Sustainable Remediation Forum (SURF)
SURF 29: July 14, 2015
Webinar

Members participated in SURF 29 via webinar on July 14, 2015. ." Individuals that participated in the webinar, along with contact information, are listed in Attachment 1. The two-hour webinar marked the 29th time that various stakeholders in remediation—industry, government agencies, environmental groups, consultants, and academia—came together to discuss the use of sustainability concepts throughout the remediation life cycle. Meeting minutes of the webinar are posted for members at www.sustainableremediation.org. Members should log in and access the minutes by clicking "SURF Meeting Minutes" under "Member Resources."

Welcome

Maile Smith (SURF President) welcomed SURF members to SURF 29. Maile urged participants to continue to be introspective—to document and dissect our practices, while at the same time innovate, share our findings with others, and develop and implement robust standards for sustainable remediation. Although many individuals may view sustainable remediation as optional today, this will not be the case in the long term. Many communities are already facing the impacts of climate variability and have local mandates for climate action planning, resiliency, and adaptation. With that in mind, Maile reviewed how SURF works to improve the state of the practice of remediation through its mission of maximizing the overall environmental, societal, and economic benefits from the site cleanup process by advancing the science and application of sustainable remediation, developing best practices, exchanging professional knowledge, and providing education and outreach. SURF helps its members by:

- Demonstrating alignment between professional practice and organizational sustainability goals
- Providing frameworks, guidance, and tools to help reduce the environmental footprints, costs, and long-term liabilities of remediation sites
- Developing social responsibility and public outreach avenues for implementation in communities
- Providing peer benchmarking (both domestic and international) and access to participate in innovative thinking, research, and real-world application
- Providing in-depth access to leading edge case studies and the project managers and responsible parties implementing them
- Providing networking and collaboration opportunities and access to subject matter experts to help professional development

Updates from Committees and Technical Initiatives

Members provided updates on the recent progress of the Case Study Initiative and Social Aspects of Sustainability Initiative. Summaries of these updates are provided below.

- Case Study Initiative
  Amanda McNally (SURF Secretary) provided the status of this initiative and progress to date. Fourteen case studies are complete and posted on the SURF website under the Library menu in the Case Studies folder under Case Study Initiative Database. This database provides a publicly available resource for remediation professionals to use to demonstrate sustainable remediation successes. The goal is to post 20 case studies on the website by the end of the summer. Completed case studies and questions about the initiative may be directed to csi@sustainableremediation.org.

- Social Aspects of Sustainability Initiative
  Melissa Harclerode (Initiative Co-Chair) provided the status of the white paper that initiative members are writing (see Attachment 2). Currently the team is compiling revisions and addressing comments received.

  Melissa also provided a summary of recent SURF-funded research conducted as part of the social aspect of remediation. The study is being conducted by Montclair State University (MSU) and New Jersey City University (NJCU) to gather information on Jersey City residents' perception of the risk associated with lead contamination in soil and paint on their property. The results of the study will be shared with the Jersey City Department of Health and published in a peer-reviewed journal. SURF's support in this study has two long-term benefits. First, the study introduces NJCU undergraduate students to an important social aspect of remediation: the community's perception of risk to hazardous substances. Second, this study serves as the foundation for similar research as part of SURF's Groundwater Reuse and Conservation Technical Initiative. The public's perceived risk of reusing treated groundwater is a major obstacle to the practice, as noted in SURF's paper on the topic (www.sustainableremediation.org\water).

General Motor's Green Remediation Program

Geraldine Barnuevo (General Motors) provided an overview of her company's green remediation program—from conducting a pilot program to developing programmatic guidelines to applying the guidelines at remediation sites. As a result of these efforts, the company is now working with Region 5 of the U.S. Environmental Protection Agency (USEPA) to integrate green remediation at all of its RCRA sites that are scheduled for closure by 2020. Through its efforts, Geraldine said General Motors has realized the following benefits of green remediation: provides a consistent approach for integrating sustainability, supports other project requirements, illustrates short- and long—term impacts, and promotes enhanced stakeholder collaboration and satisfaction. Presentation slides are provided in Attachment 3.

- Phase 1: Pilot Study
  The first phase involved a pilot study from which to build a larger program. Data were compiled from a site in the Midwest that was in the investigation stage. Best management practices (BMPs) were identified and incorporated into the project to improve performance in specific areas (e.g., energy consumption, water use, waste generation, health and safety, stakeholder satisfaction). Spreadsheets were created as guidance to help implement the practice and document the benefits and challenges. Lessons learned were derived from a green remediation evaluation and revealed that integrating green remediation does not require a significant level of effort and is part of good business.

- Phase 2: Programmatic Guidelines
  Following the success of the pilot study, General Motors began working with USEPA Region 5 to integrate green remediation at its Corrective Measures Proposal facilities. Company programmatic green remediation guidelines were finalized at the end of 2014. The guidelines outline the following four steps for the program: (1) defining the scope (i.e., core elements and boundaries), (2) identifying and implementing BMPs, (3) performing an initial green evaluation during remedy selection and refining the evaluation during the corrective measures implementation, and (4) managing and reporting green remediation data and efforts.

- Phase 3: Guideline Application
  Geraldine reviewed two examples of General Motors' green remediation program in action. In the first example at a site in Brazil, two remediation scenarios were compared using green remediation BMPs. In the second example at a site in the Midwest, the environmental impacts of specific core green remediation elements of proposed final corrective measures were evaluated.

Questions after the presentation focused on the environmental footprint methods and approach. In response to whether the ASTM *Standard Guide for Greener Cleanups* was used, Geraldine said that a spreadsheet developed by the USEPA was used to quantify the environmental footprint. The quantification focused on the cleanup alternatives, not raw materials.

Accelerated Site Closure Achieved after System Optimization

Sheri Knox (Amec Foster Wheeler) provided three case studies to demonstrate the value of system modification and/or optimization in achieving progress toward closure. Long-term remediation systems are generally successful but tend to diminish in efficiency over time, leading to potential stagnation and no progress toward the goal (i.e., closure). The case studies below highlight the need to review the remedial approach with stakeholders on a regular basis, avoid becoming complacent (even if the approach is going as planned), and consider the current business climate. Presentation slides are provided in Attachment 4.

- Site #1: Southeast Military Installation
  At this site, the soil vapor extraction (SVE) system had been operating for 13 years to treat groundwater contaminated with total petroleum hydrocarbons (TPH). Risk-based closure was not an option. The goal (i.e., closure) was confirmed with the stakeholders and changes in the regulatory view of the site and the possibility of collaboration were discussed. With the responsible party and regulator engaged in problem solving, a plan was developed to demonstrate that a creek located within 250 feet of the contamination would not be impacted. An impact analysis was performed, and historical monitoring results were analyzed to identify trends. Hypothetical rebound was included in fate and transport modeling. With groundwater restrictions now a possibility (vs. 13 years ago), a no further action decision was granted for the site within a year of the reevaluation.

- Site #2: Southeast Military Installation
  At this site, the SVE system had also been operating for a long time (14 years) to treat soil and groundwater contaminated with TPH. Again, the goal (i.e., closure) was confirmed with the stakeholders and the possibility of collaboration was discussed. To achieve closure, the vadose zone impacts in the source area needed to be addressed and the receptor (i.e., surface water within 300 feet) needed to be protected. With the groundwater recovery system in need of repair, the groundwater treatment system was rebuilt and restarted to protect surface water (vs. groundwater). In parallel, bioremediation was enhanced in the source area by excavating the smear zone and blending the soil with calcium peroxide. Groundwater remediation was accelerated by injecting stabilized 3% hydrogen peroxide.

  The goal is to achieve closure in five years. In the meantime, annual monitoring will reveal potential residual effects of the hydrogen peroxide amendment and be used to determine if additional injections are feasible. In addition, on-site ultraviolet fluorescence testing was used to fingerprint the TPH, which will allow stakeholders to determine if additional excavation is worthwhile.

- Site #3: Former Manufacturing Site
  At this site, the pump-and-treat system was operating for 20 years, with most wells continuing to exceed maximum contaminant cleanup levels. Using a collaborative approach, remedial alternatives were reevaluated, the source area was addressed, and risk was incorporated into the developed approach.

After the presentation, participants discussed the closure associated with Site #1. Sheri said that, although risk-based closure was not officially an option, it was negotiated during the collaboration because the regulatory perspective about the site had changed.

Enabling Green and Sustainable Remediation through Contracting Mechanisms

Carol Dona [U.S. Army Corps of Engineers (USACE)] provided an overview of how green and sustainable remediation elements should be integrated when writing contracts. Carol reviewed the importance of identifying the customer, determining the basis for conducting green and sustainable remediation, specifying the level of effort required, and documenting the benefits of green and sustainable remediation before writing the contract. Using these important steps, Josh Van Bogaert (USACE) presented example contract language used for a USACE Formerly Used Defense Site (FUDS) project, the incentives used to increase green and sustainable remediation incorporation and implementation quality, and the results of the project to date. Josh said that the process of incorporating green and sustainable remediation at the contract level is a developing process at the USACE and not yet uniformly implemented across the agency. As such, he encouraged participants to provide feedback on the process. Josh believes that incorporating green and sustainable remediation into performance-based RI/FS contracts is challenging because of potential greenwashing. He emphasized the importance of the documentation step in the process so that the benefits of green and sustainable remediation are recorded and sufficient funding for this work can be maintained. Presentation slides are provided in Attachment 5.

