beneficial reuse
- Seek opportunities to incorporate green remediation techniques in the design and implementation phase
- Where appropriate, ensure future use is consistent with the site's location in the community and in the environment

Case Study

Site Background & Selected Remedy

PHARMACIA & UPJOHN COMPANY LLC SITE
NORTH HAVEN, CT

Pharmacia & Upjohn Company LLC Site



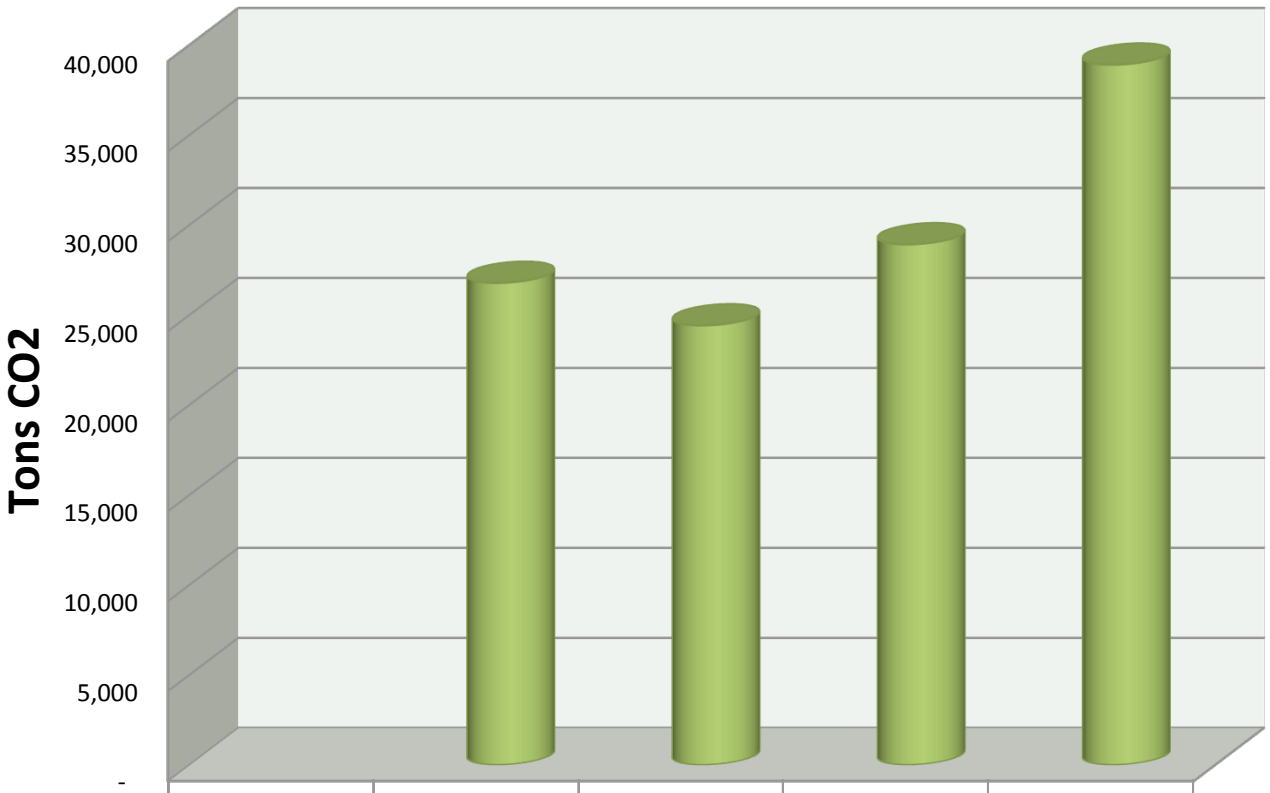
Site Conditions – Post Operations

- Primary Causes
  - 140 year industrial history
  - Releases from aboveground / underground tank operations
  - Use of lagoons (former clay borrow pits) for wastewater treatment
  - Onsite stockpiling of wastewater treatment residuals/sludge
- Resulting Site Conditions
  - Chemical impacts in soil, groundwater and adjacent title flat sediments
  - Constituents include broad range VOCs, SVOCs, PCB and metals
  - Areas with free phase organics (DNAPL) below water table
  - Large quantities of impacted waste water residuals/sludge
  - Shallow groundwater impacts across the Site
  - Limited impacts below aquitard
- Regulatory Drivers
  - RCRA 3008(h) Corrective Action Order
  - CT Transfer Act

