Sustainable Remediation Forum (SURF)
SURF 28: February 24-25, 2015

SURF 28 was held at the Boeing Long Bridge office in Arlington, Virginia on February 24-25, 2015 and focused on "Moving Sustainable Remediation Forward." Individuals that participated in the meeting, along with contact information, are listed in Attachment 1. Meeting minutes are posted for members at www.sustainableremediation.org. Members should log in and access the minutes by clicking "SURF Meeting Minutes" under "Member Resources."

Day 1

The meeting began with Mike Rominger (meeting facilitator) discussing meeting logistics, ground rules, nonconfidentiality assumptions, export control laws, and antitrust issues. He thanked current SURF sponsors for supporting the organization. (Members interested in sponsorship opportunities should contact the SURF Treasurer at treasurer@sustainableremediation.org.) Presentation slides for Day 1 are provided in Attachments 2 through 14.

Welcome Remarks

Nick Garson (SURF Past President) welcomed attendees to SURF 28. He provided a brief history of the green and sustainable remediation movement and SURF, including the organization's mission, definition of sustainable remediation, and technical initiatives. With green and sustainable remediation a topic of conversation for nearly 10 years, Nick believes that we need to determine how to make green and sustainable remediation an accepted part of doing business. Presentation slides are provided in Attachment 2.

Keynote Presentation: The Intensely Local Nature of Global Climate Change

Scott Schang (Acting President, Environmental Law Institute) provided the keynote presentation, emphasizing that site remediation managers are at the forefront of climate adaptation in what will likely be a significant challenge to managing sites moving forward. The summary below contains excerpts of the text of Scott's presentation, which is provided in Attachment 3. Scott discussed the following:

- Local Nature of Climate Change Impacts
  The effects of climate change for the purposes of discussing adaptation have to be dealt with on a local scale to be meaningful and effective because warming is occurring at different rates in different places, the kinds of precipitation changes depend on local conditions, and the degree of climate change in any single place will vary. In addition, almost all of the responses to climate change are likely to occur at the state and local levels. Scott described the likely impacts that may affect remedial sites, categorizing them into physical, living, and human impacts. Attachment 3 provides the detailed listing. He also discussed the following resources to help participants understand how their site's location may be affected: (1) the U.S. Global Climate Research Program's

National Climate Assessment; (2) states' climate adaptation plans, which are located on the Georgetown Climate Center's website; and (3) the National Weather Service's Local Climate Analysis Tool (LCAT).

- Legal Opportunities and Challenges
  In this world of climate change, future conditions are predicated by models that are necessarily imperfect. The baselines predicted by those models will continue to change, perhaps in a highly unpredictable manner. Effects will be highly localized, so sweeping national laws are unlikely to work. Scott discussed adaptive management, traditional legal tools, and broad trends that may be used to meet some of these challenges (see Attachment 3 for details). He described some issues that may arise when implementing adaptive management principles in the real world and emphasized that the many available tools to manage climate change at the local level tend to be resource intensive and difficult to use.

- Future Trends
  Scott ended his presentation by discussing four future trends in climate change adaptation governance. First, as localities take actions to respond to climate change, the tension between the authority of the localities vs. the state authority will increase and will have to be resolved in courts and legislatures and town councils. Second, new legal theories (e.g., the public trust doctrine described in Attachment 3) will be developed to try to adapt laws to the climate change challenge. Third, tort law will be used to claim that those who added greenhouse gases to the environment must pay for the damages done. And fourth, inventive lawyers will use provisions like Section 101 of the National Environmental Policy Act to push for expanded legal protections from climate change or argue that authorities have the power to take actions to adapt to climate change.

Climate Adaptation Planning and Strategy: An ASTM Guide

Elisabeth Freed [U.S. Environmental Protection Agency (USEPA)] provided an overview of the most recent *Climate Adaptation Planning and Strategy* document being developed by ASTM Committee E50 on Environmental Risk Assessment and Management. The guide will be a first step for municipalities and businesses in formulating a plan of action and responding to risks from drought, fire, storms, floods, tidal surge, and sea level rise. Like other ASTM documents, the guide is being developed using a consensus-based process. The first four sections of the guide provide background, while the fifth section focuses on the risk management options associated with climate adaptation planning. The goal is to help stakeholders identify actions and areas of vulnerability before the risk assessment phase. To become involved in this effort, join ASTM Committee E50, Subcommittee E50.05. Presentation slides are provided in Attachment 4.

Sustainable Remediation: A Perspective in Low and Middle Income Countries

Bob Montgomery (World Bank) highlighted the key issues and considerations in low- and middle-income countries so that participants would have insight when implementing sustainable remediation in these areas. Bob presented the challenges arising from contaminated sites in low- and middle-income countries (see Attachment 5 for details) and emphasized that these challenges create opportunities for sustainable remediation to be a vehicle for promoting dialog between countries about contaminated sites and potential assistance as well as mechanisms to finance remediation. Bob highlighted the following two documents:

- *Developing a Program for Contaminated Site Management in Low and Middle Income Countries*, which provides alternatives for the design and implementation of a contaminated site program and an agenda of short- and longer-term actions
- *Financing Mechanisms for Addressing Remediation of Site Contamination*, which provides information to communities and countries interested in identifying potential financing tools (e.g., bond financing and loan fund programs, grants, tax credits and incentives, emerging international finance models) for remediating and redeveloping contaminated industrial sites)

Bob stressed that sustainable remediation must fully and equally address all three elements of the triple bottom line, taking into consideration the specific socio-economic conditions in these countries. He reviewed the considerations associated with each element of the triple bottom line. For economic considerations, thinking beyond project cost is essential so that tradeoffs are included. For social considerations, it is important to transfer technology locally and remember local stakeholders' perceptions when identifying and addressing issues. For environmental considerations, it is necessary to be more sensitive to critical environmental issues in the area and make decisions based on this context. Finally, remediation professionals need to adapt their usual approaches to better help decision makers in low- and middle-income countries to define and implement sustainable remediation at the program and project level. Presentation slides are provided in Attachment 5.

A Big Picture Look at the Benefits of Greener Cleanups

In his presentation, Charlie Bartsch (USEPA) emphasized the importance of increasing awareness of the value and role of remediation in sustainability so that opportunities arise that can be built upon. To increase awareness, he recommended the following: (1) leveraging funding from all types of organizations by linking remediation activities to their missions, (2) leveraging incentives for remediation as part of redevelopment, (3) attracting private interest and/or capital, and (4) evaluating remediation costs along with a broad range of benefits. Charlie highlighted three case studies that demonstrate how some of the social and economic benefits of greener cleanups can be leveraged to convert potential skeptics of green remediation into believers. Presentation slides are provided in Attachment 6.

- Former Ford Motor Assembly Plant
  This plant was built in 1930 in Richmond, California, and was designed by the industrial architect Albert Kahn. It was the largest automobile assembly plant to be built on the West Coast and, as a Kahn-designed building, is on the National Register of Historic Places. The plant closed in 1956, and an earthquake damaged the plant in 1989. After the earthquake, the City of Richmond repaired and prepared the plant for rehabilitation. Cleanup and rehabilitation work at the site began in 2004 and included seismic retrofits, green construction, and solar panels. Historic rehabilitation tax credits ($11 million) provided the majority of funding. Now the plant is part of the Rosie the Riveter/World War II Home Front National Historical Park and houses the National Park Service visitor center, several private businesses, and a 45,000 square foot entertainment venue.

- Former Gas Station
  This ¾-acre property in Eugene, Oregon, operated as a filling station from 1976 to 1991 and now is home to a mixed-use bio-diesel fueling station. Remediation of contaminated soil and groundwater was performed as part of the redevelopment activities. The project was completed thanks to creative financing, which included $1.2 million in low-interest, favorable-term redevelopment loan funding through the Oregon Department of Energy's Sustainable Energy Loan Program as well as $250,000 in business energy tax credits. Sustainable elements were incorporated into the design, such as solar panels on the fuel pump canopies, passive solar design of the convenience store, and a vegetated roof that is part of a site-stormwater system. In addition, the store offers mostly locally sourced and organic products. Fifteen jobs have been created, along with $4,000 in annual property tax revenues.

- Deteriorating Parking Garage
  This parking garage at the edge of downtown Boise, Idaho, was built in 1963 but closed in 2000 because of major structural and some environmental concerns. The site is now the location of the Banner Bank Building, which is made from 42% recycled content materials. As a result, over 90% of construction and demolition debris was diverted from the landfill. Creative financing included $324,000 in highway district funds and $100,000 from Idaho Power to offset upfront energy efficiency costs. The building is LEED (Leadership in Energy & Environmental Design) Core and Shell Platinum Rated, generates $370,000 in annual tax revenues, and brings 650 new jobs to downtown Boise.

In discussions after the presentation, Charlie emphasized the importance of stakeholder engagement. Referencing Bob Montgomery's presentation, he suggested working with "reasonable stakeholders" to create "reasonable solutions" that benefit them. In response to a question about the role of the USEPA in promoting green remediation, Charlie said that the agency's goal is to create a climate that encourages the practice of green remediation.

Greener Cleanups: Past, Present, and Future

Deb Goldblum (USEPA) provided an overview of the past, present, and future of greener cleanups. Presentation slides are provided in Attachment 7.

- Past
  Deb reviewed the activities and accomplishments associated with greener cleanups. As presented at previous SURF meetings, the USEPA and DuPont performed a pilot at a site in Martinsville, Virginia. Pilot results indicated that incorporating sustainability concepts in remediation resulted in more informed remedial decision making and that an agreed-upon sustainability framework was needed. Deb emphasized the lack of USEPA staff available to develop a skill set in life-cycle analysis. Instead, the USEPA focused on five core elements (i.e., materials and waste, energy, air, water, and land and ecosystems) to integrate these concepts into remediation. Eventually, ASTM's *Standard Guide for Greener Cleanups* was born. The guide defines the term "greener cleanup," provides a level playing field for remediation practitioners implementing these cleanups, and promotes a culture change within the remediation community.

- Present
  Deb provided the current status of how greener cleanups are facilitated and encouraged by USEPA Headquarters and regions, as well as state agencies. Headquarter personnel present at national conferences, conduct in-reach through workgroups and trainings, share information on funding mechanisms (like Charlie Bartsch's presentation), and contribute to the ASTM Task Group. USEPA regional personnel provide regional and state training, reach out to individual states, recommend the use of greener cleanups at specific sites, and share information with co-workers through regional green teams. Lastly, Deb highlighted some of the ways Illinois, Massachusetts, and Wisconsin state agencies facilitate and encourage greener cleanups.

- Future
  Deb reviewed 2015 planned activities, which include providing training to specific regions and states, presenting at specific conferences, and updating profiles posted on Clu-In to include in the ASTM guide.

Deb ended her presentation by reminding participants of the tremendous opportunity provided by the nearly 300,000 contaminated sites in the U.S. She urged participants to work with the USEPA to collectively raise the bar on cleanups by implementing greener cleanups and communicating the benefits. One participant agreed and encouraged the USEPA to take advantage of consultants' skill sets when performing sometimes resource-intensive footprint analyses.

After the presentation, Deb responded to a question about how the ASTM *Standard Guide for Integrating Sustainable Objectives into Cleanup* will be meshed with the *Standard Guide for Greener Cleanups*. Deb said that the concepts included in the former document are already

integrated into USEPA programs and that evaluating the environmental footprint of remediation projects is the focus of the USEPA. One participant said he agreed in concept that the social and economic elements of sustainability are included in other USEPA programs, but wondered how these elements are recognized by the agency. For example, is community interest always considered in a remediation project? He believes that social and economic elements need to be considered as part of the same process that considers environmental elements. Deb said that brownfield sites lend themselves better to sustainable remediation compared to industrial sites in the RCRA program where many external forces exist. With that in mind, one participant commented that the majority of sites (see pie chart in Attachment 7) should be evaluated holistically using the triple bottom line. Deb responded by reiterating that agency resources are limited, with 10% less personnel than two years ago.

Massachusetts's Clean Energy Goals and Promotion of Greener Cleanups

Tom Potter (Massachusetts Department of Environmental Protection) shared how greener cleanups fit into clean energy and the clean energy economy, which is why he believes states should be embracing greener cleanups. Presentation slides are provided in Attachment 8.

Tom provided an overview of Massachusetts' clean energy goals in relation to greener cleanups. He discussed the 2014 Massachusetts Clean Energy Industry Report, which highlights the significance of the state's clean energy industry (i.e., $10 billion industry and 2.5% of gross state product) and its continuing projected growth. High utility prices in the state were the primary driver for integrating clean energy jobs into the economy. To become more energy independent, the state established the Executive Office of Energy and Environmental Affairs in 2007. In 2008, the Green Communities Act was passed and has a goal of creating 15% "new sources" by 2020. The same year, the Global Warming Solutions Act was passed and outlined a 2020 goal of reducing greenhouse gas levels 25% below 1990 levels. In 2011, the CleanEnergyResults Program was launched. The program promotes clean and efficient sources of energy at sites regulated by the Massachusetts Department of Environmental Protection (MassDEP).

Next, Tom presented the regulatory provisions that were part of the 2014 amendments to the Massachusetts Contingency Plan. The provisions address the core elements of greener cleanup in support of the energy and emission reduction mandates of 2008 with the goal of making agencies more efficient and removing barriers to greener cleanups. Greener cleanup language is included in regulation (see slides 23 and 24 in Attachment 8). In addition, the state's Greener Cleanup Policy was effective in October 2014 and "strongly recommends" the use of the ASTM's *Standard Guide for Greener Cleanups*.

Updates on Green and Sustainable Remediation in the Army and USACE

Carol Dona [U.S. Army Corps of Engineers (USACE)] provided an update of the Army and USACE's green and sustainable remediation programs and presented a case study to illustrate

the approach used. Presentation slides, including a list and links to documents, are provided in Attachment 9.

Carol began her presentation with an overview of the definitions, guidance, and policy regarding green and sustainable remediation for the Department of Defense and, more specifically, the Army and USACE. A green and sustainable evaluation in the Army and USACE includes all three elements of the triple bottom line and good management practices that allow real-time adjustment to the remedial process.

To demonstrate the process, Carol described a green and sustainable evaluation performed for the former Lockbourne Air Force Base. The evaluation involved a list of best management practices (BMPs), triad processes when designing and implementing field work, SiteWise™, flexible language in upcoming decision documents, and a financial incentive. (Details on each of these components is provided on slide 7 of Attachment 9.) Upon completion of the remedial investigation, 53 BMPs were implemented with 26 resulting in significant cost savings. Sixty percent of BMPs implemented (e.g., waste and water minimization) produced cost savings; 30% were cost neutral and 10% increased costs.

Carol ended her presentation by stating that the Army's and USACE's approach to green and sustainable remediation involves continual optimization throughout the remedial cycle.

Striving for Simpler, Consistent LCA of Remediation Activities using LCA Templates

Todd Krieger (DuPont) presented how DuPont collaborated with AECOM, CH2M Hill, Geosyntec Consultants, and Parsons to develop a suite of life-cycle analysis (LCA) templates for commonly applied remedial actions at DuPont. Todd explained the templates, discussed current plans for sharing the templates, and obtained participants' feedback. Presentation slides are provided in Attachment 10.

The goal was to identify, develop, and validate LCA template modules for remediation processes, materials, modes of transportation, types of equipment, and energy supplies for remedial actions common to DuPont. The remedies evaluated were as follows: capping; cut-off wall; excavation; groundwater extraction, treatment, and reinjection; in situ bioremediation; in situ soil mixing; and well drilling processes. The team identified the specific tasks required to complete each remedy, noting the typical requirements (e.g., equipment, materials, mobilization) for each task. Attachment 10 provides the materials, equipment, and fuel supply and transportation chains that were evaluated and vetted as part of the project.

Todd showed screenshots of input/output and parameter pages to demonstrate how the resulting templates simplified data entry and ensured consistent application while allowing the remediation professional to evaluate results on both an inventory level and impact assessment level.

Todd said that DuPont is looking for the best way to economically and legally share the results and improve the current templates. With that in mind, current plans involve either donating the

templates to Earthshift to incorporate into their DataSmart! Database or working with Earthshift to develop a web-based solution. The latter option could be an opportunity for SURF to contribute.

After his presentation, Todd asked participants for feedback about sharing the templates. In general, participants seemed to agree that SURF should pursue this as a technical initiative. The work aligns well with SURF's goals, and SURF could facilitate industry consensus on weighting different parameters. One participant agreed and said that SURF members could improve the economic and social aspects (e.g., return on investment, property value) in the templates that are not currently supported by LCAs. Another participant questioned how these LCA results would be used. Todd responded that results could be used to direct future remediation efforts in terms of planning and utilities/energy usage. He acknowledged that these templates do not cover every potential remedy, but said they provide quantification when comparing alternatives, developing new research ideas, or optimizing a system.

Humic Acid: A Sustainable Solution for Detoxifying Wastewater

Ralph Nichols (Savannah River National Laboratory) presented how Savannah River National Laboratory is moving sustainability upstream into technology development. He began by reminding participants of the many regulations enacted to protect the environment and the resulting pollutant concentrations considered to be protective of the media being addressed. Attainment of these concentrations often has an environmental burden of its own which results in a risk transfer from one resource to another. Ralph said that there are many cases of this type of risk transfer in which a policy that is developed and implemented for a target problem is unaware, or unresponsive to, the collateral impacts on the "risk receiver." As an example, he described how requiring the addition of large quantities of oxygenates (e.g., methyl tert butyl ether) to gasoline to improve air quality ultimately led to soil and groundwater contamination from this relatively long-lived recalcitrant contaminant. In this example, risk was transferred from the air (Clean Air Act) to the groundwater (Safe Drinking Water Act).

Ralph presented a case study to illustrate how science has impacted regulation development and informed remedial solutions. In 2007, new science in the form of the Biotic Ligand Model created the need for improved wastewater management. At the Savannah River site, a proposed National Pollutant Discharge Elimination System permit reduced the copper limit from 25 µg/L to 6 µg/L to a stream to protect organisms. Traditional methods (e.g., ion exchange, constructed wetlands, peat beds) used to reduce copper to this new level were explored, but abandoned because of high cost and low level radioactive waste generation. Both of these methods produce contaminated treatment residue that must be disposed of in compliance with another regulation.

