Optimization and Green Remediation: Strategies for Effective Cleanups with a Smaller Environmental Footprint

Carlos Pachon and Kirby Biggs
US EPA Superfund Program
Washington, DC
USA

United States Environmental Protection Agency

Federal Remediation technologies Roundtable
November 6, 2014

1

Themes

- We have made significant progress in remediating contaminated sites, but we still have work to do
- Budget constraints, policy priorities, and legacy remedial systems among other factors are driving remedy optimization and environmental sustainability goals
- Optimization and green remediation practices help us achieve protectiveness at lower cost and environmental footprint
- Better integration of the two practices promises to meet both goals more cost effectively by leveraging knowledge, information, and operational synergies

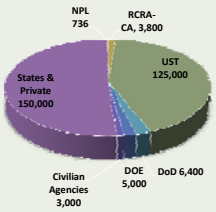
2

EPA Contaminated Site Programs: We Still a Lot of Remediation Work to Do

- In Superfund we have 1164 construction completions and 384 delisted sites**, but…
- Going forward we will invest significant resources cleaning up contaminated sites in all programs
  - » Superfund
  - » RCRA Corrective Action
  - » Underground Storage Tanks
  - » Brownfields
  - » Federal Facilities
- We have an opportunity to take lessons learned over the past decades, and apply the innovations and best management practices to future sites.

Estimated Number of Contaminated Sites
(United States, Cleanup horizon: 2004 – 33)*

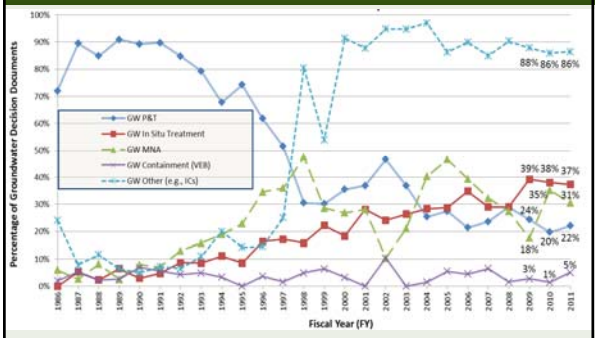
Total Sites = 294,000



Sources:
* http://cluin.org/market
** http://www.epa.gov/superfund/sites/npl/index.htm

3

Superfund Groundwater Remedy Selection (1986–11) Legacy Remedies plus a Mix of Gen X and Millennials



Draft Superfund Remedy Report; do not cite or quote: Fina ant cipated to be available 10/13 at cluin.org/asr

4

In Situ Source Treatment Technologies at Superfund Sites

- About 45% of treatment remedies for source control are currently in situ (in place)
- We are seeing fewer developments in new technologies, and more innovation in design, construction and operation of commercial technologies
- More aggressive remedies used to tackle source areas (such as in situ thermal treatment , chemical oxidation)
- Often coupled with groundwater remedies, treatment and non-treatment

Technology	Total 2009 2011	Percent 2009 2011
In Situ		
Soil Vapor Extraction	25	14%
Chemical Treatment	17	10%
Solidification/Stabilization	11	6%
Multi-Phase Extraction	9	5%
In Situ Thermal Treatment	7	4%
Bioremediation	5	3%
Subaqueous Reactive Cap	2	1%
Flushing	1	1%
Fracturing	1	1%
Phytoremediation	1	1%
Total In Situ	**79**	**45%**

Draft Superfund Remedy Report; do not cite or quote: Fina ant cipated to be available 10/13 at cluin.org/asr

5

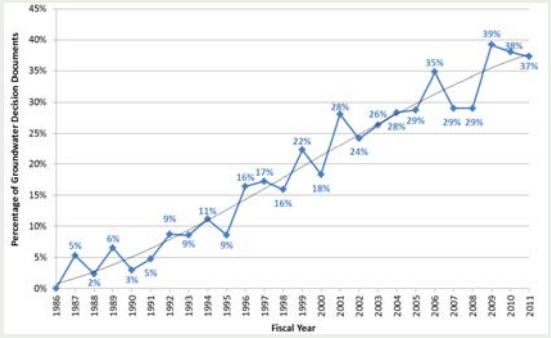
Groundwater Remedy Types Recently Selected in Superfund

- Groundwater pump and treat still common, but we see more in situ treatment remedies
- Monitored natural attenuation is used either alone or in combination
- Concept of "adaptive management" gaining ground: Actively monitoring operating systems to determine optimal transition time and place between remedy components