Greener Cleanup Design/Construction Considerations

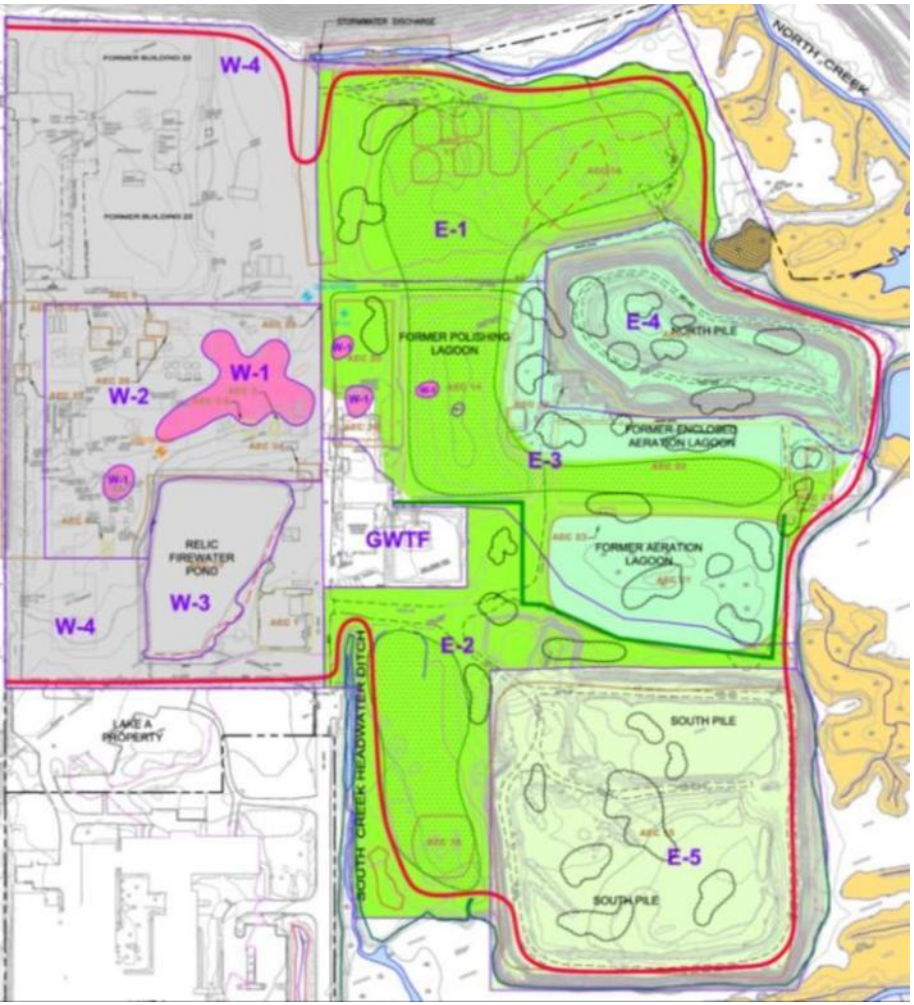
- Environmental footprint
- Overall chemical mass removal (i.e. DNAPL area)
- Impact/nuisances to the community
- Remediation worker safety
- Beneficial reuse of Site
- Public support for remedy
- Short term vs long term costs
- Core elements for greener cleanup (defined by ASTM)
  - Energy
  - Air
  - Water
  - Land & Ecosystems
  - Materials & Waste

CMS Carbon Footprint Comparison
Energy, Air, Water, Materials & Waste, Land Reuse



	Long-Term O&M CMA #2	Caps and Covers CMA #3	ISTT CMA #4	Soil & GW Treatment CMA #5
Mass of CO2 Emissions (tons)	26,790	24,428	28,933	38,918