Instead, the team regrouped, reviewed the NPDES objective (i.e., protect ecosystem and human health), leveraged the science in the BLM, and determined how that objective could be met in a different way. The developed detoxification alternative amends outfall water with natural

organic matter to bind up to 25 µg/L copper rather than remove it, thereby mitigating its toxicity, protecting the sensitive species in the ecosystem, and eliminating risk transfer. The amendments are Organic Materials Review Institute certified commercial products that are naturally rich in humic acids and are commonly used in organic farming. Humic acids (common in wetlands) are one of the treatment methods used by nature to reduce metal toxicity. By thinking differently about how discharge limits are calculated, the team developed a sustainable solution that improved environmental quality relative to traditionally accepted methods. Presentation slides are provided in Attachment 11.

Green and Sustainable Remediation Practice at Navy Sites

Kim Parker Brown (Naval Facilities Engineering Command) provided an overview of the Navy's green and sustainable remediation approach and the results of a recent case study review. Green and sustainable remediation is implemented as part of the Navy's existing optimization program, with the goal of maximizing the overall environmental benefit of remedial activities throughout all phases of the remediation life cycle. A recent case study review identified 60 sites in which a green and sustainable evaluation was performed and/or green and sustainable BMPs were identified. Among these 60 sites, project documentation was readily available for 32 of the sites to summarize detailed information on their site-specific approach. The information obtained was then used to identify and categorize BMPs and their potential impact on the remedy footprint and to track overall trends in the adoption of green and sustainable remediation practices. Kim summarized the results as follows:

- 67% of green and sustainable remediation evaluations were performed during the feasibility study phase.
- The top 10 BMPs among the sites were as follows: material and waste minimization, optimized equipment use, emission control measures, optimized transportation, alternative fuels, monitoring program optimization, alternate material use, remedy optimization, renewable energy, and optimized water consumption.

The case study review is available online by clicking here. Presentation slides are provided in Attachment 12.

After the presentation, one participant commented that quantifying parameters during a footprint analysis or LCA is valuable because it helps identify trends (similar to those provided in slide 6 of Attachment 12). Kim agreed and responded that the next step is to determine how effectively the footprint has been reduced after the remedy has been implemented.

The Boeing Company: Sustainable Remediation Program Overview

Nick Garson (Boeing) presented an overview of Boeing's sustainable remediation program, which aligns with the corporation's environmental goals. The program is designed to reduce the Boeing's environmental footprint in a timely and productive manner and increase the company's social responsibility and community involvement. In the program, sustainable

remediation practices and principles are incorporated throughout the remediation project life cycle. To demonstrate how sustainable remediation can be embedded into all aspects of cleanup projects, Nick provided a high-level overview of case studies highlighting energy, air, water, and lands and ecosystems. Presentation slides are provided in Attachment 13.

Starting with the End in Mind: A Sustainable Approach to Site Cleanup and Reuse

Russ Downey (Pfizer) presented Pfizer's guiding principles and best practices when implementing sustainable remediation. Key points are summarized briefly below; presentation slides are provided in Attachment 14.

- Emphasized the importance of identifying and engaging appropriate stakeholders early in the process. He challenged remediation practitioners to think about how we can better communicate with and include stakeholders in an active, meaningful way.
- Encouraged participants to look beyond remediation site boundaries (e.g., sea-level rise, precipitation trends, erosional energy forces) to provide context.
- Suggested that remediation professionals consider the following:
  - Optimize groundwater extraction and treatment by using hydraulic barrier controls or reinjecting treated groundwater instead of discharging it.
  - Use recycled materials and local labor and suppliers to minimize transportation energy needs and conserve off-site landfill capacity.
  - Use on-site clean and low-impact recycled concrete, redistributed soil, or other recycled materials when grading and contouring on-site areas for capping.

To demonstrate the importance of meaningful stakeholder interaction, Russ described work performed at the Pharmacia & Upjohn Company site in North Haven, Connecticut. The site operated for 140 years and is located adjacent to a river. Soil and groundwater are impacted with polychlorinated biphenyls (PCBs), semi-volatile organic compounds (SVOCs), and metals. Before 2003, stakeholders were not engaged in the remediation process, no vision for the property existed beyond the remedy, negative press was common, and little progress had been made. After 2003, stakeholders (i.e., Town, Citizen Advisory Panel, local commissions) became involved, a vision for the property was developed, and much progress has been made. Russ described the stakeholder engagement, which included sharing alternatives, setting up a website (www.upjohnnorthhaven.com), holding interactive meetings, and requesting reporters to interview interested parties. Russ reviewed the elements of the remediation, which resulted in the ecological restoration of 60 acres and the economic development of another 17 acres.

Industry Panel on Sustainable Remediation: Past Successes and Future Programs

At the end of the first day, four members of industry participated in a panel discussion of past successes and future programs. John Simon (Gnarus Advisors) moderated the panel discussion;

panelists included Buddy Bealer (Shell), Pfizer (Russ Downey), Nick Garson (Boeing) and Scott Pittinger (Norfolk Southern Railway).

The moderator's questions and panelists' responses are provided below.

1. Does your company have a policy or guidance, written or unwritten, regarding sustainable remediation?

   Some type of sustainable remediation guidance is present in all panelists' companies. Shell and Boeing have formal programs in which personnel are trained. Programs for Norfolk Southern and Pfizer are in the development stages, with Pfizer's program designed to be more informal.

2. How does your company fund sustainable remediation projects? For example, is it necessary for the program to be cost neutral or is there a willingness to spend a little (or a lot) more to promote sustainability?

   Funding for established sustainable remediation programs (i.e., Shell and Boeing) among panelists is expected to be cost neutral. Programs for Shell and Boeing are funded on a project basis based on the scope of work. That being said, both programs recognize that sustainable remediation at some sites costs more while other sites cost less.

   Programs at Pfizer and Norfolk Southern are in development. Pfizer's goal is to have a cost neutral program that achieves a return on investment within two to three years yet allows flexibility to support upfront capital investments that reduce operation and maintenance costs. Norfolk Southern's remediation projects are of a smaller scale and complexity, which results in a lower cost remediation program. They are currently working on developing funding for the program.

3. Do you coordinate with your company's real estate department with respect to sustainable remediation?

   Shell has a network team, which includes engineering and real estate personnel, so that sustainable remediation is coordinated. At Norfolk Southern, the interaction is less formal (e.g., one-on-one discussions about sampling); environmental personnel assist real estate personnel with identifying risk and liabilities. At Boeing, remediation is left to the remediation group.

4. What would you recommend and what can SURF do to help?

   Buddy and Russ do not think that anything else is needed other than advocating green and sustainable remediation. Buddy believes sustainable remediation is a simple concept, but hard to visualize what it looks like in the field. Case studies will demonstrate how to implement sustainable remediation. Scott believes that how sustainable remediation is addressed should be the same as how safety is addressed at

companies (i.e., a developed culture). He said the institutional process of developing sustainable remediation is underway, but it will take decades for the practice to be part of the culture of remediation. Russ agreed. Nick believes that standardization (e.g., common tools and templates), clear and understandable case studies, and easily understood metrics will help move sustainable remediation forward.

Scott suggested that environmental professionals help provide context and relevance about sustainable remediation to non-scientists (e.g., sustainability officer).

After the moderated portion of the discussion, a participant asked panelists how their sustainable remediation programs address larger company goals. Nick said Boeing's sustainable remediation provides a qualitative analysis of achievements toward corporate sustainability goals. In addition, the program provides a framework for defining the important aspects of a remediation project. Buddy agreed, saying that Shell's program provides guidance on important issues and tracks metrics important to the company. Scott said that the program being developed for Norfolk Southern will fit corporate goals. Russ agreed, but added that there will be guidance on sustainable remediation information about how it should be used.

Another participant asked how panelists began advocating sustainable remediation. Nick and Scott were first introduced to the topic at a SURF meeting. For Nick, sustainable remediation was intuitive, so he advocated its value within his organization. He believes the shorter timeframes of site closure resulting from sustainable remediation bring the most value. Scott compared the current sustainable remediation movement to the sustainable development movement of the 1980s. Like Nick, he emphasized the need to communicate the value of sustainable remediation. As a mechanical engineer, Buddy was "forced" to learn about remediation. He believes that environmental professionals always have been performing sustainable remediation, but now professionals are becoming better at implementation. He believes that sustainable remediation needs to be accepted and communicated in the next couple of years or momentum will be lost.

Day 2

At the beginning of the second day of the meeting, participants shared what they learned during the first meeting day and general reflections. A summary of lessons learned on Day 1 is provided in Attachment 15 (see slide 2).

Breakout Session 1:

Connecting the Dots – Telling the Sustainable Remediation Story

Participants gathered into groups to discuss the questions below. The goal of this session was to focus on sustainable remediation in general, its value, and the real and perceived root causes for the challenges facing its growth and forward movement.

1. Why would someone pay/allow/require us to do sustainable remediation over the status quo?

2. What are we assuming about the general remediation-practicing public that might not be true, and how do we better educate them?

3. How do we get more responsible parties and consultants to practice sustainable remediation?

A summary of the discussions is provided in list form in Attachment 15.

Breakout Session 2:

Spotlight on SURF: Lights, Camera, Action!

Participants gathered into groups to discuss the questions below. The goal was to focus on SURF as an organization, its value, and feasible actions that capitalize on the value of sustainable remediation (discussed in Breakout Session 1) and the means and methods to overcome challenges.

1. What can SURF do that no other professional organization can/will do?

2. What can SURF do to build on our recent successes and/or current activities?

3. What should SURF be doing *now* (in 2015)?

A summary of the discussions is provided in list form in Attachment 15.

Attachment 1
SURF 28 Participant Contact Information

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Attachment 2
Welcome Remarks

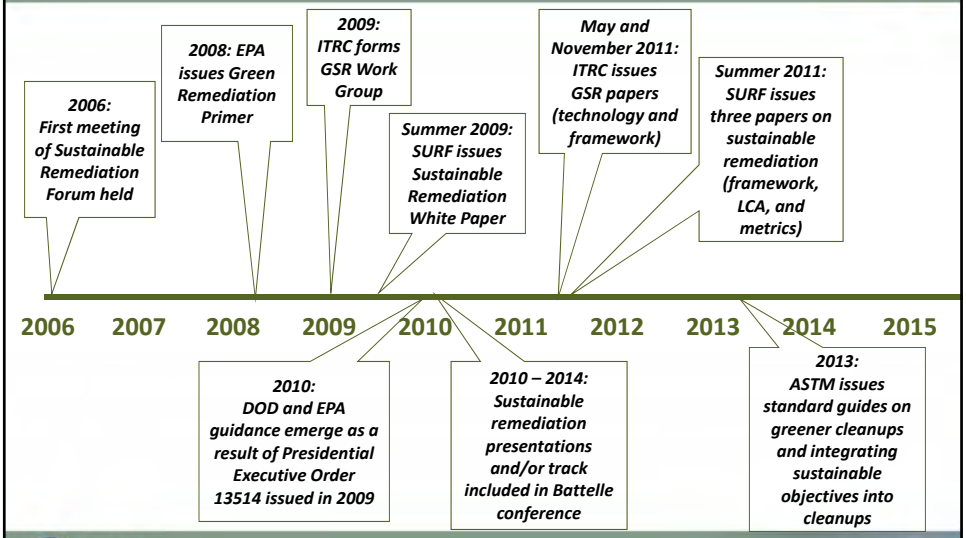
SURF 28: Moving Sustainable Remediation Forward

Boeing Washington DC Office
Arlington, VA
February 24-25, 2015

Y. Nicholas Garson, P.G.
Past President, SURF

SURF

A Brief History…



SURF

Primary Objective

- SURF's primary objective is

  "…to provide a forum for various stakeholders in remediation — industry, government agencies, environmental groups, consultants, and academia — to collaborate, educate, advance, and develop consensus on the application of sustainability concepts throughout the lifecycle of remediation projects, from site investigation to closure."

Mission Statement

The mission of SURF is to maximize 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
- Providing education and outreach

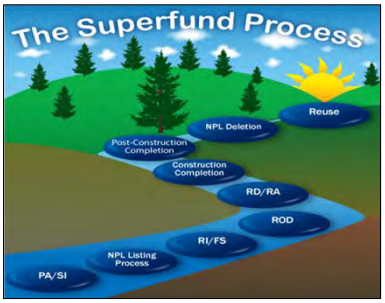
www.sustainableremediation.org

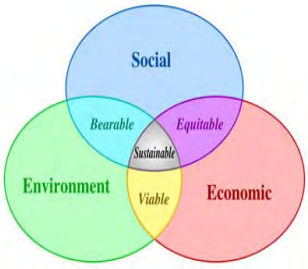
@SR_Forum

LinkedIn Group: Sustainable Remediation Forum

Sustainable Remediation

- Protecting human health and the environment while maximizing the environmental, social, and economic benefits throughout the project life cycle (SURF, 2013).

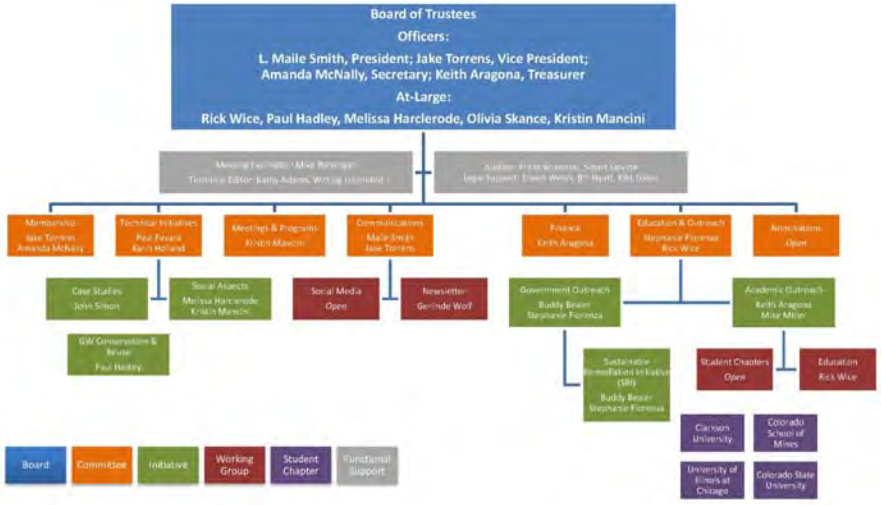




SURF's Value Proposition

- Alignment with organizational sustainability goals
  - Reduce environmental footprint
  - Increase social responsibility and public outreach
  - Reduce remediation costs and long-term liabilities

SURF Organization



Complementary Programs

- ITRC
- State advisories, initiatives, strategies, and guidance
- ASTM
- Federal policy and guidance documents

How We Work

- General membership meetings
  - Two in-person meetings and one webinar per year
- Working groups
  - As-needed teleconferences
- Professional conferences
- Participation in international sustainable remediation conferences, webinars, affiliate work-products
- Technical journal articles

SURF's 2014 Initiatives

- Ongoing communications and outreach
  - Encourage government and academic participation
  - Student Chapter development
- Technical initiatives
  - Sustainable remediation and site development
  - Water conservation and reuse
  - Case studies standardization & compilation
  - Social aspects
  - Sustainable remediation initiative (SRI)

Moving Sustainable Remediation Forward…

- Today…
  - Discuss the state of the practice
  - Share ideas and suggestions on how SURF can support opportunities or challenges
- Tomorrow…
  - Breakout Sessions
    - Connecting the Dots - Telling the Sustainable Remediation Story
    - Spotlight on SURF: Lights, Camera, Action!

SURF

SURF Membership

- Industry
- Consultants
- Academics
- Regulatory
- Government
- Vendors

SURF

Attachment 3
Keynote Presentation: The Intensely Local Nature of Global Climate Change

The Intensely Local Nature of Global Climate Change

Scott Schang, Acting President, Environmental Law Institute
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I. Introduction

Thank you for having me here today, John. I very much appreciate the invitation. I particularly enjoyed having a chance to learn more about SuRF and the innovative approaches you're taking to advance sustainable remediation. As I'll talk about in a bit, many of the core recommendations from SuRF's 2009 White Paper are also climate change adaptation best practices, so there's an important convergence there.

John asked me to talk about climate adaptation and sustainable remediation. I have just enough background in both of those areas to be dangerous. I hope today I can identify some major ideas and trends but also hear from you on areas you're seeing as leading issues and concerns at the interface between climate adaptation and remediation.

On that note, have any people dealt with climate adaptation issues at their remedial sites already? What kinds of issues?

I have three things I'd like to talk with you about today:

1. The intensely local nature of climate change's impacts and how they may relate to sustainable remediation;
2. Legal opportunities and challenges that may arise as a result of these responses to a changing climate; and
3. Some overarching trends in how environmental law may itself change to respond to climate impacts.

There are three main messages I'd like to suggest from these areas:

1. Many tools exist to manage climate change at a local level, but they tend to be resource intensive and quite difficult;
2. Adapting to climate change means operating in an environment where baseline conditions change more rapidly and more frequently than in the past, making flexibility paramount
3. Great changes spur great innovation, both technical and legal.

The overall message is that all of these forces put site remediation managers at the forefront of climate adaptation in what will likely be a significant challenge to managing sites moving forward.

II. Local Nature of Climate Adaptation

The first issue is the local nature of climate adaptation. Why, with something called global climate change, am I focusing on impacts in localities like counties, towns, cities, and states? While it's rightly called global climate change and the climate of the entire ecosystem is in fact changing, the effects of

climate change for the purposes of discussing adaptation have to be dealt with on a local scale to be meaningful and effective. There are a few reasons for this:

1. Although the entire planet is warming, warming is occurring at different rates in different places. The poles are warming faster than the tropics, for example, and even within the continental United States, warming will differ from region to region.

2. Although we know that precipitation will change due to climate change, the kinds of changes that will take place are highly local. Some areas will experience more overall precipitation, others less.

3. And finally, even with as global a consequence of climate change like sea level rise, the degree of change any single place will see will vary. As you may have heard in the news recently, locations along the eastern U.S. seaboard are expected to see higher sea levels more quickly than other locations, for example.

But the other, equally important reason to focus on state and local as opposed to regional, national, or international scales when discussing climate adaptation is that almost all of the responses to climate change are likely to occur at the state and local levels. The tools we have to address rising temperatures, variable precipitation, and other effects are mostly local tools like zoning, building codes, and common law, not federal statutes that proclaim a national "fix" for dramatically different local circumstances. So as we look at legal responses across the United States and in other nations, climate adaptation is largely a state and local phenomenon to date and is likely to remain that way.

III. What Will the Impacts Likely Be?

I'm not going to run through climate change or its causes or even the high-level impacts expected, but I'll instead focus on the issues that may affect remedial sites.

On a side note , one thing I do want to mention, not because I think you don't know the distinction, but because it's been helpful to me as I talk with people and it might help you as you discuss climate issues with colleagues and communities, is how to explain the distinction between weather and climate. The way it was put to me was that the weather tells you whether to take an umbrella today, while the climate dictates whether you own an umbrella at all. I like that description because I think it helps people who get caught up in confusion about the difference between short-term weather issues and long-term climate trends.