Discussions after the presentation focused on quantifying the results with respect to uncertainty. Although sensitivity analyses are performed for some projects, the particular project presented focused more on identifying and implementing BMPs and performing carbon footprint analyses at the FS stage.

Do Green and Sustainable Remediation Frameworks Adequately Represent Ecosystem Services and Natural Resources?

Jonathon Weier (CH2M) began his presentation with an answer to the above question: no. He explained that optimizing the net environmental benefit – the change in ecosystem services between the pre- and post-remediation landscape – is often not considered in remediation decision making. Jonathon defined ecosystem services as the benefits that people gain from natural resources. He believes that ecosystem services and natural resources are under-represented in remediation decision making because of the following:

- An evolution of focus
- The lack of pre- vs. post-remediation landscape in guidance
- Ineffective communication of value
- Lack of ecologists included in decision making during the FS stage
- The myth that “changes in nature are too difficult to quantify”

Jonathon emphasized the importance of including ecosystem services in the process by (1) explaining the options available to address ecosystem service changes; (2) reminding participants that contamination impairs and remediation influences ecosystem services; and (3) demonstrating the importance of the relationships between cost, risk, and net environmental benefit. He presented three examples showing how changes to ecosystem services can be quantified over time. Jonathon ended his presentation by listing several characteristics that make a remediation site a good candidate for a net environmental benefit analysis (NEBA). Presentation slides are provided in Attachment 6. For more information on the types of ecosystem services and a link, visit http://www.millenniumassessment.org/documents/document.300.aspx.pdf.

Attachment 1
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Attachment 2

Update: Social Aspects of Sustainability Initiative

Social Aspect Technical Initiative

Objectives:

- is researching and writing a **White Paper** (journal article) to present on the current state of the practice for **evaluating impacts to the social component** of sustainability during **remedial activities**

Status:

- **To Date:** ***Received contributions*** from institutions at an international level (see team members)
    - First round of review completed
- **Presently:** ***Compiling revisions/addressing comments***
- **Future Milestone Dates:**
    - ***Second round of review (mid-August/September 2015)***
    - Compile revisions/integrate comments (October/November 2015)
    - Submit to journal for publication (December 2015)

Team Members:

- Lead – Melissa Harclerode (SURF)
- Additional Represented Organizations:
    - SURF Canada
    - SURK UK
    - SURF Taiwan
    - SURF Italy
    - ISO
    - Common Forum
    - NICOLE
    - Academic Representatives
        - University of Venice
        - University of Nottingham
        - Montclair State University

Contact:

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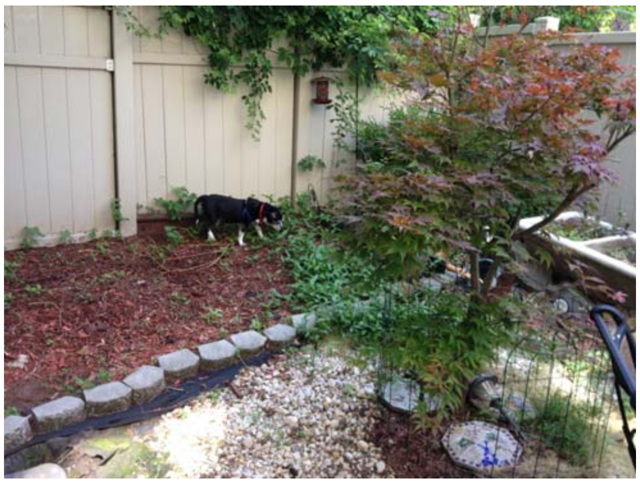
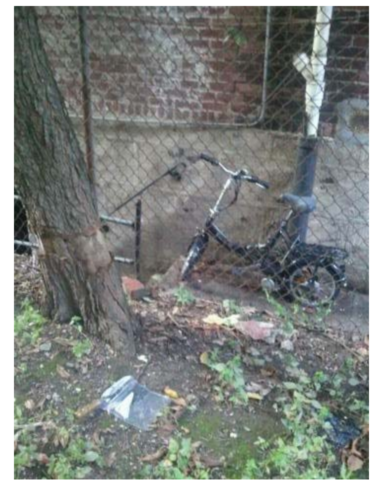
SURF Funded Research: Social Aspect of Remediation

- **Risk Perception Survey:** gauge individuals' opinions/mitigation efforts on exposure
  - **Address non-point source pollution** (e.g., historic fill material, lead-based paint)
  - **Identify education and outreach needs** (Jersey City Department of Health)





**Study will serve as a foundation to conduct similar research for the SURF Groundwater Reuse and Conservation Technical Initiative*
  - The public's perceived risk of re-using treated groundwater

Attachment 3

General Motors' Green Remediation Program

General Motor's
Green Remediation Program

SURF Webinar 14 July 2015

Presentation Outline

- GM's Corporate Sustainability Goals
- Green Remediation Program

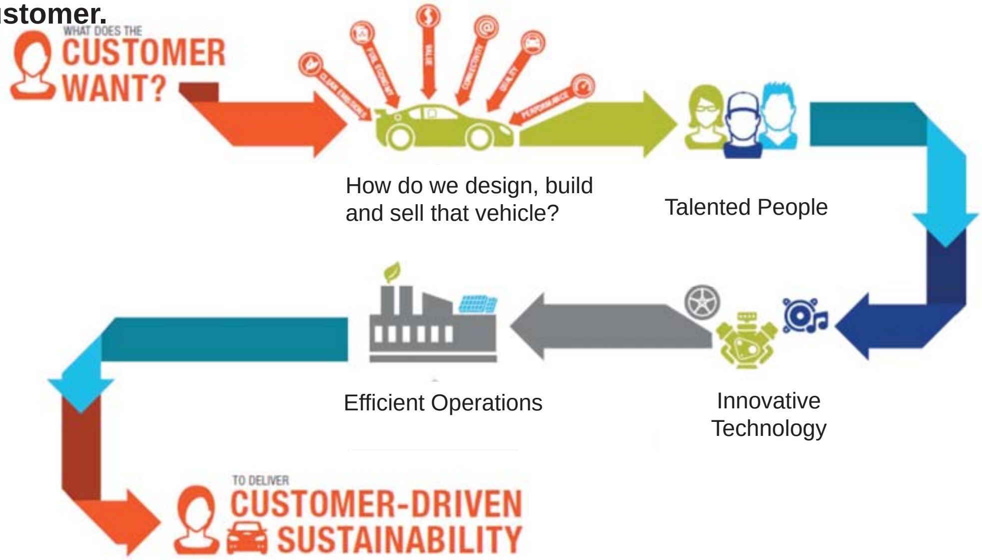
Phase 1: Pilot

Phase 2: Programmatic Guidelines

Phase 3: Guidelines Application

Customer driven sustainability

With respect to Sustainability, as in all things, our focus is our customer.



GM

We start with the vehicle attributes that our customers most desire and then apply GM resources to design and build that vehicle in the most environmentally sustainable and socially responsible manner possible.

GM Corporate Sustainability Commitments

GM

Why Integrate Green Remediation?

- Aligned with GM's manufacturing sustainability commitments
- Supports other remediation project goals (efficiency, protection of human health and the environment)
- Encouraged in several states and/or by certain regulators

Phase 1: Green Remediation Pilot Study

Objective: small initial effort from which to build larger program

Background

- Building Construction 1960-1992
- 2.9 million ft^2 manufacturing & administrative
- 40+ years of manufacturing

Green remediation evaluation focus: stage 3 of RFI investigation

Pilot Approach

Best Management Practices (BMP) identification

↓

BMP implementation

↓

Green remediation evaluation

Incorporation of BMPs

Focus on specific metrics to improve performance:

- GHG emissions/energy consumption
- Water use
- Waste generation
- Health & safety
- Stakeholder satisfaction

Water Consumption

No.	Methods/Best Management Practices
	Water Consumption
1.1	Increase efficiency during packer testing activities
1.2	Explore options for reusing graywater
1.3	Use clean water for site irrigation or place it into the stormwater system rather than discharging it to a public sewer system
1.4	Minimize the use of water when employing drilling techniques
	Water Contamination
2.1	Use biodegradable hydraulic fluids on hydraulic equipment such as drill rigs

BMP Implementation

- Responsibilities assigned to each BMP
- Implementation guidance provided
- Benefits and challenges identified
- Implementation progress recorded

Energy Consumption — GOAL: Reduce energy intensity & greenhouse gas (GHG) emissions during the implementation of RCRA Corrective Action

No.	Methods/Best Management Practices	Metric	Responsible	Implementation Guidance	Implemented Yes/No	Benefits	Challenges	Notes	J	F	M
	Evaluate Investigation Methods										
1.1	Use in situ data loggers wherever appropriate to monitor water levels		D. Putz/ D. Breedon	- Identify where data loggers will be beneficial. - GM to acquire additional data loggers.	Yes	Reduces trips to the field for manual water level measurements.	To purchase enough transducers and to reuse them.				
1.2	Utilize direct-push technology for soil sampling where feasible		G.Barnuevo/ D. Putz	- Review investigation areas. - Identify options where traditional techniques can be substituted by direct-push (e.g. groundwater grab samples versus monitoring wells).	Yes	A cheaper alternative to traditional drilling.					
1.3	Ensure equipment/techniques used on site match requirements and minimize days in the field (e.g. sonic vs hollow)		G.Barnuevo/ D. Putz	- Review drilling techniques with contractors during the planning stages of field investigation. - Identify equipment that are oversized for the task at hand and replace this equipment with equipment that match site requirements where feasible.	Yes	Reduces cost and fuel use, complete task faster.	Identify "right-sized" equipment for task (e.g. Geoprobe was often underpowered for TOR sampling).				