Key Components of EPA Approved Remedy



- Groundwater control and treatment, long-term operations

East Side Components

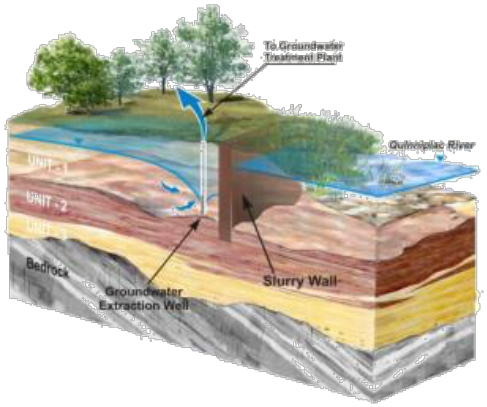
- Sediment removals, tidal wetlands mitigation
- Eastern side consolidation, protective barriers, ecological enhancements

West Side Components

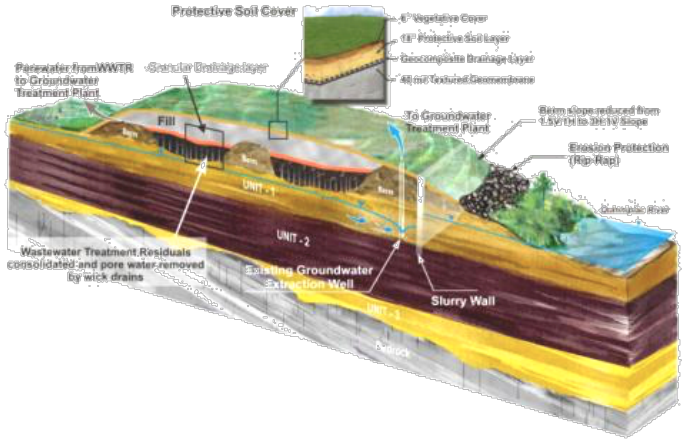
- Thermal desorption to treat the most impacted area
- Western side protective barrier

Key Components of CMS Selected Remedy

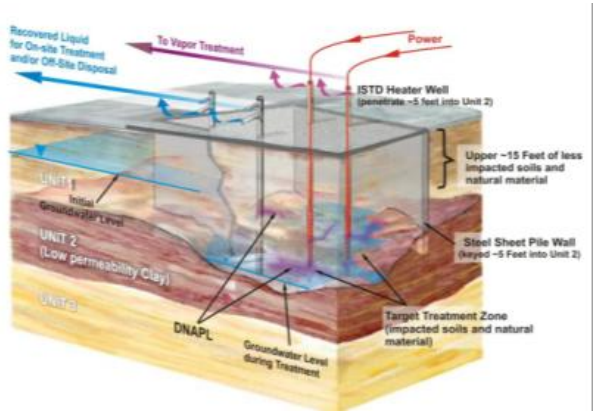
Hydraulic Containment with Barrier Wall and GW Treatment