So to briefly outline the likely impacts of climate, we can look at three systems: physical, living, and human.

So first, physical impacts. These are changes to the physical world, like increasing temperatures. They can include issues like:

1. Salt water intrusion into aquifers along the coastline, impacting water under your sites.

2. A gradual creeping of the coasts landward, particularly in low lying areas. This is likely to manifest as more days of flooding and more intense floods, instead of cities suddenly being swallowed up. You may find your sites at increased risk of flooding.
3. Changes in the amount of precipitation areas receive, and more significant precipitation events.
4. Water quality degrading because of changing water quantity.
5. Entire climate systems will likely shift, with Washington DC having Georgia's climate in the next 50 years or so, for example. The changes in humidity, temperature, etc., will stress existing systems. Your remediation system may have been designed with certain parameters in mind. Although the change will likely be slow, query if there are key factors that may undermine system design.

One note on these physical changes, which are often portrayed as massive, even cataclysmic shifts. ELI sponsored a seminar at which I heard a fascinating talk by the general counsel of Denver Water. She noted that overall, the Denver watershed is expected to get the same amount of precipitation in 50 years as they now receive. But they have a significant problem because most of their precipitation arrives in the winter as snow pack. With climate change, this is expected to shift to more intense spring rains and drier winters, summers, and falls. This means that unless they are able to greatly increase their water storage capacity, they'll be unable to meet the annual water needs of their water district.

I think that's a very telling example of how climate change impacts will actually be felt—not necessarily in cataclysmic terms, but in terms of our existing systems being built for one baseline, and then needing to respond to a new baseline that may itself be changing for some time. And that's the likely challenge for site remediation managers.

Second category of impact is impacts to living systems.

1. Wildlife may well migrate as ecosystems shift and their habitat changes. They may migrate onto or away from your site, for example.
2. Species extinctions are expected to rise. Species currently onsite may move into the threatened or endangered categories solely due to changing climate.

While most people talk about species moving, I also want to mention a side note that we will likely see much more rapid species evolution as a result of a rapidly changing environment because species could rapidly evolve to fit new niches, something that may benefit or put your site at risk over decades.

I know that sounds a little odd, but evolutionary biologists have found that species, when stressed, can change very rapidly—in decades, not eons. Jonathan Weiner's book "The Beak of the Finch" is a fascinating read and explains how Darwin's finches have been observed to change over decades in response to changes in their environment. Although it seems difficult to believe, think of the resistance we've seen to antibiotics and the ability of plants to thwart pesticides as perhaps the most familiar examples.

And finally, the third area of impacts, human systems, will likely feel many impacts that I'll just mention in brief.

1. It's expected that power needs will shift dramatically and that the source of power will need to shift. This may present opportunities for remediation sites, or threats, in terms of needing or supplying power.
2. Food systems are expected to be stressed
3. Populations may shift in response to changes in the land, water, or climate.
4. All of these changes to human systems put into question whether long-term designations we've made for sites and certain land uses will hold.

IV. How to Figure Out Your Local Impacts

Shifting our focus now, I mentioned that climate change is local, but all I've identified so far are relatively broad trends and possible impacts. That's not very helpful to you as site managers trying to understand potential impacts to your sites. How do you know what the changes will be for the areas where your sites are located? I wish there was an easy answer, but our models and data are still rough. Forbes called climate adaptation big data's biggest challenge. But there are resources you can consult to get an idea of where your site's conditions are likely headed.

1. The U.S. Global Climate Research Program has quite a bit of data on expected regional impacts. Their National Climate Assessment report is an excellent resource for understanding impacts across sectors, media, and region. It also contains helpful information on potential responses to climate change.
2. Many states have completed their own climate assessments in the form of climate adaptation plans. Georgetown Climate Center has a comprehensive set of these plans. I can tell you that if your state is on the East or West Coast, they almost certainly have a plan. If your state is in the center of the country, then unless you're Colorado, the state doesn't have a plan.
3. Some localities are undertaking climate adaptation planning, particularly coastal jurisdictions. The Georgetown Climate Center website also identifies these local efforts. The same general rule applies as for state plans, although many Gulf Coast communities have undertaken local planning efforts as well.
4. Finally, the National Weather Service has a fascinating tool, the Local Climate Analysis Tool or LCAT. Although it looks like you need a special affiliation to use the tool, obtaining a login was simple. It helps analyze local temperature and precipitation data on a local basis.

So another side note is that if your locality or state has not undertaken climate adaptation planning, you can help encourage local leaders to undertake this work. If the phrase climate change causes political hackles to rise in your area, then it can instead be framed as good planning for future growth and changes in the physical, living, and human environments. Particularly if business leaders highlight the imperatives that infrastructure investments are made wisely and that future community needs are identified and planned for, then many of the political landmines that exist around climate topics can be sidestepped.

V. Legal and Management Responses in Climate Adaptation

As a lawyer, I can't imagine a worse scenario than trying to create a governance system than climate change adaptation. In this world of climate change, future conditions are predicated by models that are necessarily imperfect. The baselines predicted by those models will then continue to change, perhaps in a highly unpredictable manner. Effects will be highly localized, so sweeping national laws are unlikely to work. For a legal system (and company managers) that like predictability and confidence in outcomes, it's a pretty awful operating environment.

But there are some tools that are presenting themselves and new ones that will likely arise to meet the challenges. IN particular, I'd like to focus on Adaptive Management, Traditional Legal Tools, and Broad Trends we may see.

Adaptive Management

The most obvious tool is one I was happy to see discussed on the SuRF website—Adaptive Management. How many people have used Adaptive Management at a site or been involved in a project that used Adaptive Management principles?

Great, as you know adaptive management relies on assessing, designing, implementing, monitoring, evaluating, adjusting, and then repeating the cycle in response to changing circumstances. It is an iterative process for making decisions based on lessons learned and changing circumstances and is contrasted with strict rules and requirements that are laid down and against which behavior is measured and enforced against.

The ideas behind Adaptive Management have much merit. My experience with it is limited and focuses on an Environmental Law Institute project where we worked with six developing nations to determine how best to adapt their biodiversity management to a changing climate.

In the real world, implementing Adaptive Management principles raises several issues:

1. Does the existing legal structure allow the use of Adaptive Management at all? Many of our federal and state environmental laws are written to not allow these kinds of flexible, iterative approaches.
2. How does Adaptive Management apply in a permitting situation or other area where long-term decisions have to be made and enforced against?
3. It's very resource intensive and requires both personnel and financial resources, not to mention significant collection and analysis of data. Who generates the data? With whom is the data shared?
4. Adaptive Management tends to devolve decisions to local resource managers, which can be positive and negative. Do you want decisions made by an agency branch chief or a site manager?
5. Adaptive Management introduces lots of decision points and opportunities for discretion by decisionmakers, which again is both positive and negative.
6. Finally, in a system build on enforcement, what's the enforcement hook if the system allows continual change and adaptation? That's not necessarily a problem, as long as the

environmental outcome is achieved, but it makes some stakeholders nervous that the system will be used to forever delay a positive and final environmental outcome.

By listing these issues, I'm not devaluing Adaptive Management. It may be the most powerful quiver in a manager's toolbox in the face of climate adaptation.

For SuRF, I'd be very curious to see how you experiment with Adaptive Management in a site remediation context. I'm hopeful you can generate case studies, best practices, major areas to explore and discuss. And if you want to collaborate, Environmental Law Institute can help with these questions through Jay Pendergrass, the Director of both our State Program and our Brownfields Program. Jay has 30 years of experience with governance systems, and serves on several ASTM committees.

Traditional Legal Responses

The other legal tools likely to be brought to bear are those that are more traditional and that range from the site-specific to state-level.

The most local of local places to focus are on the documents that govern your sites—agreements, orders, and permits, for example. There are a variety of tools that you may find already embedded in these documents or that you may want to embed in future documents or future revisions.

1. Do the agreements or orders or permits have reopener clauses? In other words, is there a provision for reopening the agreement or the remedy if certain events occur? Most agreements have provisions like this—for example, what happens if a remedy fails. But these can also be used to address potential climate impacts, such as what to do if water quality changes due to climate shifts.
    a. This is also a provision to consider putting in future agreements. Are there critical climate related events that could trigger the need for a reopener or is there a need for a generic reopener clause? Note that while these provisions can give some flexibility, they can also introduce unpredictability.
2. Do the agreements or orders have provisions for waivers—for not meeting condition x if circumstance y presents itself?
    a. As with reopener clauses, is this something to put into future agreements?
3. Are there clauses, or should there be clauses, that outline what happens if certain baselines change, such as ambient temperature that affects a biological remedy? Would allocating risks and responsibilities in the face of potential changes be helpful or even attainable? For example, Department of Interior has safeharbor agreements around managing endangered species impacts. Can you negotiate a similar provision that a regulator may accept restrictions on future enforcement actions in exchange for actions taken by the regulated community today?
4. What role will Force Majeure play? Force Majeure suspends the normal workings of a contract or agreement due to "acts of god." Will circumstances caused by climate events be considered acts of god? Will it excuse performance of some agreements' requirements? I think that remains to be seen.

5. Can Adaptive Management techniques outlined above be worked into agreements and orders in a way that's mutually beneficial?
6. Is insurance available to help mitigate climate risks?

Pulling back from the site-specific level, there are a variety of approaches that local and state governments may take to climate adaptation that could impact site remediation. The list is actually quite extensive. Instead of trying to cover all of that here, I'm giving you a chapter from an ELI Press book, "Protecting the Environment through Land Use Law: Standing Ground." In this chapter, Pace Law Professor John Nolon does an excellent job highlighting practices that local governments in particular can implement to address climate impacts in their jurisdictions. The tools he identifies are remarkably similar in concept to SURF's 2009 white paper:

1. Develop best practices
2. Train local officials
3. Create permitting regulations where needed to keep development away from at risk areas
4. Undertake comprehensive planning
5. Create a task force
6. Plan pre and post-event
7. Study and network with other localities

One side note is to ask whether Adaptive Management techniques can be worked into state or local remedial programs. Can SuRF and other organizations work with officials to identify ways in which remedial programs can be made more flexible and adaptive to meet changing baselines so remedies remain effective and efficient?

There are also three broader trends in local climate adaptation law that I want to point out.

1. First, we will likely see an increasing amount of conflict between property owners and laws meant to protect the environment. For example, a seaside landowner may want to use hard solutions such as seawalls to protect her property, while local and state authorities may mandate soft defenses like wetlands and floodplains. There are already lawsuits like these pitting property rights against communal rights. These have the potential to reduce the effectiveness of some tools communities have to address climate change, yet it's also clearly important to establish the right balance between private rights and communal rights.

2. Second, query whether state and local climate adaptation plans could interfere with, conflict with, or promote remedial site management. Local planners may rezone an area to act as a wetland and a floodplain buffer, for example.

3. Finally, the concept of rolling easements is gathering some force, particularly in academia. In most states, the public owns land in the tidal zone and seaward. The idea is that as the seashore encroaches landward, the public's ownership of the sea-land interface moves with it. Although it's an area of dispute, arguably this means that as the sea rises, private property rights recede.

Some are arguing that these same principles apply to species management, and that government may gain an easement over private property to protect species as they migrate. This right is highly speculative at the moment.

VI. Future Trends in Climate Adaptation Governance

That brings us to my final topic, which is how law more generally may shift to address climate change. Like physical and living systems, legal systems shift and adapt according to needs and circumstances. 45 years ago, we didn't have modern federal environmental law. It grew in response to circumstances and the perceived necessity for a national solution. Thus, local, state, and federal laws and jurisprudence will likely change as well.

One area where we're seeing lots of activity is the tension between the authority of localities versus state authority that continues to play out and may increase over time as localities take actions to respond to climate change. You may have noted that I've used the terms locality and state somewhat interchangeably, although they're quite distinct entities.

The general rule in U.S. law is that all authority for local jurisdictions flows from the state. The majority of states interpret this strictly to mean that if the state has not empowered a locality to undertake an action, like having the power to ban fracking, then the locality lacks that power. But there is a lot of gray area in this space. Staying with the fracking ban example, some courts have found that state-level regulation of oil and gas prohibits local fracking bans. Other courts have allowed localities to ban fracking as part of their delegated authority over zoning to preserve the special nature of a community. So while most local fracking bans have fallen under court review, some have stood.

You can imagine that as localities seek either to undertake climate adaptation actions that are more or less strict than state actions, there will be this same tension. These issues will have to play out in courts and legislatures and town councils.

Another area where we'll likely see efforts to adapt laws to the climate challenge is new legal theories. We have already seen an attempt to do this with the public trust doctrine. Some activists are trying to expand this doctrine to argue that state governments must act to protect their resources from climate change. The public trust doctrine gives states authority over common resources, most often lakebeds, the tidal zone I mentioned earlier, and similar areas. It requires states to act as trustees of these resources, and to take actions to protect them from harm. Activists brought lawsuits in all 50 states saying that this same doctrine applies to the ambient air, that states are stewards of the common air we breathe, and as a result states need to act to mitigate climate change. To date none of these suits has succeeded.

Another area is to use tort law to claim that those who added greenhouse gases to the environment must pay for the damages done. The argument is that if you added benzene to my water well, then you'd have to pay damages and that adding carbon to the atmosphere is a similar situation. These efforts have also failed to date, although they did find some traction in a few courts. The problem is that it's extremely difficult to tie any actor's actions to overall climate change and to then tie the impacts on

any community. The fact that you can't show that carbon emissions from Exxon's oil led to Massachusetts losing x inches of shoreline makes it difficult for judges to accept these claims.

There are other areas that lawyers are mining to use as well. For climate adaptation, we can expect creative lawyers to take the same approach. Several states have a right to a clean environment in their constitutions. Query how inventive lawyers might use these provisions. For example, consider this provision:

recognizing the profound impact of man's activity on the interrelations of all components of the natural environment, particularly the profound influences of population growth, high-density urbanization, industrial expansion, resource exploitation, and new and expanding technological advances and recognizing further the critical importance of restoring and maintaining environmental quality to the overall welfare and development of man, it is the policy to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations.

I left out identifying nouns in this quote because this is actually Section 101 of the National Environmental Policy Act, which has been the law of the land since 1970. I've always thought that sustainable development has its roots here in the USA just as much as in the 1987 Brundtland Commission report, which is often cited as the source of sustainable development. Inventive lawyers will almost certainly use provisions like this to push for expanded legal protections from climate change or to argue that authorities have the power to take actions to adapt to climate change.

VII. Conclusion

So to sum up, climate adaptation poses unprecedented challenges on several fronts. Site remediation managers will be at the forefront of climate effects and the need to respond with adaptive responses. But for all of its challenges, climate change will also present opportunities. It will spur technological, economic, social, and legal innovation. And that's where I see a good bit of opportunity to be hopeful. Americans are the most innovative people on the planet. It is our core strength. So if you put a challenge like climate change in front of us, and we'll work hard to solve it. As Winston Churchill said, Americans always do the right thing after trying all other possible avenues.

As leaders in this area, SuRF is at a special juncture to affect this developing area of practice and not just react to climate change, but to help shape the legal and management tools to be used to be sure we adapt to a changing climate in order we can to protect the environment, our economy, and our communities. Thank you for all you do, and thank you for your time today.

Attachment 4
Climate Adaptation Planning and Strategy: An ASTM Guide

ASTM Guide Development:

WK 21812

Climate Adaptation Planning and Strategy.

"CAPS"

What is ASTM?

- American Society for Testing and Materials
- Why should you care?
- Standard Guides are voluntary.
- They can be used by municipalities, states, businesses, Federal agencies and so on.
- Balance and consensus
- Transparency

Committee E50

- Environmental Assessment, Risk Management and Corrective Action
- Developed Risk Based Corrective Action for Petroleum and Chemical Release Sites.
- Phase I and Phase II Assessment
- Recently, both the Sustainable and Green Cleanup Guides.

Why address Climate Adaptation?

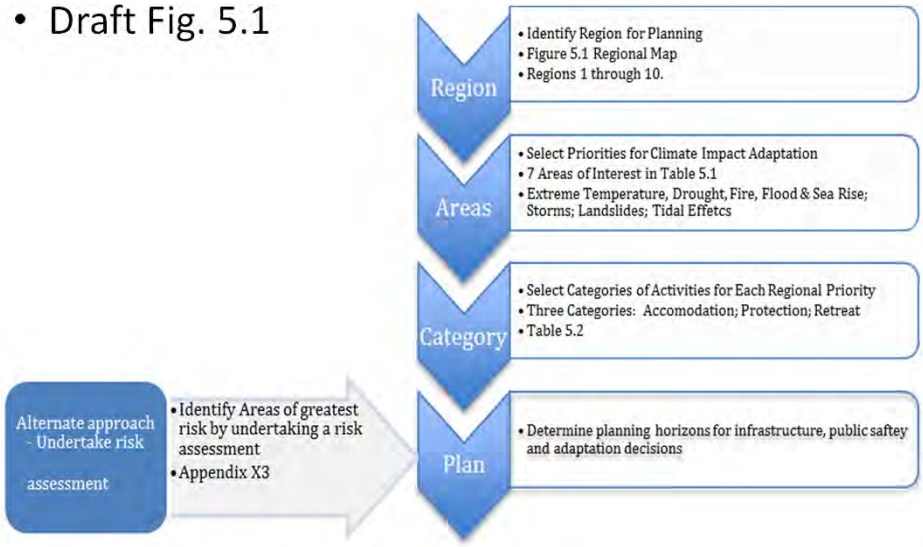
Because it is not going away!