Green Remediation Evaluation

Core element	Metric	Units	Footprint (no BMPs)	Footprint (BMPs)
Materials & Waste	Refined materials	Tons	2	2
	% refined materials from recycled sources	%	0%	27%
Energy	Total energy used	MMBtu	2,005	1,991
Air	Total GHG emissions	Tons CO2e	160	159
	Total NOx, SOx and PM emissions	Pounds	2,538	2,523

http://cluin.org/greenremediation/methodology/

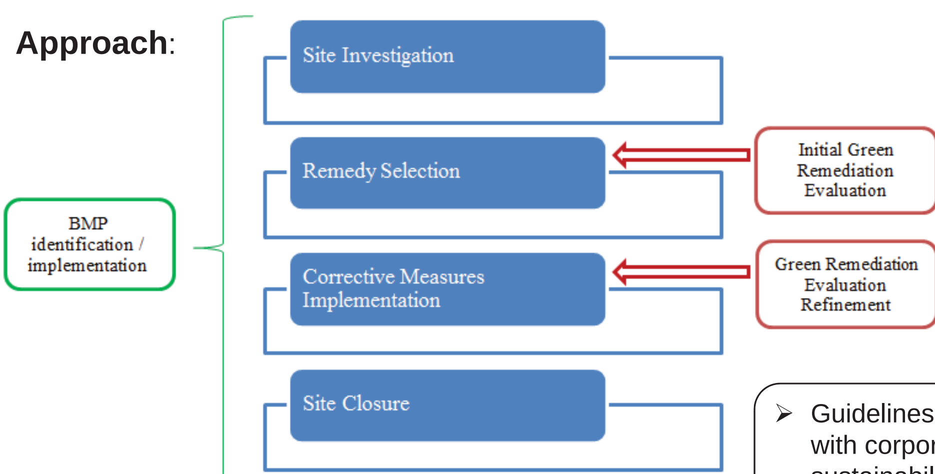
Lessons Learned during Pilot

- ✓ Green remediation integration doesn't require significant levels of effort
- ✓ Effective planning:
  - Significantly reduces impacts
  - Ensures sustainability considered throughout project
- ✓ Appropriate drilling technique may reduce air emissions, and energy, waste and water use
- ✓ Pilot logged 3132 hours without accidents or incidents onsite
- ✓ Enhanced communications prevented delays/standby time
- ✓ Green remediation incorporated into future site activities
  - ✓ → **part of GOOD BUSINESS**

Phase 2: Programmatic Green Remediation Guidelines

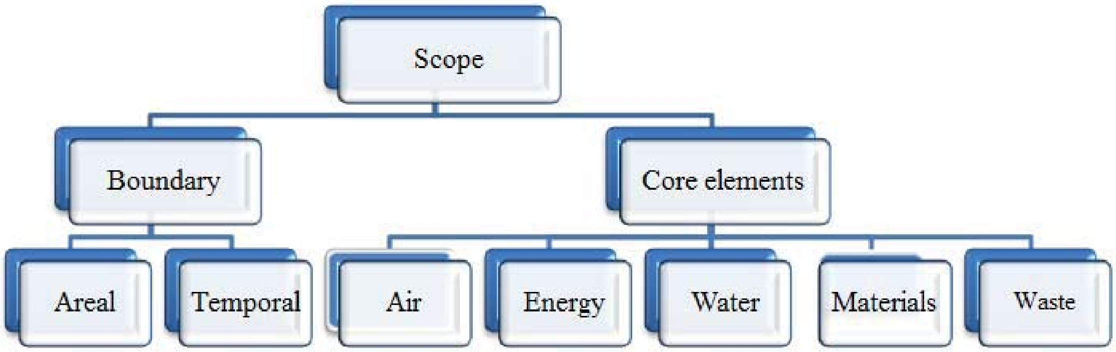
Objective: incorporate/evaluate green remediation for Corrective Measures Proposal (CMP) facilities

Approach:



- ➢ Guidelines again aligned with corporate sustainability commitments

Step 1: Scope

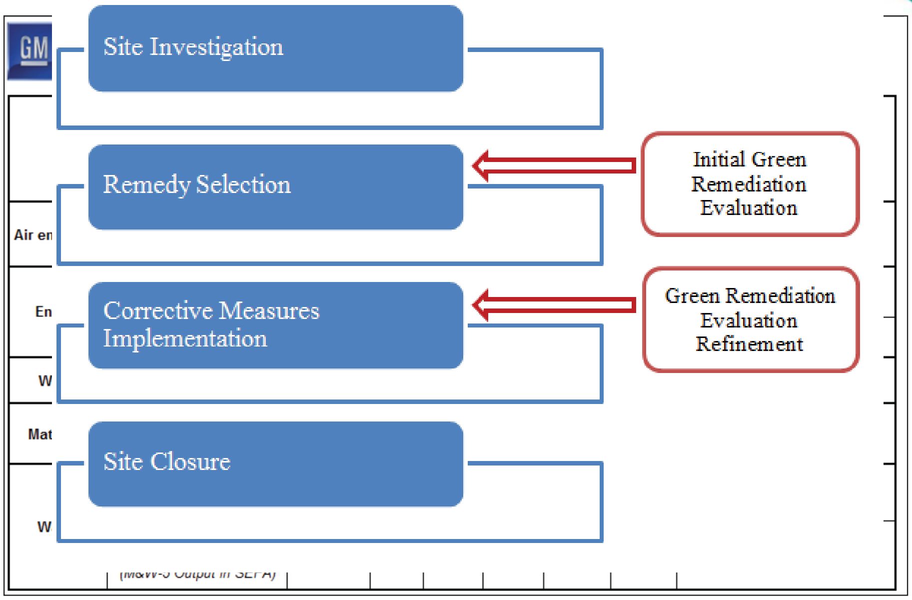


Step 2: BMPs

LIST OF BEST MANAGEMENT PRACTICES

Best Management Practice	Core Element Addressed (at Site Level)				Applicable?	Employed at the site?	Notes
	Energy	Air	Water	Materials and Waste	Y/N	Y/N	
Use of the greenest remediation technology or approach, considering all controlling parameters (e.g., cost, time, remediation goals, land reuse, technical restrictions)	X	X	X	X			
Consider emerging technologies to lower environmental impacts	X	X	X	X			
Reexamine and update the conceptual site model as necessary	X	X	X	X			
Identify opportunities to create habitat as part of site remediation			X				
Reduce fugitive dust/volatile emissions during on-site operations and storage (e.g., covering, biodegradable foam, watering)		X					
Retrofit machinery with clean diesel or other technologies for cleaner engine exhaust		X					
Reduce fugitive dust/volatile emissions during off-site shipment (e.g., covered hauling trucks)		X					
Use cleaner fuel, where available		X					
Evaluate on-site and in situ treatment and containment technologies to determine whether they provide lower emissions	X	X		X			
Select technologies that reduce duration of drilling, pumping/purging, and other sources of site-related emissions	X	X					

Step 3: Green Remediation Evaluation



Step 4: Data Management and Reporting

Internal requirements:

- Record green remediation data in real time
- Assigned team member should record data

External requirements:

- Green remediation included in documentation submitted to regulatory agency(ies)

Phase 3: Guidance Application Example 1

Green remediation comparison of two remediation scenarios, Brazil:

- Scenario 1: Installing an impermeable cap
- Scenario 2: Employing an existing permeable soil cover

OUTPUT	UNIT	SCENARIO 1 IMPERMEABLE CAP	SCENARIO 2 PERMEABLE SOIL COVER
Total Greenhouse Gas Emissions	tons CO_2e	1,367	1,320
Total Energy Consumption	MMBtu	25,454	18,900
Refined Material Consumption	tons	249	63
Unrefined Material Consumption	tons	96,188	167,674
Non-Hazardous Solid Waste Production	tons	1,060	1,060
Land and Ecosystem	--	Qualitative	Qualitative