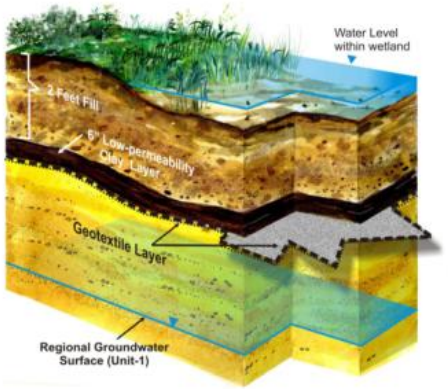
Consolidation and Capping



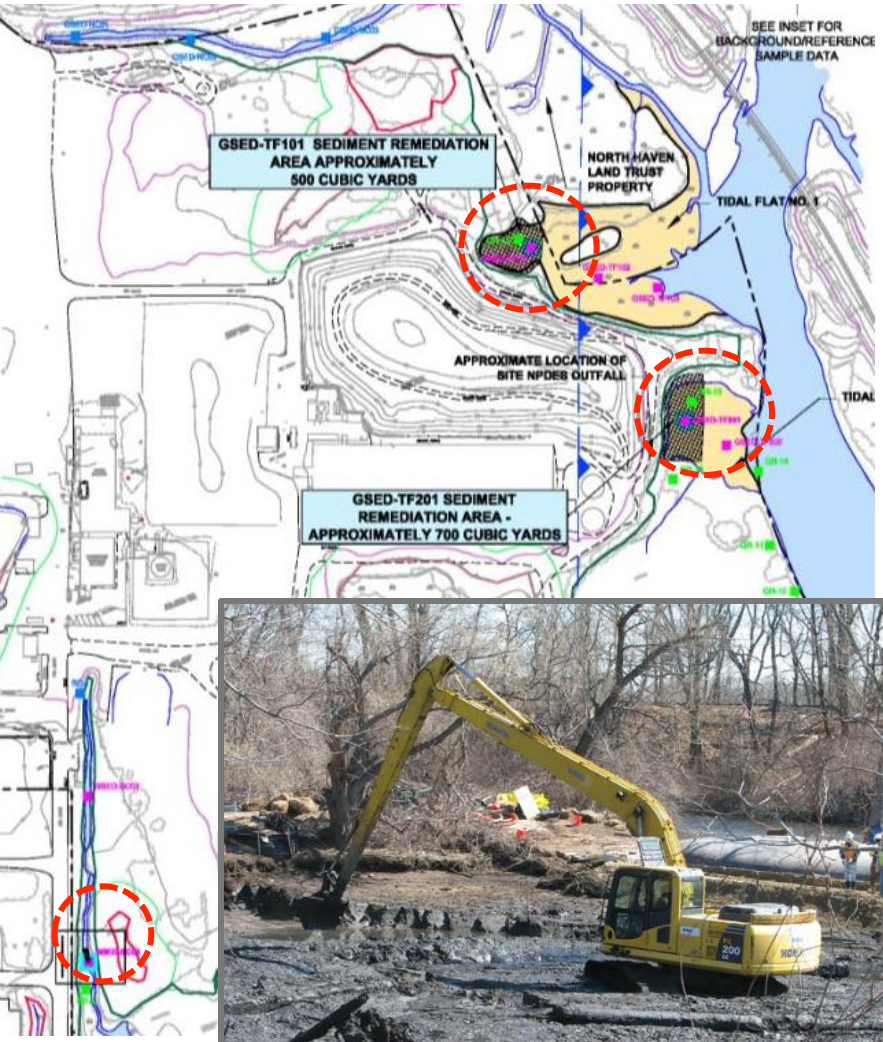
In-Situ Thermal



Constructed Wetlands



Sediment Removals
Land & Ecosystems: Conserve, Protect & Restore



Sediment Removals

- 2013 - 2014

Tidal Wetland Mitigation

- 2014 - 2015

Groundwater Control
Water: Improve Quality, Decrease Quantity of Use

Initial upgrades to existing Groundwater Treatment Facility

- 2012 - 2013

Installation of Perimeter Hydraulic Barrier Wall

- 2013

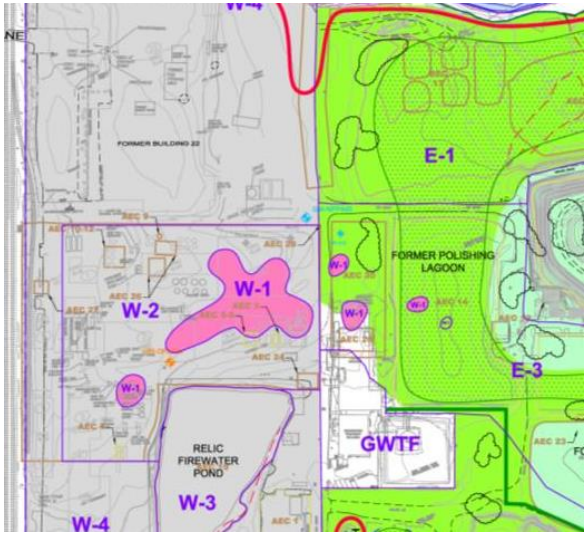
Expansion of Groundwater Extraction System

- 2013 - 2014

Final retrofit of existing GWT Facility

- On-Going

In-Situ Thermal Remediation of DNAPL
Energy: Reduction, Efficiency and Renewables



Full-scale & Pilot-scale design, construction, operation, decommissioning

- 2014 – 2016
- 275,000 lbs removed
  - Dichlorobenzenes
  - PCBs

East Side Consolidation, Stabilization, Covers
Materials & Waste: Minimize, Reuse, Recycle

North Pile

Reuse of onsite soil for grading below caps thus reducing volume of imported fill material

- 2013

New cover system completed including final cover and planting

- 2014

East Side Ecological Restoration
Land & Ecosystems: Conserve, Protect & Restore

- Ecological restoration and Tidal Wetland Mitigation
- Creation of 6+ acres of new freshwater wetland habitat
- Planting and subsequent monitoring / maintenance
  - 2014 – On-going