The CAPS Guide

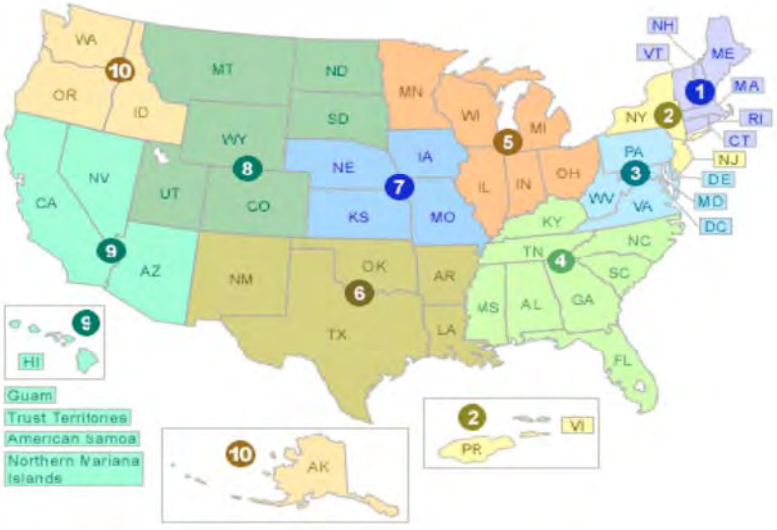
- Climate Adaptation Planning and Strategy
- First Four sections are in standard ASTM format:
- 1.0 Scope
- 2.0 Referenced Documents
- 3.0 Terminology
- 4.0 Significance and Use

Overall Procedure for planning

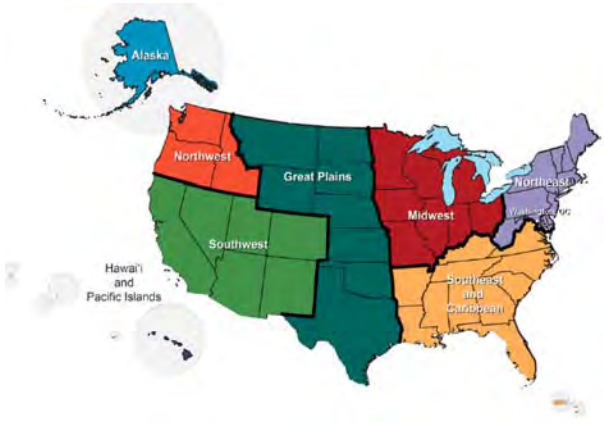
- Draft Fig. 5.1



FEMA and EPA Regions



National Climate Assessment Regions



Regional Climate Adaptation Priorities

Region	Extreme Temp. (hot or cold)	Drought	Fire	Flood	Storms (wind straight line and tornadic and snow hail, sleet and ice)	Land Movement Subsidence uplifts and landslides)	Sea Rise and Tidal effects
1 New England				*	*		*
2 NY/NJ				*	*		*
3 Mid Atlantic				*	*		*
4 Southeast	*			*	*		
5 Great Lakes	*						
6 Southwest	*	*	*				
7 Midwest							
8 Mountains & Plains	*	*	*				
9 Pacific Southwest			*	*		*	
10 Pacific Northwest			*	*		*	

Table 5.2 Simplified Classification of Responses

Adaptation Risk Sector	Category 1: Accommodation	Category 2: Protection	Category 3 Retreat/Relocate
Extreme Temps	Build green roofs, conserve water,	Add insulation and energy efficient windows to buildings.	Move residences and buildings
Drought	Conservation. Plant	Integrated water resources	Move crops, livestock
Fire	Construct firebreaks,	Fire resistant coatings;	Move residences
Flood	Free-board buildings;	Build seawalls barrier islands	Remove,
Storms	Emergency Response	Upgrade building	Redesign occupied areas
Land Movement	Upgrade building and community	Build retaining structures	Move residences out of high risk areas.
Sea Rise and Tidal Effects	Free-board buildings away from impact	Build seawalls, retaining structures, levees	Remove relocate or raze occupied structures

The "rest of the story"

- **6.0 Additional Considerations for Climate Adaptation: Examples**
- 7**.0 Planning and Selection of Actions**
- 8.0 **Assessing Options**
- 9.0 **Implementation, Monitoring, Review and communication**

Appendices

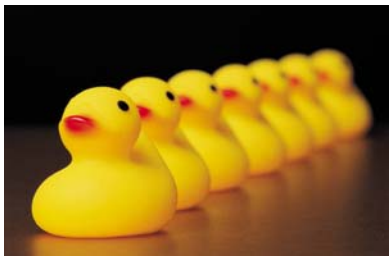
- **X1. Examples of Climate Risk Accommodation, Protection and Retreat.**
- **X2 Planning redundancy and resilience for critical infrastructure such as power, water, waste treatment, fuel.**
- **X3 Climate Risk Assessment Examples**
- **X4 Financial Assistance and Schedule considerations and examples**

First Ballot: 2/19/15

- **NOT FOR DISTRIBUTION OR CITATION 2/4/15 WK 21812 PRELIMINARY DRAFT SUBJECT TO REVIEW & REVISION**
- **WK21812 Draft Standard Guide for: Climate Adaptation Planning and Strategy**;
- **Introduction:** This standard provides a uniform set of options for planning climate resiliency management and strategies. This includes adapting local business and government infrastructure to increasingly chronic, extreme weather events and sea level rise. It may not apply to entities where such assessment and risk management is already widely available through standard, uniform sets of guidance, such as the construction of green buildings. This standard provides a voluntary framework of the risk management options and steps that may be beneficial to evaluate climate resiliency solutions. It provides strategies for existing organizations, even those currently operating outside of various voluntary and regulatory schemes. The environmental assessment and risk management strategies contained in this guide recognize the overall value of existing responses. This guide references and blends similar, effective programs and extends them to provide a consistent approach that will facilitate communication and preparation for extreme weather events.
- Background: This standard guide presents a series of options for an individual, group or entity to use in forming a strategy or plan to address climate change and extreme weather.
- **1.0 Scope**
  1.1 Overview
- For the purposes of this Guide, adaptation' refers to efforts by entities, organizations, or individuals to prepare for or adjust to future climate change.
- 1.1.1 This guide presents a generalized, systematic approach to voluntary assessment and risk management of extreme climate related events and conditions. It helps the user structure their understanding of the climate change related vulnerabilities and consequences they seek to manage. It helps the user identify adaptation actions of both an institutional (legal), as well as engineering (physical) nature. Options for analysis provide a priority ranking system to address the —worst first risks of a municipality, local area or facility, addressing practicality and cost-benefit.. Users may approach this having initially undertaken a risk assessment to determine what they are seeking to manage, or use the guide to help determine the likely areas of greatest need..

How do I get involved?

- Join ASTM Committee E50 and
- Subcommittee E50.05
- Volunteer to work on the task group



Contact info for this Guide:

- ASTM.org
- Committee E50
- hawaldorf@aol.com
- WK 21812

Attachment 5
Sustainable Remediation: A Perspective in Low- and Middle-Income Countries

Sustainable Remediation: A Perspective in Low and Middle Income Countries

Sustainable Remediation Forum
SURF 28: Moving Sustainable Remediation Forward
February 24-25, 2015

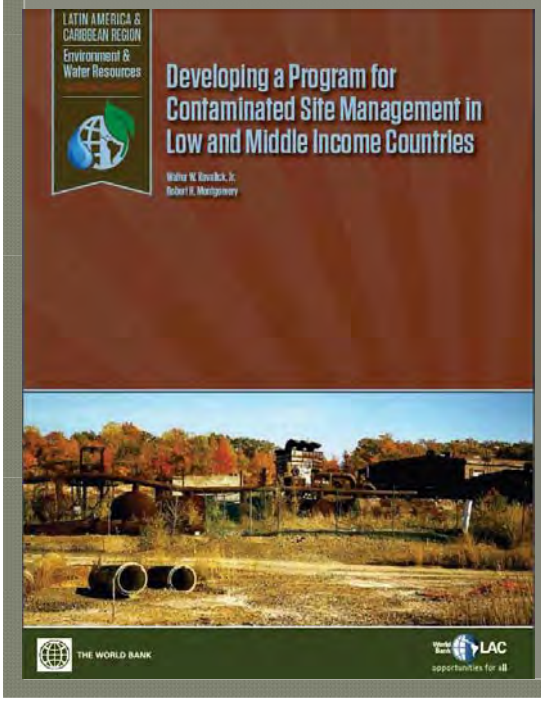
Dr. Robert Montgomery
Lead Environmental Specialist
World Bank
Email: rmontgomery1@worldbank.org

Contaminated Sites are Relevant in Low and Middle Income Countries

- Challenges:
  - Economic growth and increased urbanization are increasing site contamination impacts on public health and environment
  - Often disproportionality affects poor and disadvantaged populations
  - Can cause serious political and governmental budgetary impacts, negative economic impacts on property values, and limitations on development of urban and rural land
  - Complexity and cost of remediation and restoration of sites only grows with time
- Opportunities:
  - Most countries have “some” legislation or actions, but not sufficient or fully effective
  - Resolution of contaminated sites can lead to economic development and improved quality of life and environment
  - Range of financial mechanisms to address fundamental problem of how to pay for site cleanup
  - Increase benefits with sustainable remediation

Problem needs solving – Assistance needed

Developing a Program for Contaminated Site Management in Low and Middle Income Countries



Vehicle to promote dialogue with countries related to contaminated sites and potential assistance

- Alternatives for the design and implementation of Site Contamination Program
- Policy, legislation, regulatory, implementation, and organizational issues
- Agenda of short- and longer-term actions

Financing Mechanisms for Addressing Remediation of Site Contamination

Vehicle to promote dialogue with countries on mechanisms to finance contaminated sites remediation

- Bond Finance Programs
- Loan Fund Programs
- Tax Increment & Special Assessment Finance Programs
- Tax Credits & Incentives Programs
- Grant Financing Programs
- Emerging International Finance Models)

Sustainable Remediation

SuRF
SUSTAINABLE REMEDIATION FORUM UK

"The practice of demonstrating, in terms of **environmental, economic** and **social** indicators, that the benefit of undertaking remediation is greater than its impact and that the optimum remediation solution is selected through the use of a balanced decision-making process

SURF
SUSTAINABLE REMEDIATION FORUM

"Sustainable remediation is broadly defined as a remedy or combination of remedies whose net benefit on human health and the environment is maximized through the judicious use of limited resources"

NICOLE

A sustainable remediation project is one that represents the best solution when considering environmental, social and economic factors – **as agreed by the stakeholders** "

Environment, Social and Economic

Low and Middle Income Countries

- Poverty and inequality
- Significant basic social needs
  - Food, water, health, education
- Existing human health risks
  - Ambient air quality, drinking water, sewage, working conditions, lack of adequate health care
- Insufficient governmental budgets
  - Trade-offs between and within agencies
- Lack of understanding of sustainability
  - How to do it given country and project characteristics
  - Evolving sustainable based products and technologies, but often limited availability in these countries

Realities, Needs and Perceptions

Sustainable Remediation

- Program Level
- Project Level

Economic
Social
Environmental

Low and Middle Income Country Conditions

Considerations: Economic

- Remediate (full, partial, or not) given
  - Other priorities to address societal needs
  - Other existing human health risk
  - Change in "total" health risk (not just due to site contamination)
  - "How clean"
- Cost of Certainty
  - Resources spent on studies vs. actual remediation
- Establish Program or just do Projects
- Government pooling remediation projects to reduce unit costs (e.g., field, lab, remediation)
- Establish framework to allow alternative (economically feasible) financial mechanisms
- Cost/economic challenges
  - Valuation of benefits given range of stakeholders and their perceptions and lack of data to monetize benefits
  - Shadow costs and cost disparities

More than just Project Cost

Considerations: Social

- Selection of site/project location based on
  - Degree impacting poor community – quality of life
  - Existing operations, thus maintain jobs and reduce worker risks
  - Re-development opportunities that benefit lower and middle income population (green space, recreational, etc.)
- Remediation approach that maximizes
  - Local employment, ideally with skills to facilitate future jobs/work
  - Purchase of local goods and services (e.g., low tech, non-imported)
- "Expanded" health monitoring/treatment for remediation workforce (and local community)
- Benefits from more sustainable programs and projects
  - Must be considered and measured given the local and stakeholder socio-economic, political and environmental context and perceptions
- Community communication on rationale and benefits for remediation given other societal needs and problems

Remember local stakeholder characterizes and perceptions

Considerations: Environmental

- Remediation and Material Selection
  - Environmental context of project location (e.g., water or material scarcity, impacted water or airsheds)
  - Established governmental environmental priorities
  - Project material usage (amount) and associated local costs
- Material Use
  - Use less "locally key" resources (e.g., water due to drinking water needs, energy due to high cost)
- Recycle/Reuse
  - Contaminated soil or water (e.g., beneficial use of contaminated soil/sediments, reuse of treated water)
  - Other construction materials
- Site Selection
  - Consideration of other environmental risks (flooding, etc.)

Decisions based on local environmental context

Considerations: General

- Need to consider sustainability in all phases
  - Program Planning
  - Project Planning and Design
  - Project Construction
  - Project Operation and Maintenance
- Selection of project sustainability actions based on:
  - Project scope and size (e.g., public vs. private site, operating vs. abandoned, urban vs. rural, large scale vs. small scale)
  - Project stakeholders, in particular local community, preferences in terms of sustainability benefits (i.e. interested in what type of benefits)
  - Sustainable action availability (e.g., technology, equipment), implementability (including relevant institutional capacity) and result (i.e., value of benefit given cost or level of effort to implement).

Considerations: General

- Sustainability actions
  - Some sustainability actions can add additional cost, but many reduce costs (reduce material and energy consumption, etc.)
  - Can implement to various degrees (levels)
  - Implementation of just one action that provides significant results can be a success
  - It is never too late to implement environmentally sustainable actions, albeit the maximum benefits are likely obtained when implemented at the early project planning and design stage.
- Using in contracts/procurement
  - Establish as requirement (bid or contract)
  - Best Efforts clause
  - Remedy or Incentive
  - Public sector procurement focus on lowest economic project cost

Conclusions

- "Sustainable" is Economic, Social and Environment
  - Not just environment (green remediation)
  - Economic is more than just program/project cost
- Sustainable Remediation in low and middle income countries **must** take into account the specific socio-economic realities – "Perspective"
- Technical specialists need to "**Adapt**" the approach in low and middle income countries to better help decision makers in defining and implementing successful sustainable remediation both at Program and Project level

Attachment 6
A Big Picture Look at the Benefits of Greener Cleanups

Moving Sustainable Remediation Forward: *"Big Picture" Observations on the Environment/Economic Development/Sustainability Nexus*

Charlie Bartsch
Senior Advisor for Economic Development to the Assistant Administrator
US Environmental Protection Agency
Bartsch.charlie@epa.gov

Premises, givens, and assumptions related to…"

THE BIG PICTURE

- A safe environment is (practically) everyone's goal; the means to reach it differ
- Cleanup is not planned – and is not carried out – in a vacuum; a range of "forces" influence it
  - *Regulatory, technological, perceptual, market*
- Cleanups need to be paid for – no $$ = no cleanup; thus there is value in:
  - *Leveraging other/non-EPA agency funding by linking cleanup activities to their missions*
  - *Leveraging incentives for cleanup as part of redevelopment*
  - *Attracting private interest/private capital*
  - *Evaluating the cost of cleanup against a broad range of benefits, so spending is worth while*
- Increasing awareness of the value of cleanup, and the role of cleanup in sustainability, leads to opportunities to push greener cleanups – to build on that interest

"An America Built to Last" – Key Themes and Their Links to EPA Activities

THE BIG PICTURE

CURRENT KEY ADMINISTRATION THEMES

- Encourage manufacturing in-sourcing – IMCP
- Encourage infill and site reuse
- Facilitate energy efficiency and renewable energy
- Strengthen skills training and job development
- Promote community betterment/stronger communities

EPA/brownfield/site reuse/cleanup/waste management programs connect to all of these –

In the "big picture" – what is the context for EPA priorities, partnerships, and initiatives to fit within the Administration's themes?

- **Administrator's key themes are framed in a context of sustainable development linked to environmental protection, stakeholder involvement**
- **Supporting greener cleanups directly builds on 3 of these themes:**
  - *Making a visible difference in communities*
  - *Addressing climate change and improving air quality*
  - *Working towards a sustainable future*

In the "big picture" – what is the context for EPA priorities, partnerships, and initiatives to fit within the Administration's themes?

- **Assistant Administrator's priorities within this objective – promoting new/enhanced inter-agency, public-private working partnerships aimed at cleanup and revitalization <u>results</u>**
  - *Defining, addressing environmental issues/concerns as part of the economic/community development continuum*
  - *De-mystifying environmental component of reuse process*
  - *Identifying common program missions – promoting financing leveraging/linkages*
  - *Realistically involving community stakeholders*
  - *Implementing clean up programs with sustainability in mind*

Economic Sustainability – Advantages and Benefits

Key economic revitalization strategies related to cleanup and sustainability include –

- Redevelopment in blighted areas aligns with smart growth goals
- RCRA and Superfund factor reasonably anticipated future land use into the cleanup decision process
- Employment opportunities in areas with cleaned up sites – sometimes in the environmental cleanup sector
  - *Remediation in the US a $7 billion/year industry*
- Rising property values in communities
  - *Can make subsequent cleanups of nearby properties more financially attractive*

Economic Sustainability – Benefits and Advantages

How these efforts play out in practice –

- At 373 redeveloped Superfund sites –
  - *2,240 businesses generating $32.6 billion in sales, 70,000+ jobs, $4.9 billion in employment income*
- Improved residential property values –
  - *Increase 18.6% to 24.5% for properties within 3 miles of cleaned up/NPL deleted sites*
  - *Increase ranging from 5.0% to 11.5% for properties within 2 km of cleaned up brownfield sites*
- Such results open the door for local Tax increment Finance and property tax abatement financing tools – the most common local resources used for site cleanup

Social Sustainability – Community Engagement Efforts

Key community efforts related to cleanup and sustainability include –

- Advocating strong environmental justice practices
- Protecting the environment and health in overburdened communities
- Empowering communities to take action to improve their health and environment
- Establishing partnerships with local, state, tribal, and federal agencies and organizations to achieve healthy and sustainable communities

Social Sustainability – Community Engagement Efforts

How these efforts play out in practice –

- Developing transparent, accessible decision-making processes to enhance meaningful stakeholder participation
  - *Integrate community engagement strategies as appropriate, EPA program by program*
  - *Prepare, disseminate compendiums of best practices*
- Present information and provide technical assistance in ways that enable stakeholders to better understand environmental issues and participate in an informed way during decision-making
- Produce outcomes that are responsive to stakeholder concerns and are aligned with community needs and long-term goals
  - *Create an environmental workforce development and job training program – to focus on cleanup, green building, green maintenance/operations*

How can the public sector make sustainable redevelopment – <u>all</u> facets – <u>sustainable</u> over the long term?

- What existing, traditional public incentives are best used, best adapted to meet a range of sustainability needs and objectives – including greener cleanups?
  - *Energy efficiency incentives*
  - *Cleanup tied to site reuse/community <u>re</u>development programs*
  - *Investment incentives targeted to distressed areas – NMTCs, LIHTCs, historic rehab tax credits*
- What new tools/incentives/strategies are emerging to support sustainable development/businesses/jobs?

How can the public sector make sustainable redevelopment – <u>all</u> facets – <u>sustainable</u> over the long term?