Guidance Application Example 2

Green remediation integration into a CMP, Midwest USA:

- Overview of green remediation approach in main report
- Dedicated green remediation appendix

The proposed final corrective measures have been evaluated to identify environmental impacts (both positively and negatively). This evaluation considers the following environmental core elements:

- Air emissions
- Energy
- Water
- Materials
- Waste

OUTPUT	UNIT	ALTERNATIVE		
AOI-23 Site Groundwater		Alternative 1 - Baseline and Above-Baseline Institutional Controls and Groundwater Monitoring Program	Alternative 2 - Baseline and Above-Baseline Institutional Controls and Groundwater Extraction	Alternative 3 - Baseline and Above-Baseline Institutional Controls and Enhanced Bioremediation
Total Greenhouse Gas Emissions	tons CO_2e	1.40	939	1,426
Material Consumption	pounds	0	0	961
Solid Waste Production	tons	0	0	0.43
Total Energy Consumption	MMBtu	16.7	15,407	23,467
Groundwater Extraction	gallons	0	315,360,000	946,080,000
Land and Ecosystem	--	Qualitative	Qualitative	Qualitative

Benefits of Green Remediation Efforts

- Consistent approach for integrating sustainability
- Buy in from project teams ensures positive results
- Supports other project requirements
- Illustrates short- and long-term impacts:
  - Highlights the life cycle impact drivers
- Promotes enhanced stakeholder collaboration and satisfaction
- Ensures continuous improvement

Questions?

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Attachment 4

Accelerated Site Closure Achieved after System Optimization

Accelerated Site Closure Achieved After System Optimization

Battelle - May 2015

Sheri Knox

Amec Foster Wheeler

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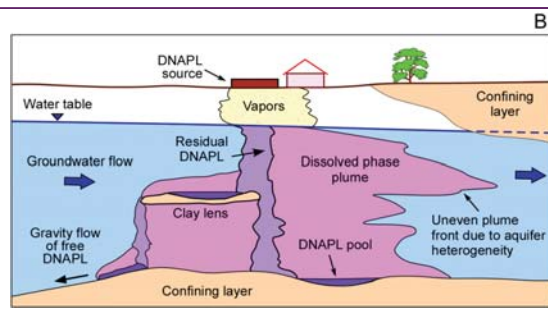
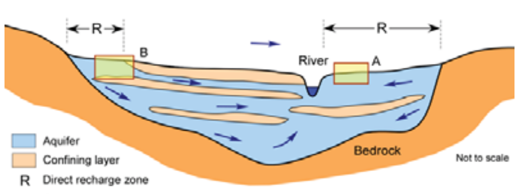
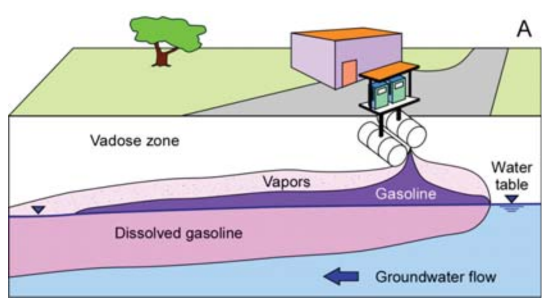
Presentation Overview

1. Background
2. Site #1 Case Study
3. Site #2 Case Study
4. Site #3 Case Study
5. Overall Results/Lessons Learned

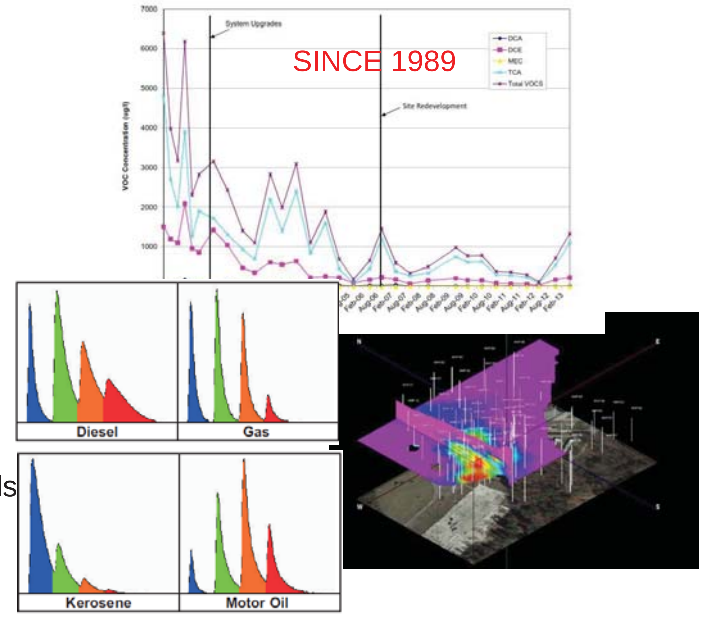






Background

- Long-Term Remediation Projects
  - Usually Successful, but Efficiency Diminishing
- Complicated Technical & Regulatory Requirements
  - Significant Time & Effort Expended to Identify a Remedy
- Stagnation
  - No Progress Toward Goals



Challenge

<u>Progress Toward Closure</u> Requires System Modification/Optimization

Site #1 – Southeast Military Installation

Site #1- Southeast Military Installation

- ▶ Maintenance Shop
- ▶ Fuel Dispenser/UST
- ▶ Release of Gasoline Early 2000s
- ▶ Creek within 250 feet

Site #1- Southeast Military Installation

Engaged to Perform Operation & Maintenance

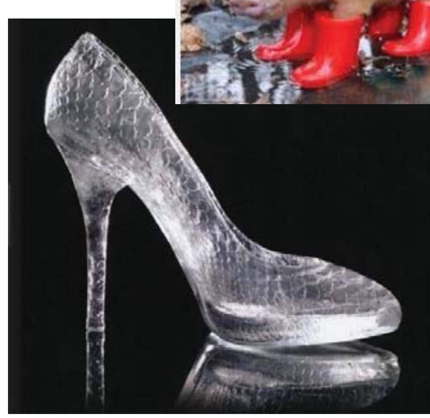
- ▶ Remedy In Place – Thirteen Years
- ▶ 8 Vacuum Enhanced/Groundwater Recovery Wells
- ▶ 31 Air Sparge Wells
- ▶ 5 Passive Vents

Helpful Tip: If numerous wells are planned that have no well head cover, consider adding a tracer wire, so they can easily be located for repairs or demolition.

Site #1- Southeast Military Installation

Recognize and Convey

- ▶ Confirm the Goal with Stakeholders
- ▶ Technologies/Approach May Change
  - ▶ What was once a “glass slipper”
- ▶ Changes in Regulatory View of Site
- ▶ Collaboration is Possible (find out)



Site #1- Southeast Military Installation

Solution

- Goal is Closure for Site #1
  - Risk-Based Closure is Not An Option
- Initiated Conversations with Regulatory Agency
- Client and Regulatory Agency Engaged in Problem Solving

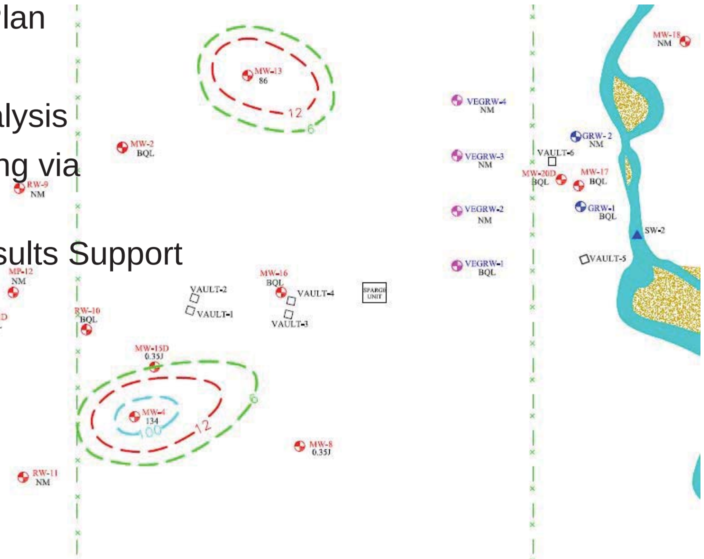
Decision Point Toward Closure

Demonstrate That The Creek Will Not Be Impacted

Site #1- Southeast Military Installation

Implement Collaborative Plan

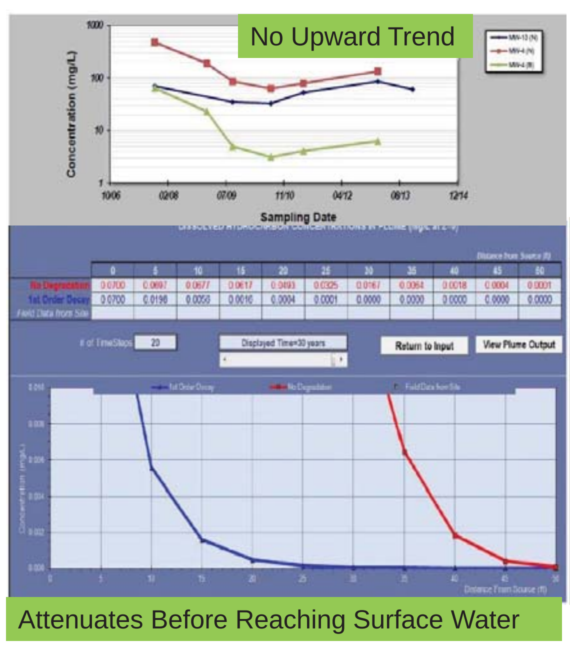
- ▶ Mann-Kendall Trend Analysis
- ▶ Fate & Transport Modeling via BIOSCREEN
- ▶ Historical Monitoring Results Support Premise
- ▶ Groundwater Restriction