Case Study

CMI Sustainability and Greener Cleanup BMPs

PHARMACIA & UPJOHN COMPANY LLC SITE
NORTH HAVEN, CT

Greener Cleanup Value-Added: Not Just Money Saved

- ***The cost of Greener Cleanup is not only measured in dollars but also the comparative environmental footprint over the project life-cycle as well as the timeframe for return of the property to future beneficial reuse***

- ***The currency of added value or reduced costs must be viewed in terms of resources consumed and impacts to the environment, as well as dollars spent***

Notable Green BMPs

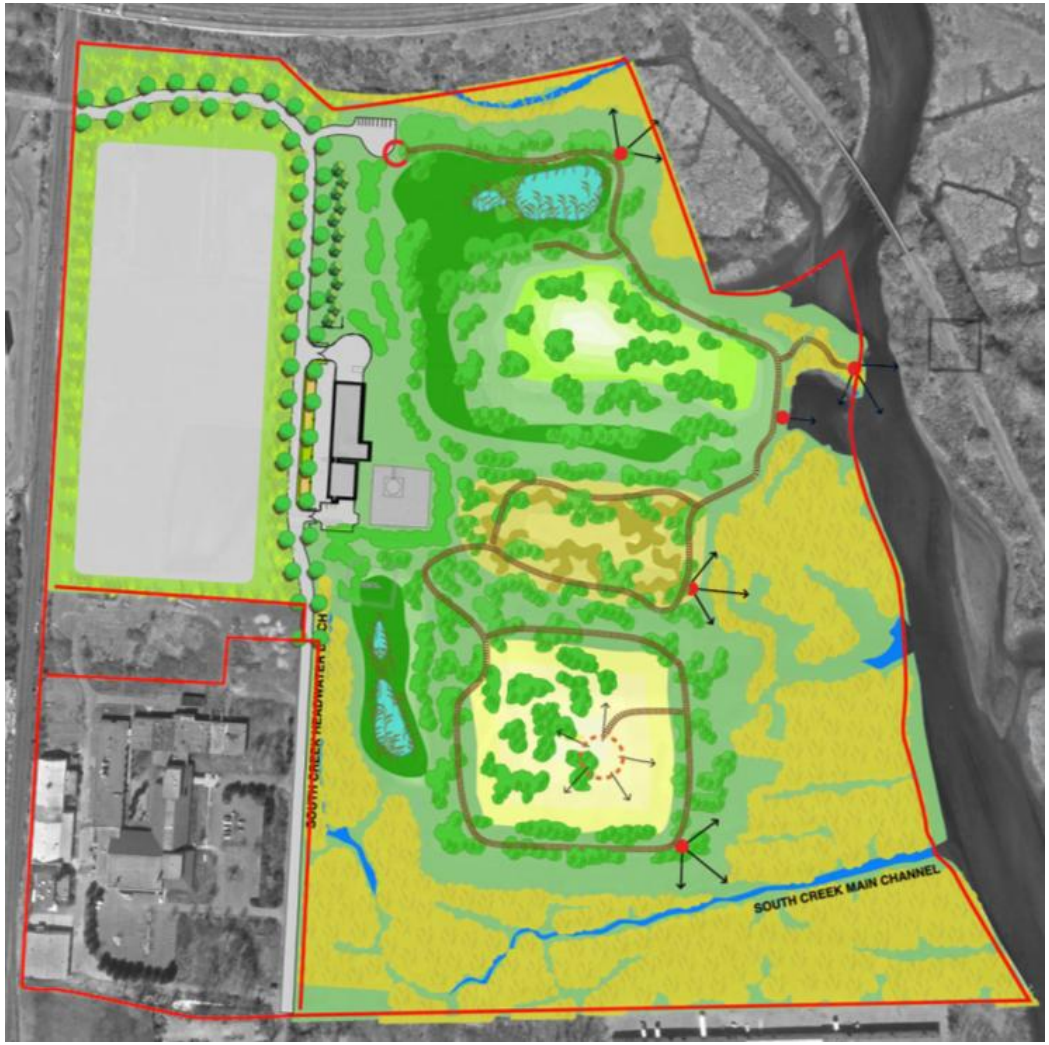
- Identified over 75 Green BMPs
- Key environmental BMPs include:
  - Consolidation of over 80,000 cubic yards of “cut” material and drill cuttings under engineered caps, avoiding off-site disposal and importing fill
  - Reduction of groundwater extraction rates by 50% via use of subsurface cutoff wall and covers
  - Creation of 6+ acres of fresh water and tidal wetlands mitigation
  - Use of approximately 2,500 tons of blast furnace slag, a manufacturing byproduct, in hydraulic barrier wall construction
  - Use local labor, suppliers and labs when possible to reduce daily transportation
- Key economic BMP
  - Local buying commitment
    - North Haven - 7% of project purchases to date
    - Within 25 miles – 44% of project purchases to date
    - State of CT – 58% of project purchases to date