- **New sustainable approaches = new risk/reward calculations = new real/perceived uncertainties**
  - *How does this new sustainability equation fit within current market?*
  - *How can we ensure that benefits go to all stakeholders?*
- How can cleaner and smarter approaches be institutionalized into the redevelopment process?
  - *How can we achieving protectiveness with a reduced environmental footprint become routine pratice?*

Challenges Remain to be Addressed….

- Ensuring greener cleanups do not trade cleanup program objectives for other environmental objectives
- Ensuring green remediation does not result in a less robust cleanup, compromising stakeholder interests
- Dissuading “Greenwashing”
- Avoiding additional regulatory concerns or requirements
- Building the necessary track record to attract, persuade more site owners to undertake greener cleanups

In short….

- EPA's primary goal is protecting human health and the environment ***but*** – economic, social, and environmental benefits are not mutually exclusive or distinct
  - *They overlap, and can re-enforce and expand one another*
  - *Prospect of a range of benefits can attract more stakeholders to the sustainability and the green remediation process*
- Combined benefits of greener cleanup, when factored into site decision-making, can lead to more cleanups because –
  - *Costs can be offset or recovered – economic benefits*
  - *Jobs generated at formerly contaminated sites (often in distressed areas) can attract additional investment – greater social benefits*
  - *Improved environmental standing because of cleanup can lead to increased property values – economic benefits*
- Range of benefits can mean that a more complete set of sustainability principles can be integrated into the remedial component
- Greener cleanup is **<u>one</u>** opportunity within the existing regulatory framework

Ford Motor Assembly Plant -- Richmond CA

- Built in 1930, 520,000 sq.ft.; closed 1953
- Original Albert Kahn " daylight factory"
- Cleanup, rehabilitation work began 2004
  - *Included seismic retrofits, green construction, solar panels on roof*
- ***Public role***: EPA assessment resources, $11 million in rehab tax credits
- ***Sustainability connection***– hosts manufacturers of sustainable products, 45,000 sq ft meeting/ entertainment venue; 350 jobs

Bio-fuel Station – Eugene, OR

- ¾ acre abandoned (since 1991) gas station, with leaking UST systems
- ***Public role***: $1.2 million low-interest, Oregon Sustainable Redevelopment Energy loan; $250,000 in state, federal energy tax credits
- Cleanup carried out as part of redevelopment, using e.d. resources
- ***Sustainability connection*** -- mixed-use bio-diesel fueling station
- 15 jobs; $4,000 in property taxes
- incorporates state-of-the art E2/P2/renewable energy techniques, including a green roof, bioswales to contain runoff

Banner Bank – Boise, ID

- Deteriorating parking garage near expanding edge of downtown Boise
- Built 1963, partially closed in 2000; major structural, some environmental concerns

Public role:

- EPA technical assistance; $324,000 in highway district funds; $100,000 from Idaho Power to offset up-front energy efficiency costs

Sustainability connection: $25 million private investment, $370,000 annual tax revenues, 650 new downtown jobs

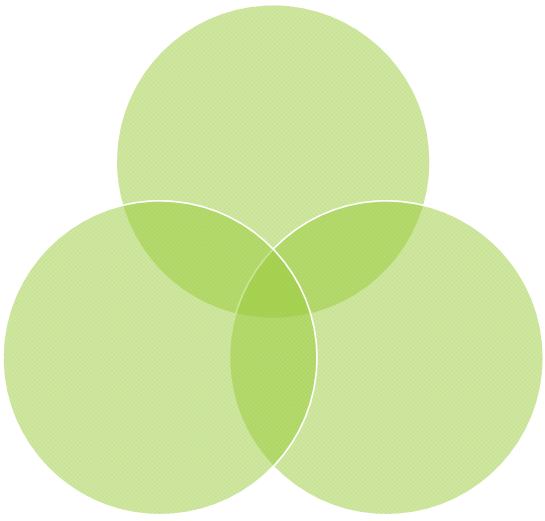
- Significant environmental benefits
  - 92% construction waste recycled
  - LEED platinum certified
  - All rainwater, graywater reused
  - 65% energy efficiency achieved
  - 95% reuse efficiency

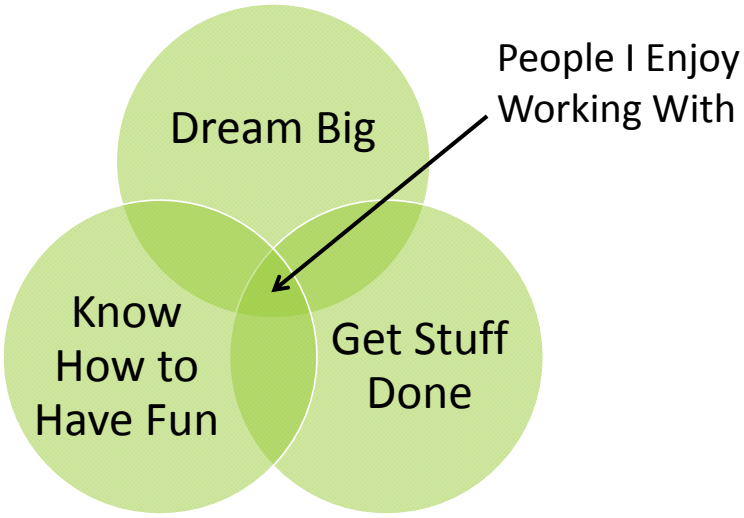
Attachment 7
Greener Cleanups: Past, Present, and Future

Greener Cleanups
Past, Present & Future

EPA United States Environmental Protection Agency

Deb Goldblum, Region 3 RCRA
SURF 28, Washington DC
February 24, 2015




Dream Big
People I Enjoy Working With
Know How to Have Fun
Get Stuff Done

3


DuPont Martinsville, VA
Unit H1
North
Fire Training Area
DuPont Precision Concepts (DPC) Building

Long Ago

4

Sustainability Measurement Factors

Greenhouse Gases & Energy

- CO_2
- Energy

Resources Consumed/Recycled

- Soil & Solid Material
- Land
- Water

Long Ago

PAST

PAST: SURF 8, October 2008

7

PAST: Greener Cleanup Principles, August 2009

8

PAST: 2009 to 2013

9

Near PAST: November 2013

10

ASTM's Standard Guide for Greener Cleanup

- Supports the tenets of EPA's Greener Cleanup Principles
- Complements any cleanup program
- Applicable to individual or multiple phases of a cleanup
- Identifies and employs best management practices "BMPs"
- Offers an option for a quantitative evaluation
- Promotes transparency through a robust reporting structure

11

Output

Protocol | Tool | Reference

12

Outcome

Defines	Provides	Promotes
greener cleanup	a level playing field	culture change

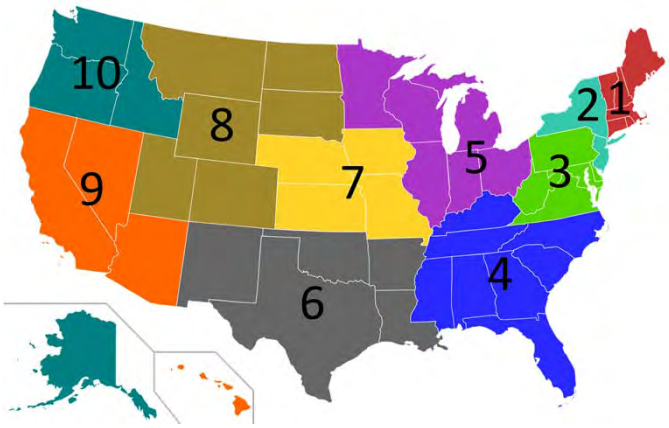
13

"…I recommend that regions and OSWER programs facilitate and encourage use of ASTM's Standard Guide for Greener Cleanups in your efforts to implement greener cleanup practices."

Near PAST: December 2013

14

10 Regions and 50 States



EPA Headquarters Facilitate and Encourage

- Maintain a web page
- Contribute to e-newsletters and publications
- Present at national conferences
- Conduct in-reach through workgroups and trainings
- Share information on funding mechanisms
- Create model language for regulatory documents
- Contribute to ASTM Task Group

EPA Regions
Facilitate and Encourage

- Provide regional and state training
- Reach out to individual states
- Recommend its use at specific sites
- Implement it at fund-lead sites
- Include its use in state grants
- Share with co-workers through regional green teams

States
Facilitate and Encourage

- Illinois and others reference it on their website
- Massachusetts recommends its use in policy to achieve greener cleanup goals in its regulations
- Massachusetts organized training for the Massachusetts Licensed Site Professional Association
- Minnesota will reference it in an update to their Green and Sustainable Remediation Guidance and is piloting the BMP Table
- Wisconsin includes it in presentations and outreach materials as a resource for complying with State Cleanup rules (NR 722.09)
- Wisconsin is encouraging staff to use BMP Table

2015 Planned Activities

- Updating profiles posted on Clu-In to include standard guide use
- Exploring contracting application at fund-lead sites
- Collaborating with the USACE on training for fund-lead sites
- Providing training to Regions 7 and Virginia
- Offering training at Superfund NARPM Training
- Presenting at Brownfields, RE3 and AEHS Conferences

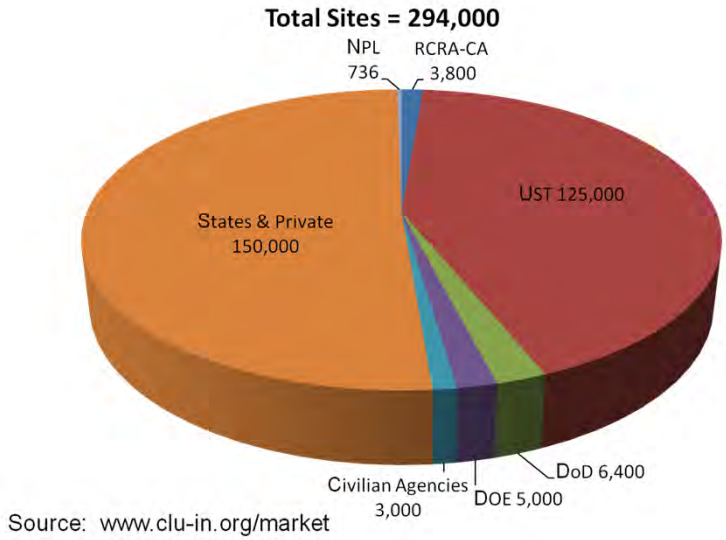
Near FUTURE

19

20

Estimated Number of Contaminated Sites

(United States, Cleanup horizon: 2004 – 33)



Source: www.clu-in.org/market

FUTURE

21

FUTURE

22

DREAM BIG

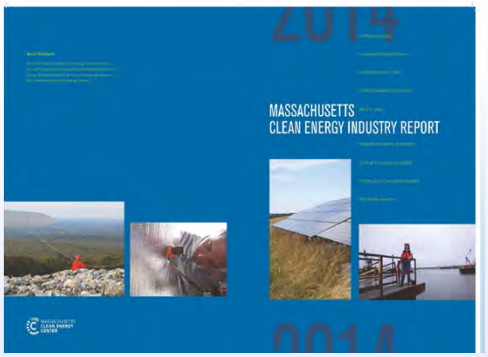
Attachment 8
Massachusett's Clean Energy Goals and Promotion of Greener Cleanups

An Overview of Massachusetts's Clean Energy Goals and Promotion of Greener Cleanups

SURF28: Moving Sustainable Remediation Forward

Tuesday, February 24, 2015
Boeing Crystal City Offices, Arlington, VA

Thomas M. Potter, Clean Energy Development Coordinator



2014 Massachusetts Clean Energy Industry Report

MASSACHUSETTS CLEAN ENERGY CENTER

Massachusetts Clean Energy Industry is Significant

$10 Billion Industry

2.5% of Gross State Product

88,372 jobs

2.4% of total Massachusetts workforce

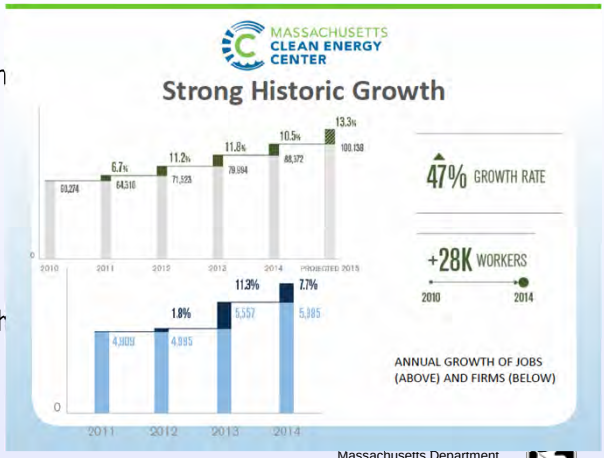
5,985 firms

2.7% of total Massachusetts companies

Massachusetts Department of ENVIRONMENTAL PROTECTION

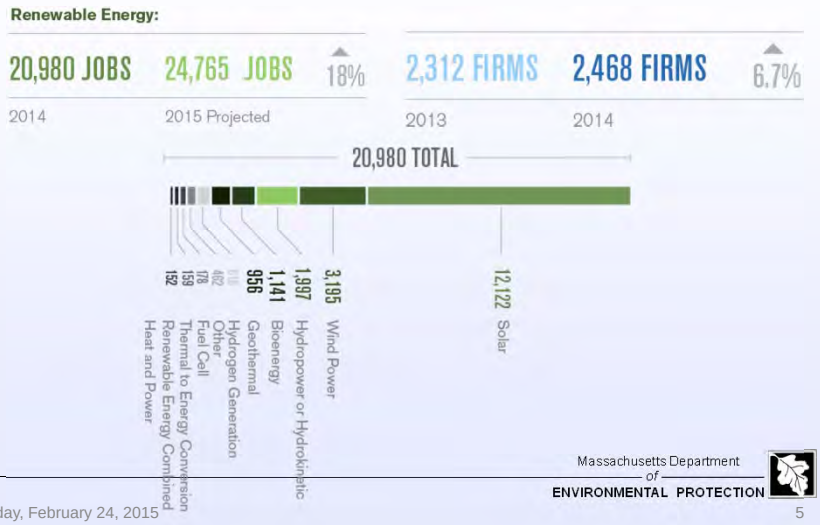
Massachusetts' Clean Energy Economy Is Large and Growing

- 10.5% **JOB** growth from 2013 to 2014
- 13.3% Projected **JOB** growth in 2015
- 7.7% **FIRM** growth from 2013 to 2014



Massachusetts Department of ENVIRONMENTAL PROTECTION

Solar Is a Major Employer

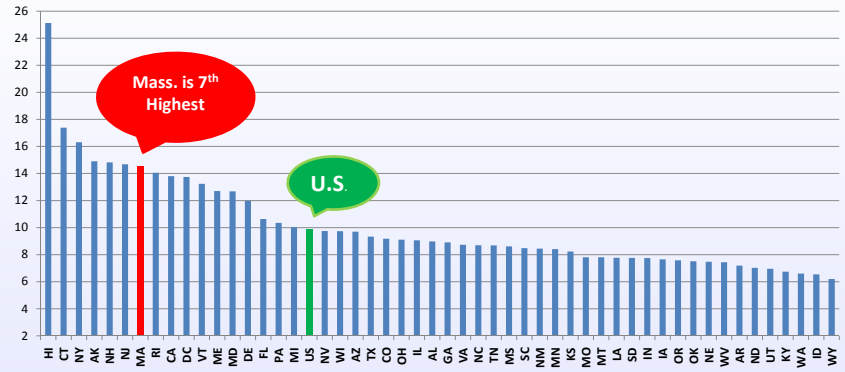


From Clean Energy to Greener Cleanups

- 2007 • Administration Mandates & Goals
- 2011 • Clean Energy Results Program (CERP)
- 2012 • Bureau of Waste Site Cleanup Goals

Mass. Has High Electricity Prices!

2010 Average Retail Electricity Price c/kWh



Source: EIA Form 826

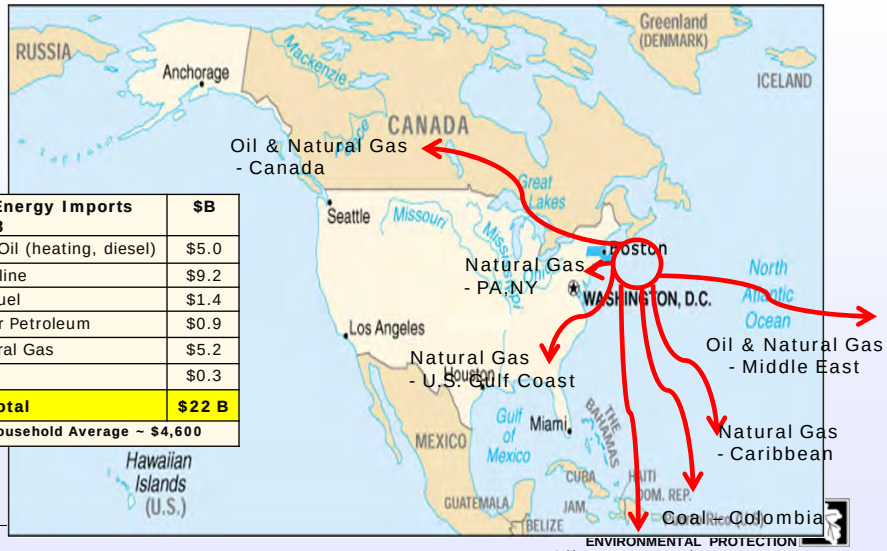
Massachusetts Department of ENVIRONMENTAL PROTECTION

7

Energy Dollars Flow Out of MA

We spend $22B per year on energy; 80% leaves MA -- $18B

MA Energy Imports 2008	$B
Fuel Oil (heating, diesel)	$5.0
Gasoline	$9.2
Jet Fuel	$1.4
Other Petroleum	$0.9
Natural Gas	$5.2
Coal	$0.3
Total	**$22 B**
Per Household Average ~ $4,600	



Massachusetts Department of ENVIRONMENTAL PROTECTION

Tuesday, February 24, 2015

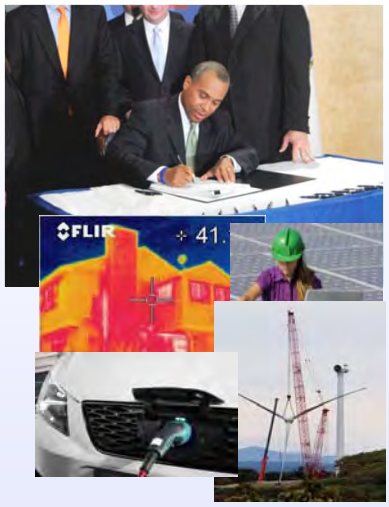
8

Leadership in Climate and Clean Energy

Since 2007 –

An integrated approach to:

- Lower energy costs
- Mitigate volatility
- Grow clean energy sector
- Become more energy independent
- Improve the environment



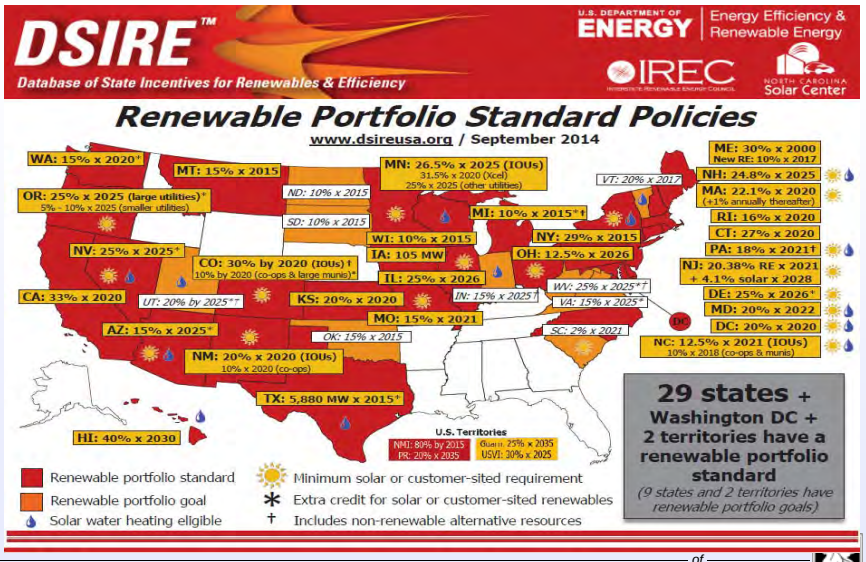
Massachusetts Department of ENVIRONMENTAL PROTECTION

Massachusetts Clean Energy

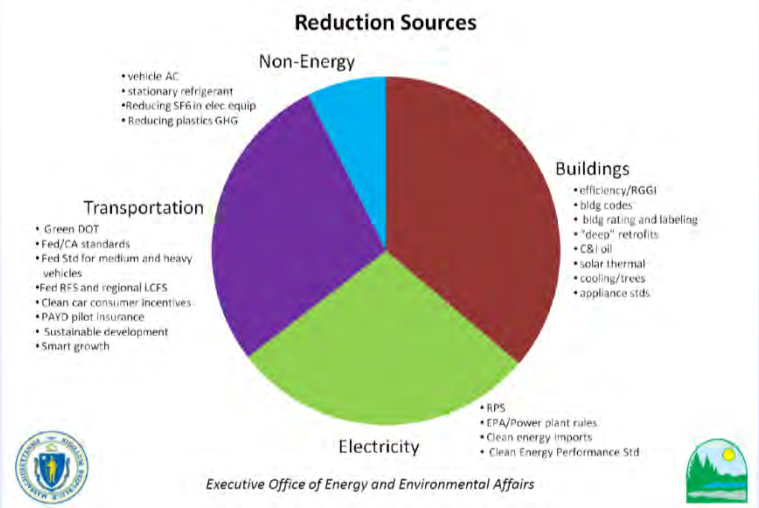
- 2007 established **Executive Office of Energy & Environmental Affairs**
- 2008 **Green Communities Act (GCA)**
  - Supports Development of Clean Energy Resources
  - Expands Efforts to Promote Energy Efficiency
  - **Increased the Renewable Energy Portfolio Standard (RPS) to 1% per year.**
  - **Goal of 15% "New Sources" by 2020 (currently 9%)**
- 2008 **Global Warming Solutions Act**
  - Comprehensive Program -> Climate Change
  - **Goal 25 % Below 1990 GHG levels by 2020**

Massachusetts Department of ENVIRONMENTAL PROTECTION

ENERGY: RPS Programs Nationally



EMISSIONS: GHG Emission Reduction Opportunities



CLEANENERGYRESULTS

- Launched 2011
- **Promotes Clean and Efficient Sources of Energy at MassDEP Regulated Sites (where we have authority or control)**
- Maximizes MassDEP's Unique Expertise to Overcome Permitting & Siting Obstacles
- **Create economic growth and employment opportunities**

CLEANENERGYRESULTS

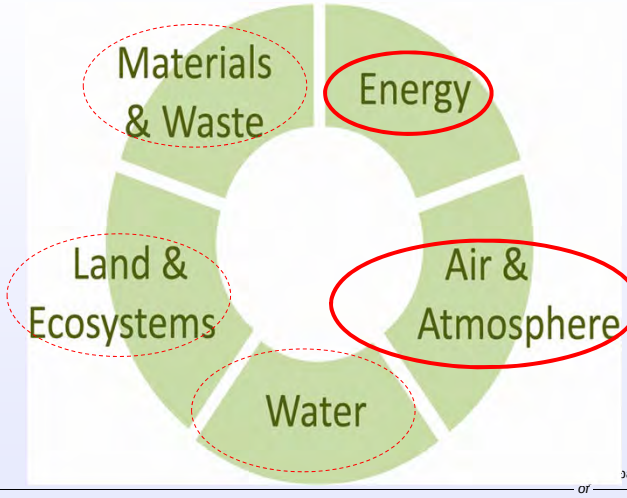
- RPS/APS Projects, including:
  - Solar Photovoltaic
    - Goal of 1,600 MW
    - Currently **752 MWs (2/15)**
  - Wind
    - Goal of 2,000 MW
    - Currently **107 MWs (2/15)**
  - Anaerobic Digestion
  - Renewable Thermal
  - Sustainable Biomass
- Energy Efficiency
- Energy Conservation

COMMISIONER'S CERP GOAL

"Promote the use of Green Remediation/ Greener Cleanups at state and federally regulated contaminated sites"

Brockton Brightfields, 425 kW solar PV

Core Elements of Greener Cleanup



WASTE: "Landfills Last" - Materials Management Framework

- **2008 Goal -** Significantly reduce the waste deposited in landfills
- **Waste Bans**
  - Asphalt Pavement, Brick & Concrete
  - Clean Gypsum Wallboard
  - Commercial Food Waste (Effective October 1, 2014)
  - Ferrous & Non-Ferrous Metals
  - Leaves & Yard Waste
  - Recyclable Paper, Cardboard & Paperboard
  - Treated & Untreated Wood & Wood Waste (Banned from Landfills Only)

WATER: Management of Water Resources

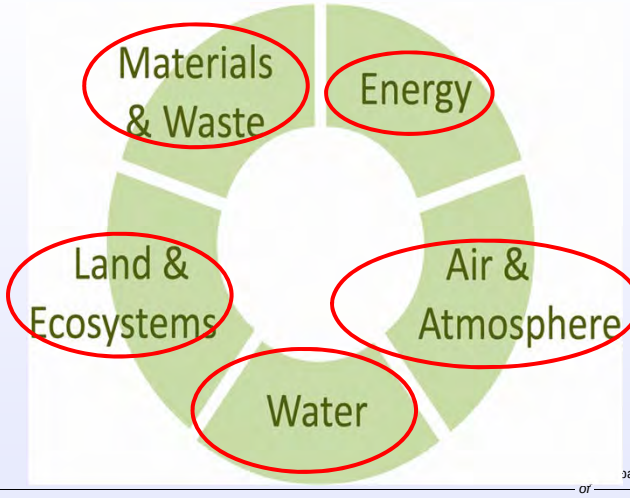
- **2008 Goal** - Work to bolster water quality and quantity by promoting best practices for better conservation, management and protection
- **Major Activities:**
  - Water Management Act
  - *SWMI – Sustainable Water Management Initiative*

Ipswich River:

LAND: Protecting Land And Ecosystems

- Minimize areas that need use limitations
- Minimize soil and habitat disturbance or destruction
- Use native species to support habitat

Core Elements of Greener Cleanup



2011 Regulatory Reform & 2014 MCP Amendments

- In 2011, MassDEP launched a major initiative to look for possible improvements to all of the agency's regulatory areas.
- Some of the reforms also remove regulatory barriers to clean energy projects and/or establish opportunities

MassDEP Efforts (2012 – 2014)

- **GREENER CLEANUPS WORKGROUP**
  - Engage regulated community/stakeholders
  - Quarterly Meetings since 2012
- **REGULATORY AMENDMANTS** (effective April 2014)
  - include provisions to address "core elements" in support of Commonwealth's energy and emission reduction mandates of 2008
- **GREENER CLEANUPS "GUIDANCE"** (effective October 2014)
  - Policy advocates use of ASTM Standard Guide for Greener Cleanups (E2893-13, November 2013)
- **TRAINING**
  - December 2014
  - April 2015
  - October 2015

310 CMR 40.0191
Response Action Performance Standard (RAPs)

- (3) The application of RAPS shall be protective of health, safety, public welfare and the environment and shall include, without limitation, in the context of meeting the requirements of this Contingency Plan, consideration of the following:
  - *(e) eliminating or reducing, to the extent practicable and consistent with response action requirements and objectives, total energy use, air pollutant emissions, greenhouse gases, water use, materials consumption, and ecosystem and water resources impacts resulting from the performance of response actions through energy efficiency, renewable energy use, materials management, waste reduction, land management, and ecosystem protection.*

310 CMR 40.0858
Detailed Evaluation Criteria (for Remedy Selection)

the remedial action alternatives identified by the initial screening shall be evaluated using the following criteria:

- (4) The comparative costs of the alternatives, including:
  - (b) costs of environmental restoration, potential damages to natural resources, including consideration of impacts to surface waters, wetlands, wildlife, fish and shellfish habitat; and
  - *(c) the relative total consumption of energy resources in the implementation and operation of the alternatives, and externalities associated with the use of those resources, including greenhouse gases and other air pollutants.*

"Consideration"

- Contribution to MA Energy and Emissions Mandates
- Reduced Cost
- Corporate Commitment
- Users determine specific cleanup phase/response action for application

Greener Cleanups Guidance (WSC #14 – 150)

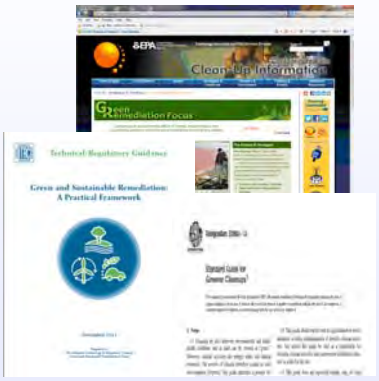
- DRAFT
  - May 2014
- COMMENTS
  - July 2014
- FINAL EFFECTIVE
  - October 2014


Department of Environmental Protection

GREENER CLEANUPS GUIDANCE
WSC #14 – 150

Compliance Through Available Industry Standards & Guidance

- **USEPA, CLU-IN**, Green Remediation Focus (http://cluin.org/greenremediation/)
- **ASTM** International, November 2013, *Standard Guide for Greener Cleanups*, E2893-13
- **ITRC**, November 2011, *Technical/Regulatory Guidance, Green and Sustainable Remediation: A Practical Framework* (GSR-2).



Cleanups Required!

- Actions and remedies must eliminate, mitigate or prevent certain conditions, including an **Imminent Hazard**, a **Condition of Substantial Release Migration**, a **Substantial Hazard** and a **Critical Exposure Pathway**

- Greener cleanup considerations MAY NOT be used to override these or any other MCP requirements.

Time-Critical Situations

- Time-critical situations (e.g., "2-hour" and "72-hour" reportable conditions under the MCP)are likely are not suitable for initial consideration of greener cleanup practices.
- However, once immediate risks and their causes have been addressed, greener cleanup practices should be considered.

MassDEP Recommendation

MassDEP strongly recommends use of the *ASTM Standard Guide for Greener Cleanups* ("the ASTM Guide") (Designation: ASTM E2893-13, November 2013)


Standard Guide for Greener Cleanups

"Best Management Practices"

REQUIRED by Law/Regulation

- *BMPs* that are **required** under federal and/or state law or regulation **should be** implemented and documented

NOT Permissible by Law/Regulation

- BMPs that are **not permissible** under federal and/or state law or regulation **should not be** implemented.

Example A: Excavation and Surface Restoration

- **Asphalt Pavement:** from roads, parking lots, and similar sources
- **Brick and Concrete:** from construction activities and demolition of buildings, roads, bridges, and similar sources

Example A = CONSIDER WHEN APPLICABLE

[Reuse in road construction (reclaimed asphalt pavement)/ Reuse as structural fill]

		Category	BMP	Energy	Air	Water	Materials and Waste	Land and Ecosystems	Excavation and Surface Restoration
YES	6	Materials	Use recycled content (for example, steel made from recycled metals, concrete and/or asphalt from recycled crushed concrete and/or asphalt, respectively, and plastic made from recycled plastic; tarps made with recycled or biobased contents instead of virgin petroleum-based contents)				X		X
YES	9	Materials	Link a deconstruction project with a replacement construction project (for example, the same site of the deconstruction project or a local current construction or renovation project) to facilitate reuse of clean salvaged materials				X		X

Example B: Soil Vapor Mitigation (AEPMM)

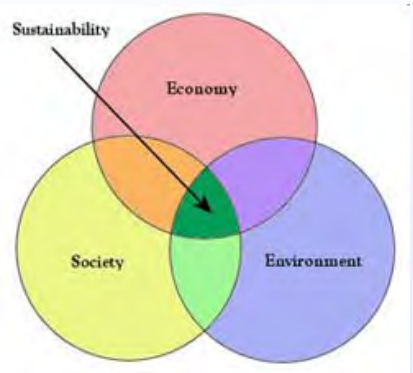
- Use of a Sub-slab Depressurization System (SSDS) to mitigate vapor intrusion when it is being operated as an "**ACTIVE EXPOSURE PATHWAY MITIGATION MEASURE**" (mechanical or electro-mechanical device) ROS, Permanent Solutions with Conditions or Temporary Solutions.

Example B = Permissible & NOT Permissible

		Category	BMP	Energy	Water	Materials and Waste	Land and Ecosystems	Vapor Intrusion Mitigation
YES	6	Power and Fuel	Use on-site generated renewable energy (including but not limited to solar photovoltaic, wind turbines, landfill gas, geothermal, biomass combustion, etc.) to fully or partially provide power otherwise achieved through onsite fuel consumption or use of grid electricity	X				X
YES	9	Power and Fuel	Use solar power pack system for low-power system demands (for example, security lighting, system telemetry)	X				X
NO	19	Power and fuel	Use passive sub-slab depressurization system to mitigate vapor intrusion	X				

Sustainability

- Exceeds the central M.G.L. chapter 21E and MCP mandates of protection of health, safety, public welfare and the environment.
- Is beyond the required MCP considerations.
- BUT, MassDEP encourages sustainable objectives (e.g., Brownfield redevelopments).



INCENTIVES

- Energy Efficiency & Renewable Energy
  - Federal Tax Credits for RE Technology
  - State Grants and Incentives
  - www.DSIRE.org
- MassDEP Public Recognition/Awards for Projects
  - 2015!

Thank You!

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Clean Energy Development Coordinator
MassDEP Bureau of Waste Site Cleanup
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Boston, MA 02108
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Clean Energy Results Program Website:
http://www.mass.gov/eea/agencies/massdep/climate-energy/energy/

Attachment 9
Updates on Green and Sustainable Remediation in the Army and USACE

Updates on GSR in the Army and the USACE

Carol Lee Dona, Ph.D., P.E.
US Army Corps of Engineers,
Environmental and Munitions
Center of Expertise, Omaha, NE

Sustainable Remediation Forum
February 24, 2015

US Army Corps of Engineers
BUILDING STRONG®

Presentation Outline

- DoD/Army/USACE Definitions, Guidance, and Policy
- Army GSR Approach
- Army GSR Application
- Conclusions

Definitions, Guidance, and Policy - DoD

- GSR -using strategies that consider all environmental effects of remedy implementation and operation and incorporating options to maximize the overall environmental benefit of response actions (Department of Defense Instruction (DoDI) 4715_7_May2013)
- DoD Component should consider and implement GSR opportunities when feasible and shall, where practicable based on economic and social benefits and costs, ensure green and sustainable remediation practices… (DoD Manual 4715.20, "Defense Environmental Restoration Program (DERP) Management Manual," March 9, 2012)

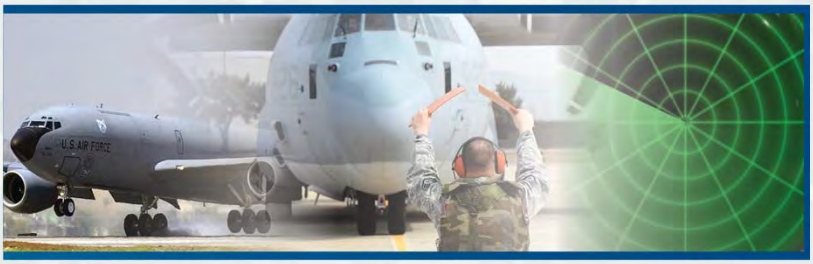
Definitions, Guidance, and Policy – Army/USACE

- Draft Army Defense Environmental Restoration Program (DERP) Manual cites DoD GSR policy as Army policy, Army DERP Manual expected to be finalized mid 2015
- USACE Formerly Used Defense Site (FUDS) program follows DERP (Formerly Used Defense Sites Program Policy, ER 200-3-1)
- In the Fiscal Year 2014-5 Army Environmental Cleanup Strategic Plan
  - Objective 8. Support the development and use of cost-effective cleanup approaches and technologies to improve program efficiency
    - Evaluate GSR approaches when preparing FS/CMS and when reviewing any ongoing RAO/LTM requirements
    - During Program Management Reviews, report on progress of incorporating GSR approaches during the FS, CMS or optimization of remedies during the periodic reviews
    - Goals reflect down to the FUDS Program

Army GSR Approach

- ACSIM GSR Study Report, Appendix A "Detailed Approach for Performing Green and Sustainable Remediation (GSR) Evaluations in Army Environmental Remediation" (Appendix A, Evaluation of Consideration and Incorporation of GSR Practices in Army Environmental Remediation, 27 August 2012 - Final Report)
- Contains list of 63 Best Management Practices (BMPs) organized over 8 remediation activity areas, e.g. Planning, Materials and Off-site Services, etc. (Attachment A-1)
- Contains example contract language for all common FUDS performance-based contract types (Attachment A-2)

Army GSR Application



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

Lockbourne Approach

- Use of BMP list from ACSIM GSR Study Report
- Use of Triad (systematic planning, dynamic work strategies, and real-time measurement systems) processes in designing and implementing field work
- Use of the SiteWise™ quantitative footprinting tool in the FS if required
- Use of flexible language in upcoming decision documents to permit maximum adaptive management in design, construction, and operations
- Financial incentive (up to 4% total contract) for quality of GSR implementation

Lockbourne Performance Based Contract Language

SELECTED PORTIONS FROM EXAMPLE CONTRACT LANGUAGE IN STUDY REPORT – SEE STUDY REPORT FOR FULL LANGUAGE FOR ALL COMMONLY USED CONTRACTS IN FUDS PROGRAM

- Green and Sustainable Remediation (GSR**)** *[Included in scope section ….of work statement.]*
- Compliance with DoD GSR Policy
  "All work performed under this Contract shall comply with: DoD Manual 4715.20 on Defense Environmental Restoration Program (DERP) Management, 9 March 2012."
  "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….."
- GSR BMPs
  "To the extent practical, the Contractor shall consider GSR practices to reduce the environmental footprint of project activities, [reference to the Army approach]….."
- Documentation of GSR
  "All work plans and reports generated by the Contractor in performance of task orders on this contract shall document for the relevant scope of work: the GSR that was considered implemented, and the reasons GSR considered was or was not implemented….."