Remedy Type and Technologies	Total (FY09–11)	Percent (FY09–11)
Groundwater Pump and Treat	**44**	**12%**
In Situ Treatment of Groundwater	**78**	**21%**
Bioremediation	49	13%
Chemical Treatment	27	7%
Air Sparging	14	4%
Permeable Reactive Barrier	8	2%
In-Well Air Stripping	2	1%
Multi-Phase Extraction	2	1%
MNA of Groundwater	**56**	**15%**
Groundwater Containment (VEB)	**6**	**2%**
Engineered (Constructed) Wetland	**3**	**1%**
Other Groundwater	**177**	**49%**
Institutional Controls	173	48%
Alternative Water Supply	13	4%
Engineering Controls	2	1%

6

Trends in Selection of In Situ Groundwater Treatment



Total number of groundwater decision documents 1,912

Managing Superfund in a Changing Landscape

- Decreasing budgets: $105 million reduction in Superfund annual remedial budget, and loss of 70 FTE, since 2011
- Program and Agency Priorities include:
  - » Working Toward a Sustainable Future
  - » Embracing EPA as a High-Performing Organization
- Administrator interest in statutory/regulatory/policy ideas that would leverage capabilities, demonstrate progress sooner, and make more efficient use of Superfund resources to maintain program accomplishments
- Maintain core mission functions with lower environmental footprints

2014 Implementation Optimization Priorities

- Fully implemented the four components of the 2012 National Optimization Strategy:
  - » Planning and Outreach,
  - » Communication and Training,
  - » Implementation, and
  - » Measurement.
- All 32 Strategy actions have been initiated
- Priority Action Areas:
  - » Increasing optimizations at Fund lead sites
  - » Expand optimizations across project pipeline
  - » Integrate tracking and evaluation
  - » Greater integration of optimization and green remediation efforts -> RSE + Footprint analysis

Focus Going Forward: Implementation & Measurement

- 2014 concentrated on starting and completing site reviews
- Additional expertise, both HQ and regional
- Diversification of contracting resources, increasing capacity and avoiding OCI issues
- Improved tracking
  - » Optimization Project Log and the Optimization Report Inventory
  - » 2015 goal is to automate recommendation tracking and conduct recommendation status updates
- Desired endpoint- optimization becomes an engrained institutional practice across the Program

FY2011 2014 Progress of Optimization Support

Optimization Events	FY2011	FY2012	FY2013	FY2014*
Started	18	19	25	19
Ongoing from Prior FY(s)	11	22	25	20
Completed	7	16	28	25

Total: FY2011-2014*

- Events: 92
- Sites: 83
- Reports: 74
- Optimization Reviews: 74
- Technical Support: 18

Total 1997 to Present*

- Total Events: 216
- Total Sites: 191

*Data current as of 9/12/14; includes projects that are anticipated to be started and completed by 9/30/14

Sustainability : U.S. Policy Drivers at Many Levels

- **Executive Order 13514: Federal Leadership in Environmental, Energy, and Economic Performance**

  It is the policy of the United States that Federal agencies shall increase energy efficiency; measure, report, and reduce their greenhouse gas emissions from direct and indirect activities; conserve and protect water resources through efficiency, reuse, and stormwater management; eliminate waste, recycle, and prevent pollution (President Obama)
- **EPA Strategic Plan 2011-2015: Goal 3: Cleaning Up Communities and Advancing Sustainable Development**

  EPA's Superfund program will …prepare the next phase of the (green remediation) strategy to reduce the energy, water, and materials used during site cleanups while at the same time ensuring that protective remedies are implemented. (Administrator Gina McCarthy)
- **EPA Office of Solid Waste & Emergency Response Policy (OSWER): Principles for Greener Cleanups**

  As a matter of policy, OSWER's goal is to evaluate cleanup actions comprehensively to ensure protection of human health and the environment and to reduce the environmental footprint of cleanup activities, to the maximum extent possible. (OSWER Assistant Administrator Mathy Stanislaus)
- **Superfund Green Remediation Strategy**
- **… consistent with regulatory requirements**

Sustainability in Superfund Site Remediation

- **Social:**
  - » Engaging communities in site cleanup decisions
  - » Turning contaminated sites into community assets
- **Economic:**
  - » Redevelopment in blighted areas (aligns with smart growth goals)
  - » Fostering employment opportunities in communities where sites are cleaned up
  - » Rising property values in communities
  - » Remediation in the U.S.: A $7billion/year economic engine
- **Environmental:**
  - » Protecting Human Health and the Environment
  - » Liberating contaminated sites for reuse (1 remediated acre redeveloped = 4 acres of green field development)
  - » Challenge: A smaller footprint in cleaning up sites

Community Involvement (CI): Robust "Social" leg in Superfund

- By Law, Superfund requires community input in remedy decisions and implementation
- EPA parallels the International Association for Public Participation 7 "core values of public participation"
- EPA has a CI policy since 1981, and nearly 100 CI Coordinators across the 10 regional offices
- Technical assistance (grants and services) are provided to ensure communities are independently advised on challenging technical issues
- Our experience shows good CI results in better remedies
- Environmental justice link

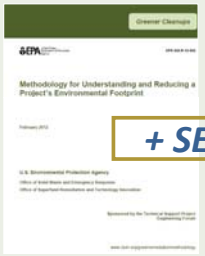
…members of the public affected by a Superfund site have a right to know what the Agency is doing in their community and to have a say in the decision-making process. (Superfund Community Involvement Handbook).