Review of Green Remediation Cost Impacts for North Haven

Green Remediation Aspects	Cost Impacts
Use of local labor resources (where feasible)	Cost neutral since this was included in contract terms at the beginning of the contract
Use of recycled material in hydraulic barrier wall mix design	Unit cost comparable to other reagents – Change in mix design resulted in project cost change
Hydraulic barrier wall at toe of slope	Resulted in reduction of HBW mix and elimination of a MSE wall
Low permeability cover system with storm water directed to BMP/wetland restoration area	Results in 50% reduction in groundwater treatment flows due to reduced storm water infiltration (treatment plant operational savings)
In-Situ Thermal Remediation (ISTR)	ISTR costs offset by cost avoidance (savings) for need of DNAPL waste incineration at Port Arthur, TX
Consolidation of on-site material for cover system sub-grade	Reduced amount of clean fill import that was needed by 80,000 cu yds

Sustainability in Reuse Plan

Land & Ecosystems: Conserve, Protect & Restore



60 acre ecological restoration

- Re-established lost habitat
- Creation of on-site wetlands
- Selected re-vegetation requires minimal mowing
- Controlled public access

17-acres designated for economic development

- On-going

Case Study

Project Recognition
Greener Cleanup

PHARMACIA & UPJOHN COMPANY LLC SITE
NORTH HAVEN, CT

EPA Recognition of Achievements

CLU-IN

EPA United States Environmental Protection Agency

Technology Innovation and Field Services Division

Search

Contaminated Site Clean-Up Information

Technologies | Contaminants | Issues | Strategies & Initiatives | Vendors & Developers | Training & Events | Additional Resources

CLU-IN | Strategies & Initiatives | Green Remediation Focus | Profiles of Green Remediation | Pharmacia & Upjohn Company LLC Site

Green Remediation Focus

Pharmacia & Upjohn Company LLC Site, North Haven, Connecticut

RCRA Corrective Action

- View Menu of 32 Profiles

Cleanup Objectives: Provide long-term protection of human health and the environment by remediating soil, sediment, and groundwater impacted by past releases of manufacturing wastes, wastewater, and wastewater treatment residuals, including contaminants such as volatile organic compounds, polychlorinated biphenyls, and lead. The remedy for this 78-acre site, located along the Quinnipiac River in south central Connecticut, involves upgrade of the existing groundwater extraction system (GWES), installation of a perimeter groundwater hydraulic barrier wall, excavation and onsite consolidation of impacted soils and sediments, construction of low permeability and protective soil barrier cover systems, in situ thermal remediation (ISTR) for dense non-aqueous phase liquids (DNAPL) removal, extensive ecological restoration, and preparation of a portion of the site for future commercial/light industrial redevelopment opportunities.

Green Remediation Strategy: The strategy focuses on: (1) conducting a quantitative analysis of the carbon footprint of remedial activities, and identifying opportunities to reduce the footprint, (2) incorporating green remediation best management practices such as re-using onsite soil, sediment, and debris generated during remedy construction, (3) revitalizing the site's ecological systems in a manner that complements the Quinnipiac River ecosystem, and (4) integrating the community's vision for future use. Key studies and findings affecting the strategy include:

IMAGE GALLERY

Click on images below for details

Aerial View of Site

Results of Carbon Footprint Analysis

Staying Connected

Podcasts

NEWS Room

Live Events

TechDirect

Pfizer

CT DEEP Green Circle Sustainability Award

Project recognized for its sustainability and green remediation initiatives

Green Circle award presented by CT DEEP Commissioner and USEPA Regional 1 Administrator

One of 59 final nominees

One of 15 award winners

One of 4 businesses recognized