Site #1- Southeast Military Installation

Implement Plan

- ▶ Mann-Kendall Trend Analysis
  - ▶ Benzene & Naphthalene
  - ▶ No Upward Trend in Monitoring Wells With Residual Impacts
- ▶ Fate & Transport Modeling via BIOSCREEN
  - ▶ Naphthalene
  - ▶ Groundwater Seepage Velocity = 8 ft/yr
  - ▶ 1st Order Decay = 0.27 per year
  - ▶ Including Hypothetical Rebound



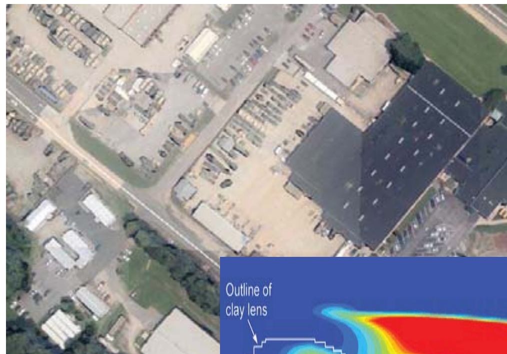
No Further Action Decision

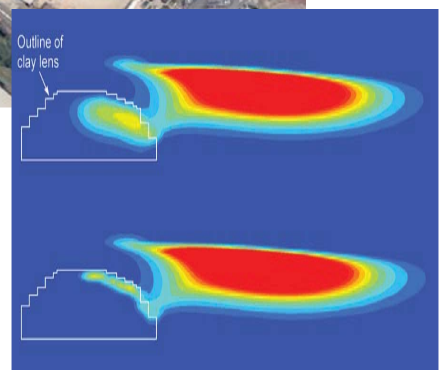
Released September 2014 Within a Year

Site #2 – Southeast Military Installation

Site #2- Southeast Military Installation

- Maintenance Shop
- Fuel Dispenser/UST
- Release of Fuel
  - Soil and Groundwater
- Surface Water within 300 feet





Site #2- Southeast Military Installation

Engaged to Perform Operation & Maintenance

- Remedy In Place – 14 Years
- 7 Soil Vapor Extraction Wells
- 7 Dual Phase Extraction Wells
- 3 Groundwater Recovery Wells

Site # 2- Southeast Military Installation

Solution

- Goal is Closure for Site #2
- Initiated Conversations with Regulatory Agency
- Client and Regulatory Agency Engaged in Problem Solving

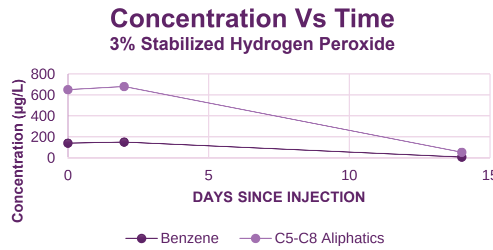
Decision Point Toward Closure

Address Vadose Zone Impacts in the Source Area & Protect Receptor

Site # 2- Southeast Military Installation

Implement Collaborative Plan

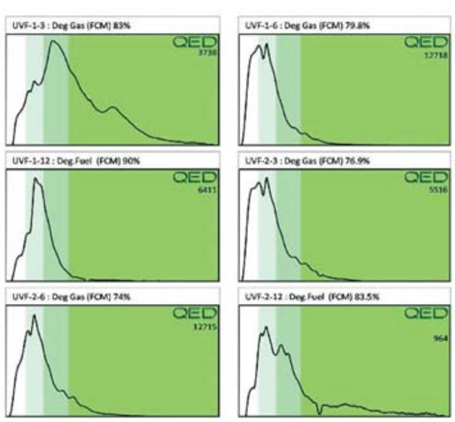
- ► Re-Build System
  - ► Re-Start Groundwater Treatment System to Protect Surface Water (Not Groundwater)
- ► Enhance Bioremediation
  - ► Excavate Smear Zone & Soil Blending - Calcium Peroxide
- ► Accelerate Groundwater Remediation
  - ► Pilot Test – Inject Stabilized 3% Hydrogen Peroxide



Site # 2- Southeast Military Installation

Implement Collaborative Plan

- ► Enhance Bioremediation
  - ► Excavate Smear Zone & Soil Blending - Calcium Peroxide



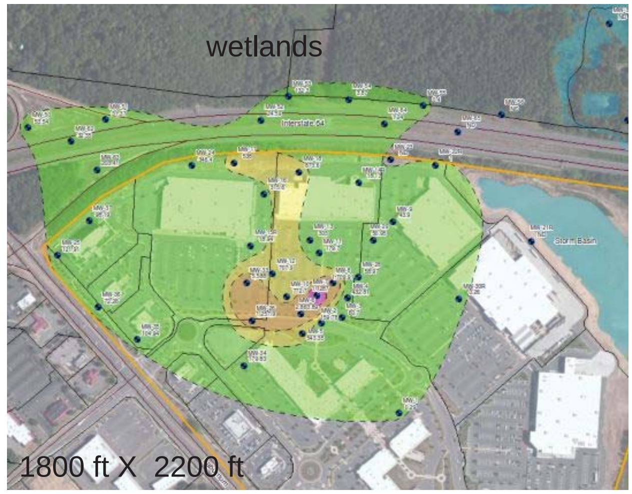
Accelerated Progress Toward Closure

Plan In Progress – Closure in 5 Years

Site #3 – Former Manufacturing Site

Site #3 – Former Manufacturing Site

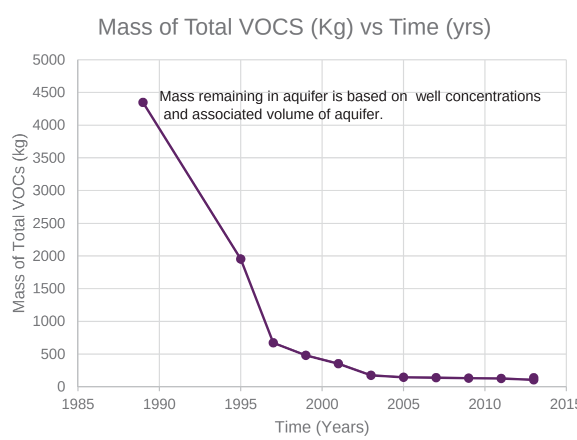
- Release of TCA & MEC
- Wetlands Near By
- Water-Supply Wells Nearby



Site #3 – Former Manufacturing Site

Engaged to Perform Site Optimization

- Remedy In Place – 20 Years
  - Most Wells Exceed MCL Style Clean Up Levels
- Historical Soil Excavation
- 18 Groundwater Recovery Wells
- Discharges 1.5 M Gal a month



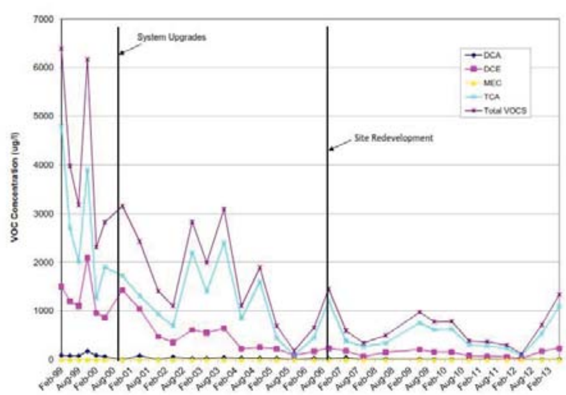
Decision Point Toward Closure

Revaluate & Update Entire Approach

Site # 3 – Former Manufacturing Site

Collaborative Planning

- ► Re-Evaluate Remedial Alternatives
  - ► Year Shut-Down Testing
  - ► Modelling
  - ► Aggressive Monitoring
- ► Address Source Area
  - ► Insitu Source Area Treatment
  - ► Assist MNA
- ► Incorporate Risk Within Approach



Summary/Lessons Learned - Bringing the Pieces Together

- Review Approach with Stakeholders on a Regular Basis
  - If Regulations Continue Toward Risk-Based Closure
  - Further Optimization May Be Required
- Avoid Becoming Complacent
  - Even if Approach is “Going as Planned”
- Consider Current Business Climate
  - Client’s Intermediate Goals
  - Client’s Ultimate Goals