* Language above is for illustration purposes only – all contract language should be reviewed by your contract specialist and/or legal staff

Lockbourne Contract Incentive

"The Contract will include a performance incentive for the incorporation of GSR…equal to 4% …measured and paid at appropriate milestone intervals…..

The incentive goals are:

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% .....

With weighting of the factors

- Waste minimization/diversion – 0.3
- Energy savings/green energy – 0.1
- Water savings – 0.1
- Other – 0.5

* Language above is for illustration purposes only – all contract language should be reviewed by your contract specialist and/or legal staff

Lockbourne BMP Evaluation

- Contractor set up BMP tracking table using ACSIM GSR Study BMP list that documented BMP evaluation
  - Activity phase
  - BMP number (from BMP list)
  - Task (reports, fieldwork, alternatives-FS)
  - BMP description
  - Evaluation results (applicable and/or practical)
  - Implementation status
  - Value (cost increase, neutral, savings)
  - Notes, which included how BMP was to be implemented, and if BMP not practical, why
- BMP tracking table with BMPs to be implemented in RI Work Plan, BMP tracking table updated for BMPs implemented in RI (Draft) Report

Lockbourne GSR Implementation

- RI completed, implemented 53 GSR BMPs, 26 with significant cost savings
- 60% of BMPs produced cost savings, 30% were cost neutral, and 10% (5 BMPs) were cost increase
- Cost increase BMPs
  - Planning - developing the BMP template, use of GSR expert
  - Land Use, Ecosystems, and Cultural Resources - conducting a habitat study for the presence of the sand piper
- BMPs for FS were identified and will be evaluated for practicality during the FS

Closer look at Lockbourne Cost Increase BMPs

Cost Increase BMPs

- **BMP H-3**: Preserve/restore ecosystems to the extent possible - Conducted habitat assessment to assess the presence or absence of habitat and the presences or absence of the upland sandpiper
- **BMP H-7**: Document sensitive ecological and cultural resources prior to initiating actions that might diminish or destroy those resources –An evaluation of the habitat suitable for the upland sandpiper of AOC 94 indicated that the upland sandpiper is not present in this area

Cost Decrease BMP (no SLERA[1] necessary) - compensates for cost increase BMPs

- **BMP A-11**: Use language in work plans, proposed plans, and decision documents that maximizes flexibility to allow GSR recommendations to be implemented - A habitat assessment was conducted at AOC 94 during the upland sandpiper breeding season to evaluate the presence or absence of habitat and the presence or absence of breeding individuals. Based on results, the potential for risk to ecological receptors was eliminated from further evaluation and a screening-level ERA (SLERA), an option in the RI WP, was determined to be unnecessary
- Flexible language in RI Work Plan allowed real-time optimization of the RI process, e.g. SLERA as an option was not exercised based on the population information

[1] SLERA = Screening Level Ecological Risk Assessment

Conclusions -Army/USACE GSR

- Army/USACE GSR evaluation includes
  - Social and economic as well environmental considerations
  - Good management practices, e.g. flexibility in project direction documents, that allow real-time adjustment to the remedial process
- Most GSR is cost savings or cost neutral
- GSR is looked at as a continual optimization process across the remedial cycle and is represented as a GSR BMP
  - **BMP B-2**: Perform regular optimization evaluations to improve efficiency of current or planned actions and/or develop alternative remedial approaches that might shorten remedy duration or otherwise improve the net environmental benefit of the remedy, including use of any methodologies, such as TRIAD (www.triadcentral.org), systematic planning (technical project planning), value engineering studies, and remedial system evaluations, expected to optimize the planning and/or execution of the project

Acknowledgements

- Josh Van Bogaert and Chris Karem of USACE, Louisville District – developed FUDS performance-based contract language

- Josh Van Bogaert – technical manager, Lockbourne Former AFB AOCs 17/18/19/103 RI/FS, also implementing GSR on Former Raco Missile Base RI/FS

Questions?

Contact

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US Army Corps of Engineers
Environmental and Munitions Center of Expertise
Omaha, NE
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Resources

- Army ACSIM GSR Study Report "Evaluation of Consideration and Incorporation of GSR Practices in Army Environmental Remediation, 27 August 2012 - Final Report" http://www.fedcenter.gov/Documents/index.cfm?id=22322&pge_prg_id=27392
- FY14-5 Army Environmental Cleanup Strategic Plan, November 2013, establishes priorities used by Army Environmental Division, Installation Services Directorate (DAIM-ISE), the Office of the Assistant Chief of Staff for Installation Management (OACSIM), and the Deputy Assistant Secretary of the Army (Environmental, Safety and occupational Health) [DASA(ESOH)]
- Defense Environmental Restoration Program (DERP) Manual, revised 9 March 2012, No. 4715.20 http://www.dtic.mil/whs/directives/corres/pdf/471520m.pdf
- DoDI 4715.7, 21 May 2013, https://dap.dau.mil/policy/Lists/Policy%20Documents/DispForm.aspx?ID=3393.
- SiteWise™ GSR Tool http://www.sustainableremediation.org/tools/
- US Army Corps of Engineers, Engineering Regulation 200-3-1, Formerly Used Defense Site (FUDS) Program Policy, http://www.publications.usace.army.mil/Portals/76/Publications/EngineerRegulations/ER_200-3-1.pdf.

Attachment 10
Striving for Simpler, Consistent LCA of Remediation Activities using LCA Templates

Striving for Simpler, Consistent LCA of Remediation Activities using LCA Templates

February 24 & 25; SURF 28 – Arlington, VA

Todd Krieger – DuPont

in collaboration with AECOM, CH2M Hill, Geosyntec, & Parsons

Purpose & Agenda

- **Describe the Workbooks**
  - Purpose of the project
  - Product of the Project
- **Path Forward for Workbooks**
  - What should be done with them now?
  - How might SURF be involved?

Purpose of the Project

- **Problem Statement**
  - DuPont desires LCA analysis of remedy options to aid in remedy selection and improvement
    - **Impacts beyond just GHG and criteria pollutants, including tracking chemical of concern**
    - **Insight into what is leading to the impacts**
  - LCAs can be complicated; require specific training
  - DuPont employs multiple contractors for remediation work
  - DuPont desires a consistent approach
- **Solution**
  - Identify, develop, and validate LCA template modules for remediation processes, materials, modes of transportation, types of equipment and energy supplies for remedial actions common to DuPont.

Product of the Project

- **Remedies Evaluated**
  - Capping
  - Cut-off Wall
  - Excavation
  - Groundwater extraction, treatment, and reinjection
  - In-situ bioremediation
  - In-situ soil mixing
  - Well drilling processes
- **Tasks**
  - Partners ccollaborated to identify specific tasks required to complete each remedy; noting typical equipment, materials, mobilization requirements, etc. for each task

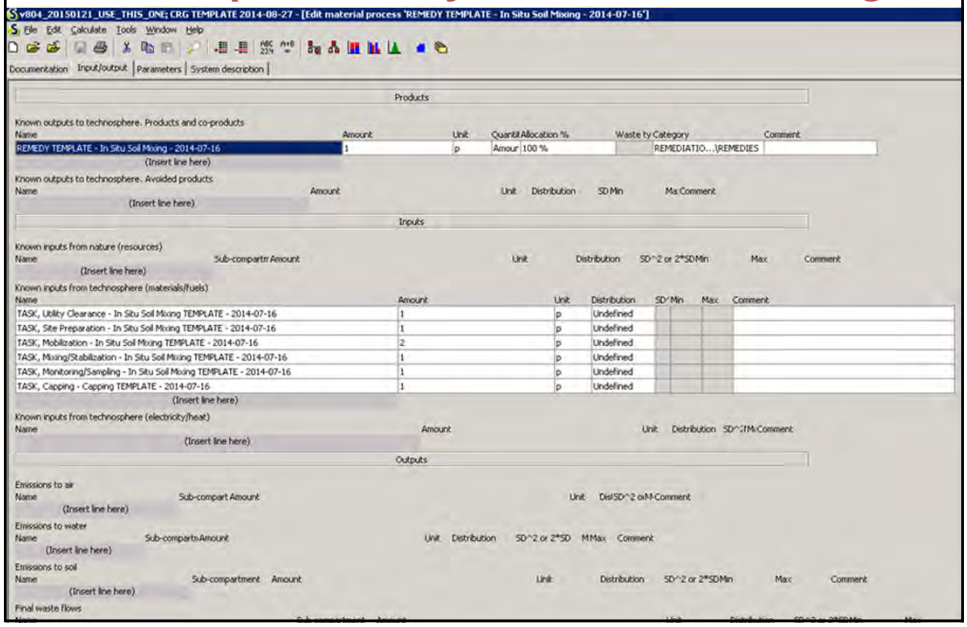
Product of the Project

- **Materials Evaluated & Vetted**
  - Asphalt
  - Bentonite
  - Carbon- GAC, with regeneration or disposal
  - Clay, Gravel, Sand
  - Emulsified Vegetable Oil (via soybean oil)
  - HDPE Pipe, sheet
  - PVC Pipe, sheet
  - Zero Valent Iron
  - Steel (pipe, sheet pile, with & without recovery at EOL)
  - Cement
  - Concrete
- **Fuel Supply Chains Vetted**
  - NG supply chain
  - Diesel & Gasoline supply chain (including biodiesel)
  - Electricity
  - Diesel models built to track on-site use and emissions as well as upstream burdens

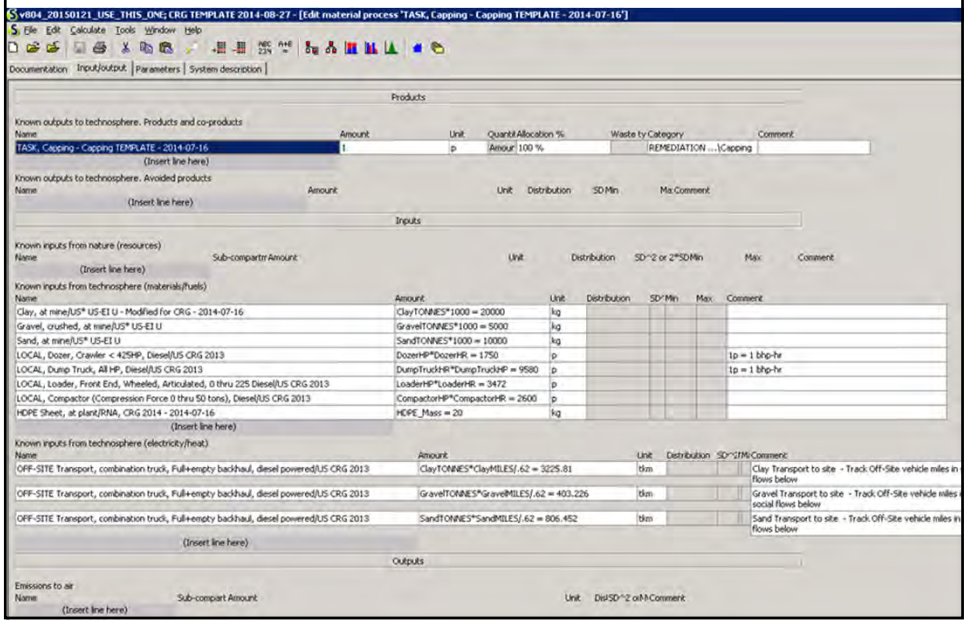
Product of The Project

- **Equipment Evaluated & Vetted**
  - Based on equipment type and horsepower - Backhoe, excavator, compactor, dozer, generator, drills, pumps
    - Horsepower factors and diesel fuel use per bhp-hr per EP1110-1-8 Vol 2, Construction Equipment Ownership and Operating Expense Schedule Nov 30, 2011 Appendix D
  - Track
    - On-site and Off-site hours of operation, miles, fuel use, and emissions
    - Method identified to evaluate alternate fuels (biodiesel)
- **Transportation Chains Vetted**
  - Dump trucks, single unit trucks, combination trucks
  - Track
    - On-site and Off-site hours of operation, miles, fuel use, and emissions
    - Method identified to evaluate alternate fuels (biodiesel)

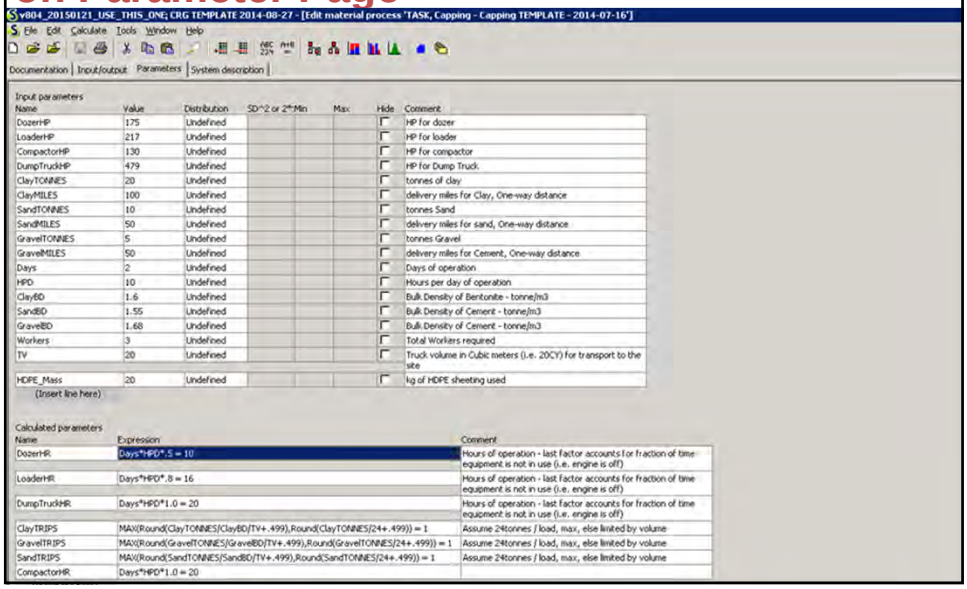
Sample Remedy – In-Situ Soil Mixing



Sample Task – Capping; Input/Output Page



Sample Task – INPUTS REQUIRED on Parameter Page



Value of The Project

- **Simplified Data Entry**
  - Adjust parameter values in each task to match project
- **Consistent Application**
  - Same level of detail in scope – each contractor is not developing its own processes
  - Key materials and fuel selections are consistently made
- **LCA results available with minimal data entry**
  - Can still 'dive' into results & identify where impacts are really occurring
  - Can evaluate both on inventory level (i.e. CO2 emissions, criteria air pollutants, diesel fuel use) AND on impact assessment level
    - Climate Change, Acidification, Eutrophication, Toxicity

What to do with the Product?

- **Desire to Share BUT…**
  - Designed with DuPont in mind
    - We are not interested in marketing or managing
  - Runs on SimaPro LCA software
    - Initial software cost + yearly maintenance costs
    - Training costs and LCA specific knowledge required
  - Uses Earthshift's US EI 2.2 Database & Ecoinvent
    - Background models tied to commercial products
    - Copyright limits transferability

What to do with the Product?

- **Easy Solution (but does not cover everything)**
  - Donate templates to Earthshift to incorporate into their DataSmart! Database
    - Passes management, database development to Earthshift
    - Makes available to anyone, but at the cost of SimaPro & DataSmart!
    - Requires LCA specific training
- **Alternate Solution**
  - Work with Earthshift to develop web-based solution
    - Utilize alternative LCA platform
    - Trade off some depth of analysis for Cost, Simplicity
    - Opportunity to partner with SURF for Development
    - Costs still not 'Free'

SURF Interest / Potential Involvement

- **Let's Discuss**

- This is not a commercial interest for DuPont. If there is no interest in the templates, we will happily use the templates ourselves.
- If interest – DuPont is looking for best way to economically and legally share the results / improve the templates

Questions?