Fostering Redevelopment and Economic Opportunities

- In Superfund, Remedial Action Objectives factor *reasonably anticipated future landuse*.*
- EPA serves as an active partner in helping to return sites to productive uses
  - » Funding reuse assessments and redevelopment planning
  - » Removing reuse barriers, real or perceived
  - » Partnering with local governments, communities, developers, and other interested stakeholders
- Beyond cleanup: Sites ready for anticipated reuse is a key Superfund "GPRA" goal
- Annually 300 businesses at 142 Superfund sites with redevelopment has taken place generate $8.8 billion in sales, 25,000 jobs and $1.6 billion in employment income

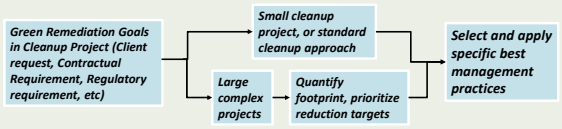
Green remediation: Options for Implementation

- **Go straight to BMPs – Use EPA GR Fact Sheets**
  - Excavation and Surface Restoration
  - Site Investigation
  - Pump and Treat Technologies
  - Bioremediation
  - Soil Vapor Extraction & Air Sparging
  - Clean Fuel & Emission Technologies for Site Cleanup
  - Integrating Renewable Energy into Site Cleanup
  - Sites with Leaking Underground Storage Tank Systems
  - Landfill Cover Systems & Energy Production
  - Overview of EPA's Methodology to Address the Environmental Footprint of Site Cleanup
- **Complex Projects Apply Footprint Methodology & prioritize BMPs**



…or apply ASTM Standard Guide for Greener Cleanups

The Role of Footprint Analysis in Greener Cleanups

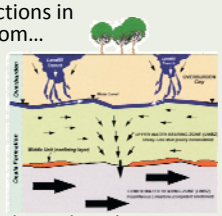


→ ***ASTM Standard Guide for Greener Cleanups (E2893):***

- ***Codifies best practices and defines a process for reducing environmental footprint***
- ***Includes over 160 BMPs and outlines process for straight BMP application or use of quantification***
- ***Useful protocol for contracting purposes***
- ***Results in a transparent documented process that is reported publicly***

Summary: Leveraging innovation to achieve efficient remedies with a lower environmental footprint

- Cost effectiveness and large reductions in environmental footprints come from…
  - » Accurate CSM
  - » Well-characterized source areas and contaminant plumes
  - » Optimal remedial strategy
  - » Adaptive management
  - » Streamlined performance monitoring & optimization



- Further footprint reductions are achieved applying green remediation best management practices
- As a result, we sustainably protect human health and the environment prepare sites for reuse

Going Forward

- Collaboration with USACE on joint optimization and green remediation training
- Capture and leverage lessons learned:
  - » Project management tools to foster implementation of RSE recommendations and green remediation practices
  - » Build experiences in operating combined remedies into remedial strategies at future sites
  - » Building lessons learned into training and outreach efforts
- Renewed focus on documenting results at a project and program level
- Align with *Superfund Program Review* Actions, such as:
  - » Adaptive management
  - » A Groundwater Remedy Completion Strategy
  - » Reinforce Smart Scoping and Best Practices at the RI Phase

Information and Resources

- **Guidance Documents**
- **Free Technical Webinars**
- **Technical Bulletins**
- **Fact Sheets**
- **Case Studies and Project Profiles**
- **Technology Descriptions**
- **Current and In-depth Information:**
  - » BMPs for common cleanup approaches
  - » Policy information at Federal and State level
  - » Assessing a project's environmental footprint
  - » Technical support

Green Remediation Focus

Hazardous Waste Clean-Up Information (CLU-IN)
www.cluin.org/

Superfund Remedies Report
www.cluin.org/asr

Green Remediation
www.cluin.org/greenremediation
www.epa.gov/oswer/greenercleanups

Optimization
cluin.org/optimization

Thank You!

Carlos Pachon
pachon.carlos@epa.gov
cluin.org/greenremediation

Kirby Biggs
biggs.kirby@epa.gov
cluin.org/optimization

Office of Superfund Remediation and Technology Innovation
US EPA, Washington DC