QUESTIONS

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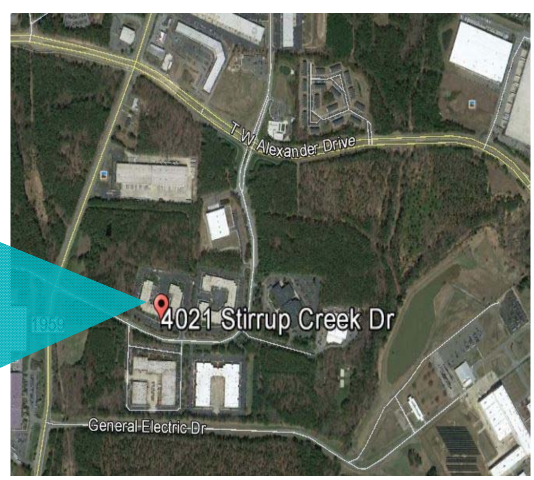


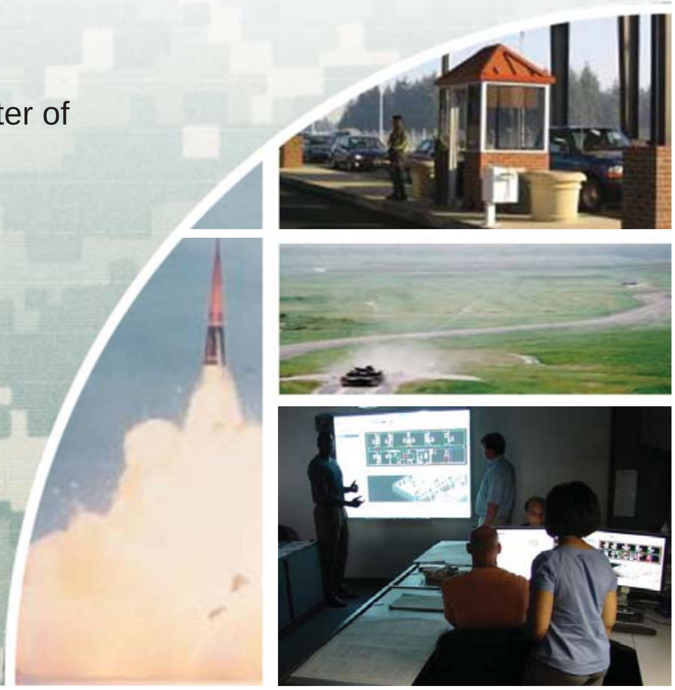
Attachment 5
Enabling Green and Sustainable Remediation through Contracting Mechanisms

Enabling Green and Sustainable Remediation with Contracting Mechanisms

Carol Lee Dona, Ph.D, P.E.

U.S. Army Corps of Engineers, Environmental and Munitions Center of Expertise

Josh Van Bogaert, P.E.
U.S. Army Corps of Engineers, Louisville District



US Army Corps of Engineers
BUILDING STRONG®

Presentation Topics

Pre-Contracting
- ► Customer
- ► Basis of GSR/GR
  - Agency Policy/Guidance
  - Approach
- ► Level of Effort
  - Best Management Practice List Evaluation
  - Quantitative Footprinting
- ► When will GSR be applied
- ► Documentation

Example Contract Language
- ► USACE Formerly Used Defense Site (FUDS) project

Conclusions and Path Forward

Who is the Customer – It Makes a Difference

Environmental Protection Agency – “Green Remediation”

- The incorporation of practices, processes, and technologies into cleanup activities with the goal of reducing impacts to the environment through reduced demands on natural resources and decreased emissions to the environment (2013 ASTM Greener Cleanups Standard Guide)

Department of Defense (Air Force, Navy, Army, USACE), Department of Energy, Nuclear Regulatory Commissions, other Federal Agencies – “Green and Sustainable Remediation”

- The site-specific employment of products, processes, technologies, and procedures that mitigate contaminant risk to receptors [during cleanup activities] while making decisions that are cognizant of balancing community goals, economic impacts, and environmental effects (ITRC, 2011)

Basis of GSR

- Agency Policy/Guidance
- Approach

Basis - Agency Guidance and Policy

- Department of Defense policy: *Consideration of GSR practices in the Defense Environmental Restoration Program (August 2009),* updated in: *Defense Environmental Restoration Program Management Manual 4715.20 (March 9, 2012)*
- US Navy: *Guidance on Green and Sustainable Remediation*, UG-2093-ENV, Rev 1 (5 April 2012)
- USACE: *Decision Framework for Incorporation of Green and Sustainable Practices into Environmental Remediation Projects, (March 5, 2010),* updated in: *Detailed Approach for Performing Green and Sustainable Remediation (GSR) Evaluations in Army Environmental Remediation (August 2012)*
- US Air Force adoption of GSR approaches including Performance Based Contracting
- Department of Energy GSR contracting policy for cleanups
- EPA: *Encouraging Greener Cleanup Practices through Use of ASTM International' s Standard Guide for Greener Cleanups (December 2013)*
- EPA Regions 1 to 10: Region-specific Green Remediation policies

Basis - Approach

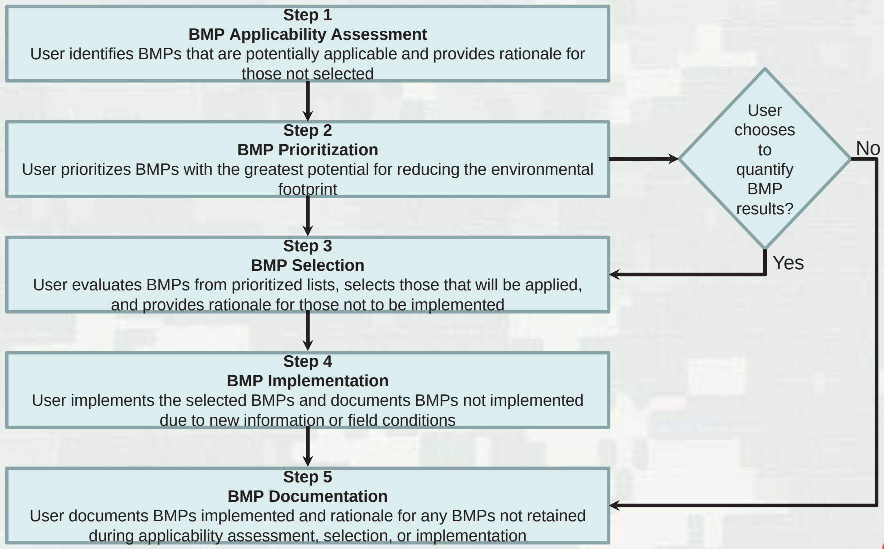
Approach

- ► Different Federal Agencies have different approaches
  - EPA – Principles for Greener Cleanups, encouragement of the use of ASTM Standard Guide for Greener Cleanups
  - Army-USACE – Army GSR Study Approach
  - Navy – DON Guidance on Green and Sustainable Remediation

All approaches are similar

- Evaluation of list of GSR/GR Best Management Practices (BMPs) to identify options that reduce the project GSR footprint
- Optional quantification of the GSR metrics, e.g. energy use, water use, greenhouse gas emissions, of different options
- These options may be identified through the BMP list evaluation or optimization of the remedial process

Army GSR Evaluation Approach – similar to ASTM Greener Cleanup Standard Guide Approach



How to Decide When to Quantify

Are quantitative footprint results important for decision-making?

- ► Any regulations or goals for GSR footprint calculation or reduction?
- ► Is footprint size or footprint reduction an important consideration to regulators or stakeholders?

Are footprinting results necessary to optimize the system, i.e. choose one option over another?

- ► Is quantitative footprinting necessary to determine which option has the smallest footprint?
- ► Can evaluation and incorporation of BMPs be used to green each option, followed by traditional regulatory criteria to choose between options?
    - Example option – Inclusion of Monitored Natural Attenuation with an active technology in the FS
        - ▷ Army BMP - Establish decision points to trigger a change from one technology to another or from one remedy alternative to another
        - ▷ ASTM Greener Cleanup Std Guide - Switch to a less energy-intensive technology for remediation polishing
- ► Do the expected footprint reductions justify the footprinting level of effort?

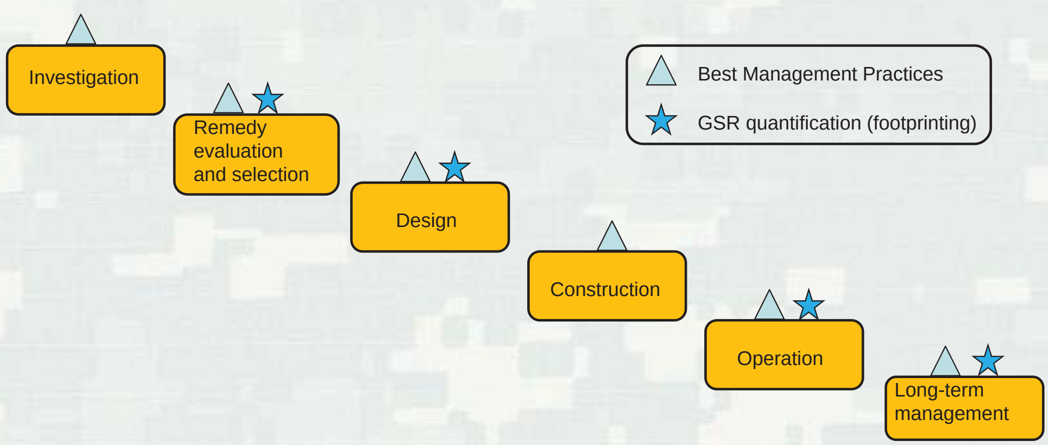
Level of Effort

	Evaluation of BMPs	Footprint Quantitative Evaluation
Description	Enhance the remedial project by incorporating sustainable methods – this involves implementing BMPs.	A quantitative decision takes a holistic view of the remedy or a portion of the remedy. Using specially designed GSR software, this approach considers the project design, metric evaluation, and life-cycle cost.
Time Commitment[a]	2-24 hrs	40-60 hrs - BMPs with footprint evaluation, 80-100 hrs - BMPs with a full life cycle assessment (LCA)
Cost[b]	$1K – $5K	$10 -$15K
When to Intervene	Anytime during the cleanup or closure process.	Most often during the Feasibility Study, Remedy Design, Remedy Operation, and Long-Term Operation. Less likely in Investigations and construction.
Example	Can be as simple as replacing diesel fuel with low-sulfur diesel or more complex, such as inclusion in a decision document a less energy-intensive technology for polishing.	Using quantitative analysis to determine that the use of in situ remediation technique instead of pump and treat reduces energy requirements, GHGs, and enables achievement of cleanup metrics in a shorter amount of time with less cost.

[a] Information from *C.F. Silver, D.R. Goldblum, and J.A. Simon,* "The Growing Impact of ASTM's New Standard Guide for Greener Cleanups", presented at the Third International Symposium on Bioremediation and Sustainable Environmental Technologies, Miami, FL, 20 May 2015, does not include GR implementation and documentation.
[b] From the 2012 Army GSR Study http://www.fedcenter.gov/Documents/index.cfm?id=22322&pge_prg_id=27392 - these costs will vary depending on the complexity of the site.

Where

GSR can be applied in a single phase but best over multiple phases – often GSR identified in one phase is implemented in the following phases



Documentation

Goals of documentation are:

- ► To document the results if a BMP evaluation is performed
- ► To provide a framework for the customer to participate in the decision-making during GSR evaluation and implementation
- ► To record the footprint reductions for project records and any upward reporting
- ► To provide a transition for any GSR that may be implemented in subsequent remedial phases

Example GSR BMP Evaluation In-Situ Injection Remedy

Best Management Practice	*Step 1* Applicable or Rationale if Not Applicable	*Step 2* Priority	*Step 3* Selected or Rationale if Not Selected	*Step 4* Implemented or Rationale if Not Implemented
BMP 1 – Consider purchase of renewable energy certificates (RECs)	✓	Low	Policy did not allow	N/A
BMP 2 – Consider on-site treatment and re-use of soil instead of off-site disposal	No soil remediation	N/A	N/A	N/A
BMP 3 - Use by-products or "waste" materials from local sources in place of refined chemicals or materials	✓	Med	✓	Substitute substrate
BMP 4 – Establish decision points to trigger a change from one technology to another	✓	High	✓	Decision deferred
BMP 5 – Use extracted and treated water for beneficial purposes	No extracted groundwater	N/A	N/A	N/A
BMP 6 – Contribute to local economy as possible	✓	Low	✓	Implemented
BMP 7 – Use appropriate characterization or remedy approach based on site conditions	✓	High	✓	Implemented

Additional Documentation – Footprinting

- Presentation of the results, either graphic or tabular, or both
- Explanation of how the results will be (planning)/were used (post implementation) in the remedial decision process
- Designation of the footprinting tool(s) used and why
- Completeness and transparency of the assumptions used for the data input and any modifications to the default assumptions in the tool(s)

USACE GSR Contracting Example

- Lockbourne Former AFB AOCs 17/18/19/103 RI/FS
- FUDS project, USACE Louisville District
- Investigation of a former central machine area with solvent, cleaners, petroleum, etc. with potential soil and groundwater contamination.
- Current owner – regional airport

FUDS Performance Based Contract Language

EXCERPTS FROM EXAMPLE CONTRACT LANGUAGE

- Compliance with DoD GSR policy and Approach
  "The Contractor shall consider and/or implement GSR practices when "feasible" and where "practicable based on economic and social benefits and costs" per DoD policy…using the Detailed Approach from the 2012 ACSIM GSR Study"
- Level of Effort and When
  "At a minimum, the Contractor shall utilize: the TRIAD approach; the SiteWise™ Tool [FS]; completion of BMP Checklists [RI and FS]."
- Documentation of GSR
  "All work plans and reports generated shall document: the GSR that was considered/implemented, and the reasons GSR considered was or was not implemented…"
- Financial incentive (as % of the contract) to go further
  "The Contractor is encouraged to develop, plan, and implement additional GSR/IT approaches…"

Incentives Increase GSR Quality and Implementation

"The Contract will include a performance incentive for the incorporation of GSR…equal to 2% *[modify % as needed]* …measured and paid at appropriate milestone intervals…..

The incentive goals are: *[modify as necessary….].*

Waste minimization/diversion – 50%
Energy savings/green energy – 50%
Water savings – 50%
Other (includes other goals listed in Section X.X.X….and those proposed by the Contractor) – 100% .....

Can also include weighting factors to indicate importance of each metric

Results To Date

- ▶ RI implemented 53 GSR best management practices (BMPs), 26 with significant cost savings
- ▶ BMPs for FS were identified and are being evaluated for practicality during the FS
- ▶ Quantitative footprinting of FS alternatives is being performed

Conclusions and Path Forward

- Work in progress
- Use on RI-FS projects is challenging
  - Goals and results are hard to quantify
  - Evaluation of GSR goal achievement is subjective
  - Beware of green-washing
- More projects are needed
  - Consider at the scoping stage
  - Contract manager and contractor both need to be engaged
  - O&M and optimization projects allow for better quantification
- Keep the momentum
  - $$$ reductions and visible benefits must be shown

Resources

- Additional Contracting GSR Case Study (EPA Fund-led site with USACE technical and contract assistance using Region 10 Clean and Green Policy)
  - South Tacoma Channel Superfund Site), Contract language example in EPA CLU-IN "An Introduction to Green and Sustainable Remediation: What, Who, Why, and How", archive of June 10, 2015 webinar, http://www.clu-in.org/conf/tio/FRTRPresents_061015/. Full case study presented at the Fall 2014 FRTR meeting, presentation available at FRTR.gov, meeting archive
- Air Force Performance-Based Contract Language and Instructions *Air Force Instruction (AFI) 32-7020, Final Draft, 28 August 2013, http://static.e-publishing.af.mil/production/1/af_a4_7/publication/afi32-10142/afi32-10142.pdf, Air Force Instruction (AFI) 32-7001, http://www.denix.osd.mil/swr/upload/afi32-7001.pdf, and Draft Optimized Exit Strategy (OES) Compendium for Performance-Based Remediation, 15 January 2013. These combined documents contain the current Air Force approach* "to focus on the most efficient and effective means of achieving accelerated site completion at the broadest range of sites across installations rather than to optimize remedy efficiency at individual sites", with the primary mechanism used in meeting this objective Performance-Based Restoration (PBR) contacts.
- ASTM Standard Guide for Greener Cleanups http://www.astm.org/Standards/E2893.htm
- ASTM Standard Guide for Integrating Sustainable Objectives into Cleanup http://www.astm.org/Standards/E2876.htm
- Department of Army, Office of the Assistant Chief of Staff for Installation Management Army Detailed Approach (DoA 2012), "Evaluation of Consideration and Incorporation of Green and Sustainable Remediation (GSR) Practices in Army Environmental Remediation, Appendix A **"**Detailed Approach for Evaluating Green And Sustainable Remediation (GSR) on Army Environmental Projects", August 2012, http://www.fedcenter.gov/Documents/index.cfm?id=22322&pge_prg_id=27392
- Department of Defense Environmental Restoration Program (DERP) Manual, revised 9 March 2012, No. 4715.20 http://www.dtic.mil/whs/directives/corres/pdf/471520m.pdf

Resources

- Department of Energy Memo "Green and Sustainable Remediation Contract Language" from J. E. SURASH, DEPUTY ASSISTANT SECRETARY FOR ACQUISITION AND PROJECT MANAGEMENT to MARK A. GILBERTSON, DEPUTY ASSISTANT SECRETARY FOR SITE RESTORATION, with attached contract language, November 2013.
- Department of Navy Guidance on Green Sustainable Remediation, UG-2093-ENV, Rev1 (5 April 2012), http://www.navfac.navy.mil/navfac_worldwide/specialty_centers/exwc/products_and_services/ev/erb/gsr.html#pol_guidin.org/greenremediation/
- EPA memorandum "Encouraging Greener Cleanup Practices through Use of ASTM International's Standard Guide for Greener Cleanups", December 2013, http://www.epa.gov/oswer/greenercleanups/pdfs/oswer-aa-gc-memo_december-2013.pdf
- EPA Principles for Greener Cleanups, August, 2009, http://www.epa.gov/oswer/greenercleanups/principles.html
- EPA Green Remediation Primer USEPA 2008, EPA 542-R-08-002, *Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites,* www.cluin.org/download/remed/Green-Remediation-Primer.pdf
- ITRC Green and Sustainable Remediation Technology/Regulatory Guidance Green and Sustainable: A Practical Framework http://www.itrcweb.org/Documents/GSR-2.pdf
- SiteWise™ GSR Tool http://www.sustainableremediation.org/tools/

Questions?

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Attachment 6
Do Green and Sustainable Remediation Frameworks Adequately Represent Ecosystem Services and Natural Resources?

Do GSR Frameworks Adequately Represent Ecosystem Services and Natural Resources?

SURF 29

Jonathon Weier

July 14, 2015

Innovation that Provides Sustainable Solutions to Complex Local Challenges, Worldwide

Do GSR Frameworks Adequately Represent Ecosystem Services and Natural Resources?

Contents

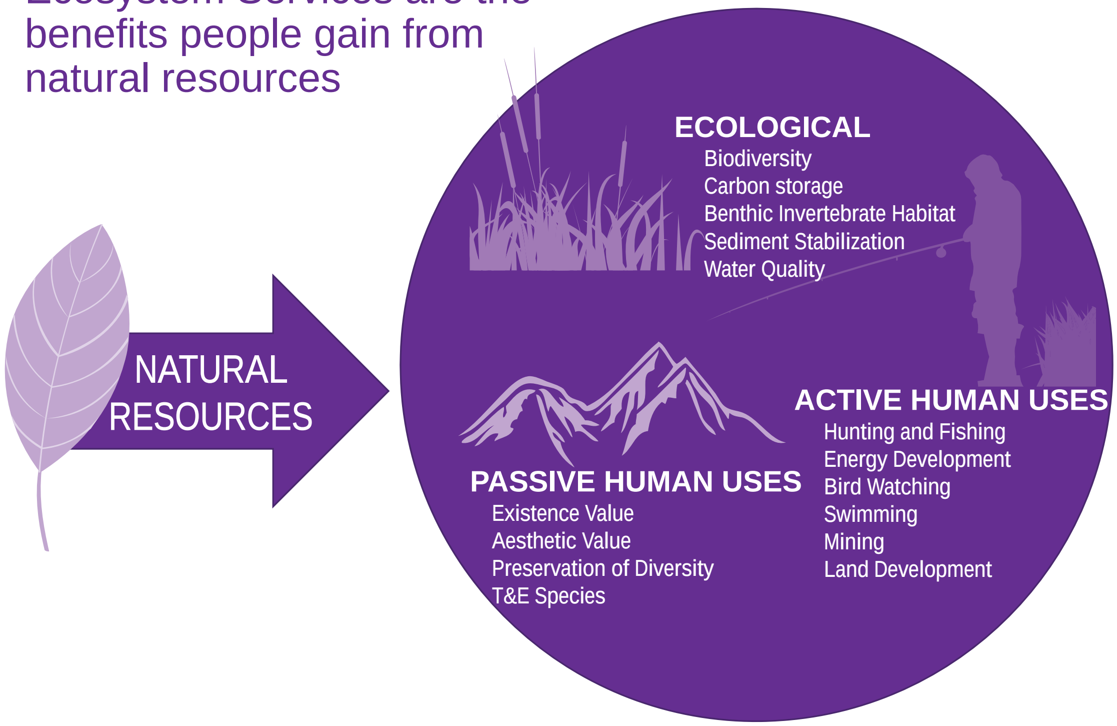
– Definition of ecosystem services (ES)

– **Why** are ES and natural resources under-represented?

– The importance of inclusion

Voting NO because optimizing net environmental benefit – the change in ecosystem services between the pre- and post-remediation landscape – is often not considered in remediation decision-making.

Ecosystem Services are the benefits people gain from natural resources



WHY? There has been an evolution of focus

Abating risk

Assessing the impacts *of the act* of applying the remedy

Maximizing benefit in the post-remediation landscape

WHY? Guidance has not been focused on the pre- vs. post-remediation landscape

- Protect Land and Ecosystems
  - Minimize areas requiring activity or use limitations
  - Minimize unnecessary soil and habitat disturbance or destruction
  - Minimize noise and lighting disturbance

WHY? Better communication of **VALUE** is needed

WHY? Ecologists are not at the table during the FS stage

WHY? A myth – “Changes in nature are too difficult to quantify!”

Options are available to address ecosystem service changes

- ✓ **Ecosystem Services Checklists**
- ✓ **Quantification of Individual ES**
- ✓ **Simple Paradigms with Numbers**
  - **Air Force**
  - **Net High Quality Acre-Equivalents**
- ✓ **Full Quantification**
  - **Net Environmental Benefit Analysis**

Contamination impairs ecosystem services

Flora and fauna are impacted

Loss of ecological function

Land uses are constrained

Remediation influences ecosystem services in several ways

All these (+) and (–) are often not considered and rarely quantified.

Impacts of Remediation	+ or -
Reduce ecological risk	+
Enable/constrain land uses (reduce human health risk)	+ or -
Eliminate/degrade habitat	-
Create or restore habitat	+
Leave residual risk	-

Understanding relationships between cost, risk, and net environmental benefit

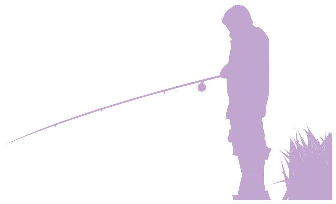
- Ability to see remedies that….
  - Provide no or little net benefit
  - Provide no or little benefit at a high $ cost
  - Cause more harm than good
  - Provide an opportunity to increase ES value
  - Maximize benefit at the least cost

Changes to Ecosystem Services Can Be Quantified Over Time

Ecological Services

Habitat equivalency analysis (HEA)

Environmental metric (SAY: services provided per hectare per year)



Active Human Use Services ($$$)

Revealed preferences

Cost-based approaches

Stated-preference approaches

Passive Human Use Services ($$$)

Stated-preference

NEBA Example – Solvents in Groundwater

Bottom Line: $70 M would have been spent to eliminate $12,000 in lost groundwater irrigation value

	Human Use Loss (NPV)	Human Risk /ARAR Profile	Ecological Risk Profile	Cost of Remedial Alternative (NPV)
No Action	$44,000	Not Protective	No Risk	$0
Land Use Controls	$44,000	Not Protective	No Risk	$130,000
GW Monitoring/ Hydrologic Ctrl	$44,000	Not Protective	No Risk	$1,300,000
In Situ* with Other Actions	$44,000	Protective	No Risk	$1,900,000
***In Situ* Chemical Ox-whole plume**	$32,000	Protective	No Risk	$71,500,000

* *In Situ* Chemical Oxidation of TCE Plume, Enhanced Natural Attenuation of Benzene Plume, Plume Containment, and Groundwater Monitoring

NEBA Example – Wood Treating Site

Bottom Line: $1.3 - 2.5 M would be spent with no significant environmental benefit

No Further Action Alternative	Acreage	Ecological Services (dSAYs)	Cost ($)
Wetland	5.6	187	-
Stream	0.06	1.5	-
Forest	1	17	-
TOTAL	**6.66**	**206**	**0**
Removal Alternative	**Acreage**	**Ecological Services (dSAYs)**	**Cost ($)**
Wetland - Remediated	2.3	73	-
Wetland – Not Remediated	3.3	113	-
Stream - Remediated	0.02	1	-
Stream – Not Remediated	0.04	1.4	-
Forest - Cleared	1	15	-
TOTAL	**6.66**	**203**	**1.3 – 2.5 $ M**

NEBA Example – Marine Sediment

Bottom Line: Unnecessary environmental impacts were avoided and EPA saved $6 M in remediation costs

- State Marine Superfund Site, TX
- Alternatives
  - No Further Action
  - Monitored Natural Attenuation
  - Removal
- NEBA with Feasibility Study
- Results
  - Demonstrated that sediment removal would not be protective of the environment

There are Several Characteristics that Make a Site a Good NEBA Candidate

Marginal ecological risks

Potential for remediation-related impacts

Presence of high value habitat

Disproportionate cost to benefit

Difficulty reaching resolution

Costly remedy

Large and complex

Need to prioritize actions

Risk of recontamination

Ongoing anthropogenic degradation

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