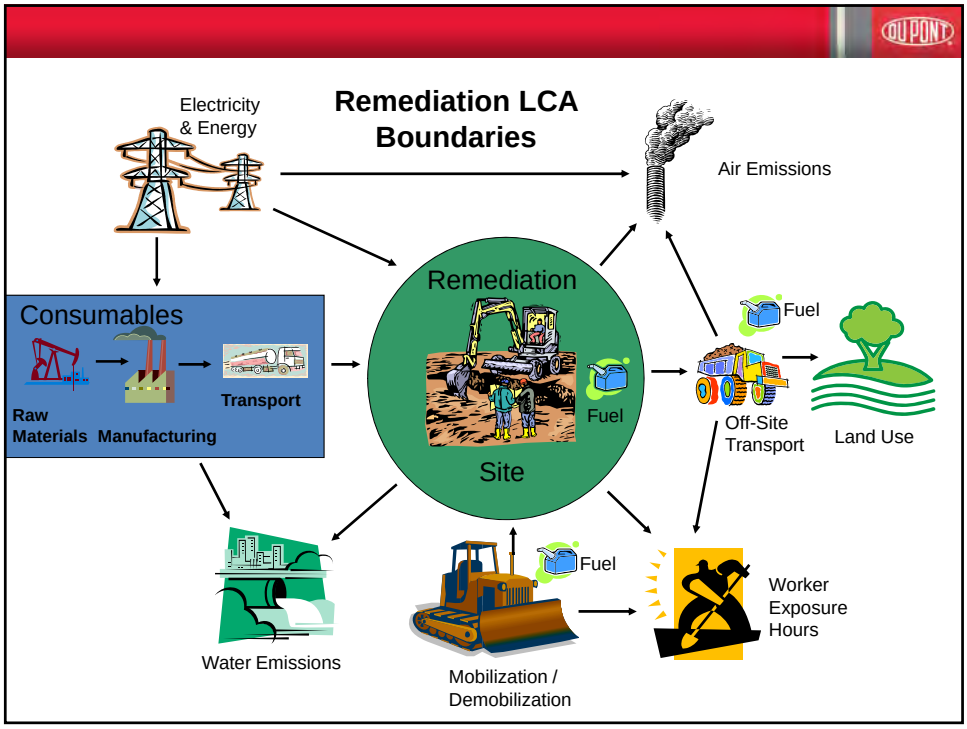
todd.m.krieger@dupont.com

The miracles of science™

Background Slides

ISSUES

- **Existing Tools**
  - **Free / inexpensive and**
  - **Do not require specific LCA training**
  - **Accepted / at least known to regulatory agencies, Remediation Industry**
  - **Less rigor & depth compared to LCA software**
  - **Limited impacts for analysis**



LCA - Application to Remediation

- **Improve Chosen Remedy**
  - Quantify key contributors
  - Identify opportunities for renewable energy uses
  - Select among remediation chemicals / manufacturers
- **Remedy Selection**
  - One Part of Balancing Criteria – Short-term effectiveness
  - Quantify and Identify Key Contributors – Often Consumables / Off-site transportation
- **Which Site should be given priority**
  - More difficult to compare – particularly if contaminant is significantly different

Guidance for Performing Footprint Analyses and Life-Cycle Assessments for the Remediation Industry

- Paul Favara, Todd Krieger, Bob Boughton, Angela Fisher, Mohit Bhargava

The Nine Steps

1. Define the study goals and scope.
2. Define the functional unit.
3. Establish the system boundaries.
4. **Establish the project metrics.**
5. **Compile the project inventory (i.e., inputs and outputs).**
6. **Assess the impacts.**
7. Analyze the sensitivity and uncertainty of the impact assessment results.
8. Interpret the inventory analysis and impact assessment results.
9. Report the study results.

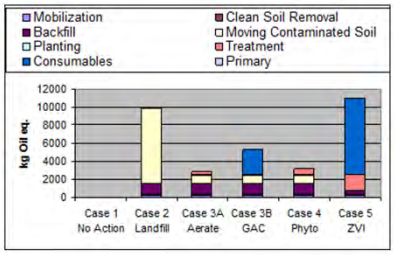
Step 6 – Assess The Impacts – Insight Gained

Built LCA model so relative contributions from different steps can be seen

Early screening performed to help identify where to get more data / extend evaluation

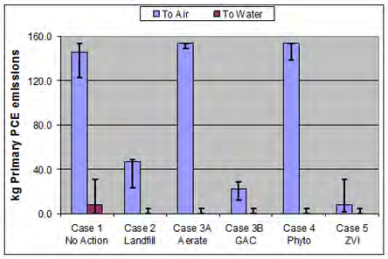
- ZVI mfg shown to be important by trying multiple LCI models for the iron – LCI Model & assumptions for ZVI further evaluated. More data gathered
- GAC mfg important – Use rate uncertainty due to concentration & efficiency
- Xport for Landfill & ZVI shown to be important – Confirm distances / modes of travel. Perform sensitivity analysis. When GAC added to scope, knew xport would be important – get vendor info on logistics as well as GAC use rate
- Backfill operations shown to be non-negligible. Revised ZVI case to in-situ to see differences in potential burdens
- Electricity source assumption for GAC case evaluated – Wind vs. Grid.
- Most impacts shown to follow diesel fuel use (equipment or xport) - Evaluate alternate diesel fuel LCI model - Comparison revealed update needed for some emissions during crude oil production in US LCI model

Fossil Fuel Depletion Potential



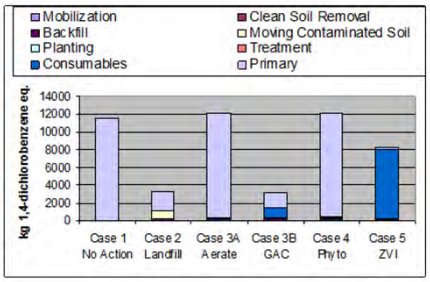
Step 6 - Assess the impacts – Toxic Air Emissions

PCE Emissions

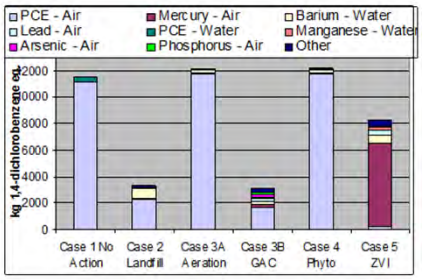


- PCE emissions metric provides local view of impacts (Ranges from uncertainty analysis included)
- HTP provides more global perspective, but 2-3 OM uncertainty in factors
- Beyond PCE - Identify what chemicals contributing from what process steps using LCA output

Human Toxicity Potential – by Process step



Human Toxixcity Potential by Emission

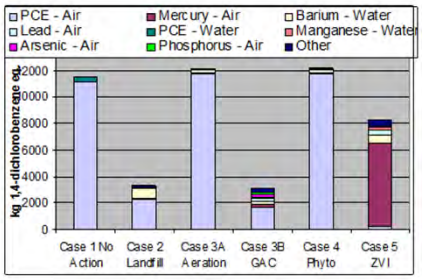


Step 6 – Assess The Impacts – More Insight Gained

Many remediation professionals are uncomfortable with LCA toxicity impact methods – Not representative due to local impacts of primary contaminant

- More work required here to find common ground or compatibility with LCA impact methods and risk-based assessments
- PCE emissions shown to be very important across No Action, Aeration, Phyto cases (Different time frames of emission)
- All cases have potential PCE air emissions during treatment – Some are specifically designed for air emissions of PCE
- Use HTP as screen for other areas of interest
- Emissions from PCE clearly important – but not only contributor to HTP -
  - Crude oil production, diesel fuel refining, diesel fuel combustion, electricity generation, ZVI mfg, GAC mfg lead to emissions of lead, barium, mercury, among others

Human Toxixcity Potential by Emission



Step 8 – Interpret Results / Step 9 Reporting

Sustainability Parameter or Stressor	Units	Case 1 No Action	Case 2 Landfill	Case 3A Aeration	Case 3B Aeration with GAC	Case 4 Phyto	Case 5 In-Situ ZVI
Overall Rating	0 - 3 3 = Highest	0	3	3	3	3	3
Airborne NOx & SOx	kg-SO2-eq	Does not meet threshold criteria	189	79	103	91	196
Greenhouse gas emissions	kg-CO2-eq	Does not meet threshold criteria	28,500	7,700	13,900	10,200	31,000
Airborne particulates/toxic vapors	PM-10-eq	Does not meet threshold criteria	73	32	42	37	91
	PCE-kg		23 - 48	149 - 154	12 - 29	138 - 154	2 - 31
Solid waste production	Cubic Yards	Does not meet threshold criteria	520	0	0	0	0
Soil structure disruption	Cubic Yards	Does not meet threshold criteria	800	800	800	800	800
Traffic, Noise/odor/vibration/ aesthetics	Trips	Does not meet threshold criteria	43	0	3	2	3
	Miles		4700 - 13600	500	1100 - 1600	1,100	1500 - 6300
Land Stagnation	Months	Does not meet threshold criteria	1	3	24	36	1
Petroleum use	kg-fuel	Does not meet threshold criteria	7,200	2,000	2,700	2,200	5,600
Construction materials	Cubic Yards	Does not meet threshold criteria	520	0	0	60	0
Construction materials	Tons		0	0	1	0	60
Land & space	Acres	Does not meet threshold criteria	0.06	0.06	0.06	0.06	0.06

Color Code	Definition
	Lowest impact where there is a difference of significance among options
	No significant difference - or in between the highest and lowest impact options
	Highest impact where there is a significant difference among options.

Step 8 – Interpret Results

- **Trade-offs are evident**
  - Reduce primary contaminant air emissions by increasing waste transport, or increasing raw material consumption (ZVI / GAC)
  - Detailed analysis aids in determining relative importance
  - BUT - Stakeholders ultimately decide relative importance
- **Trends across cases are relatively robust**
  - GAC variability does not change Case 3B's relative position
  - Note: Landfill xport could be much higher if more soil classified as hazardous, but ZVI transport has more potential downside with local sourcing
- **All cases have limited potential impacts**
  - Differences in cases are evident, but magnitude of impacts not significant enough to be key driver for remedy selection
  - Once remedy selected, key aspects can be targeted for further impact reduction

Attachment 11
Humic Acid: A Sustainable Solution for Detoxifying Wastewater

Savannah River National Laboratory™
OPERATED BY SAVANNAH RIVER NUCLEAR SOLUTIONS

We put science to work.™

Humic Acid– A Sustainable Solution for Detoxifying Wastewater

Ralph L. Nichols
Senior Fellow Engineer

SuRF 28
Arlington, VA
February 24, 2015

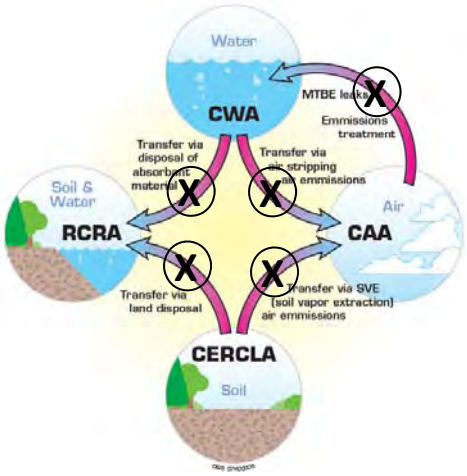
Savannah River NUCLEAR SOLUTIONS
FLUOR • NEWPORT NEWS NUCLEAR • HONEYWELL

"Success and failure in environmental problem solving is often determined by the way a problem is formulated and discussed in public discourse."

B. G. Norton, *Sustainability*

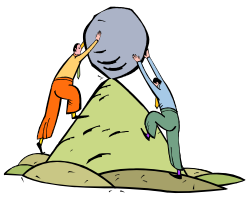
Savannah River National Laboratory™
We put science to work.™

Risk Transfers



Remediation vs Sustainability

- Remediation Goals
  - Drinking Water Standards
  - Containment
  - Mass removal
  - Reduce flux
  - Reduce risk
- Remediation Metrics
  - Concentrations
  - $ / lb
  - $ / cubic yd
  - $ / 1000 gal
  - $ / yr
- Sustainability Goals
  - Preserve natural resources
  - Minimize energy use
  - Minimize CO2 emissions
  - Maximize recycle / reuse
  - Minimize footprint
- Sustainability Metrics
  - lb / Kwhr
  - lb / lb CO2
  - lb / 1000 gallon
  - lb / cubic yard



Biotic Ligands

- 1973, evidence that free metal ion played a stronger role in determining toxicity than total metal concentration published by Zitko *et.al.*
  - Ca, Mg compete with metals at binding sites, 1976
- 1983, a chemical equilibrium model (GISM) was published by Pagenkopf *et.al*. explaining how water chemistry controls the form of metal present and how that is related to the metal's toxicity

$$Cu^{2+} + \equiv S^{n-} \overset{K_{Cu}}{\rightleftharpoons} \equiv SCu^{-n+2}$$

Gill Surface Interaction Model (GISM)

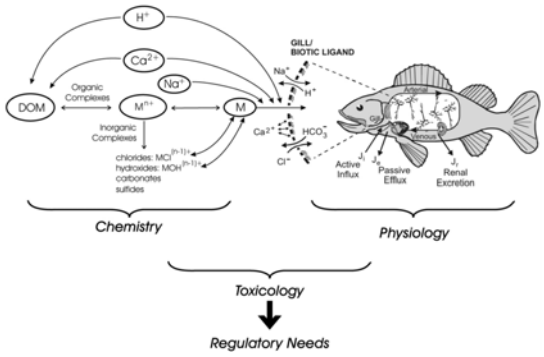
$$S_T = \equiv S^{n-} + \equiv S(M)^{n+2} + \equiv S(H)^{-n+1} + \equiv S(TM)$$

V. Zitko, W.V. Carson, W.G. Carson. Prediction of incipient lethal levels of copper to juvenile Atlantic salmon in the presence of humic acid by cupric electrode. Bull. Environ. Contam. Toxicol., 10 (1973), pp. 265–271

Pagenkopf, G.K. (1983). "Gill Surface Interaction Model for Trace-Metal Toxicity to Fishes: Role of Complexation, pH and Water Hardness.". Environmental Science and Technology 17: 342–347.

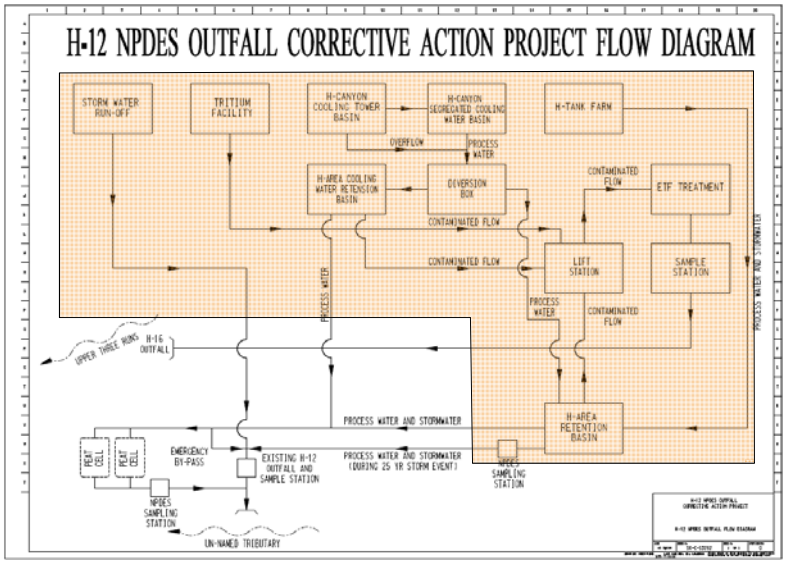
Biotic Ligands

- 2007, EPA accepts use of Biotic Ligand Model for specific freshwater WQC.
  - Replace EPA 1986 Hardness WQC for Cu



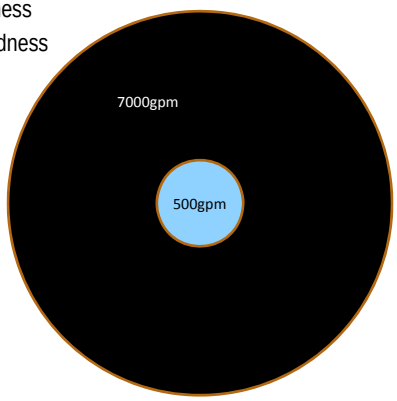
P. R. Paquin et.al., *The biotic ligand model: a historical overview*. Comparative Biochemistry and Physiology Part C 133 (2002) 3–35.

Case Study



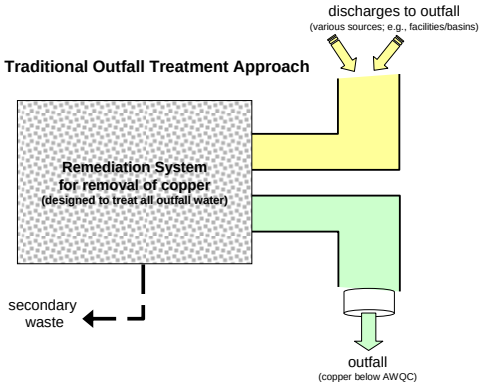
Case Study

- NPDES outfall
  - 500 to 7000 gpm
  - Copper limit reduced from 25 µg/L to 6 µg/L
    - AWQC, calculated using hardness
    - Wastewater discharge low hardness

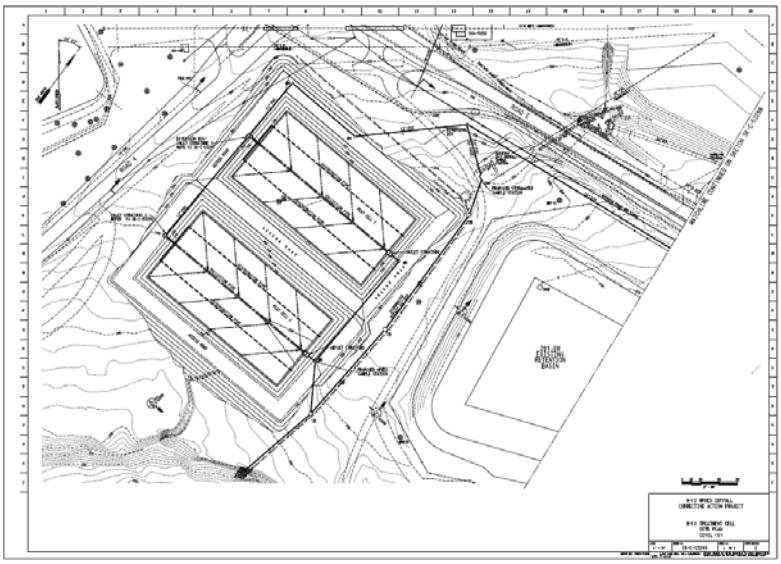


Treatment options

- Traditional
  - *Construct treatment system to reduce copper to acceptable levels*
    - Ion exchange
    - Peat beds



Peat Beds



Thinking differently

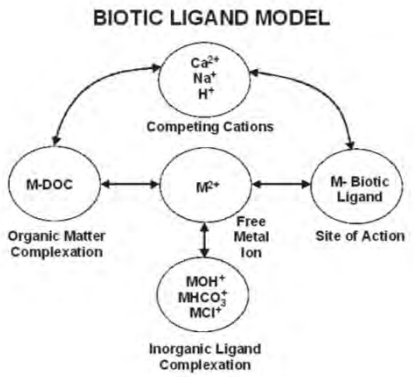
- What is the objective of the NPDES
  - Protect receiving ecosystem and human health
- Biotic Ligand Model developed for copper
  - Fish gills identified as receptor
  - Criteria calculated using geochemical model
  - Several water quality indicators used as inputs

Thinking differently

- Alternative
  - *Review objective*
    - Protect ecosystem
  - Can objective be met differently?
    - Prevent copper from sorbing to fish gill
  - Detoxify copper
    - Make copper unavailable for biological uptake

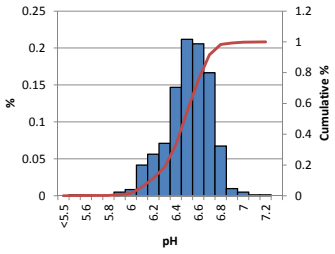
Back to the Biotic Ligand Model

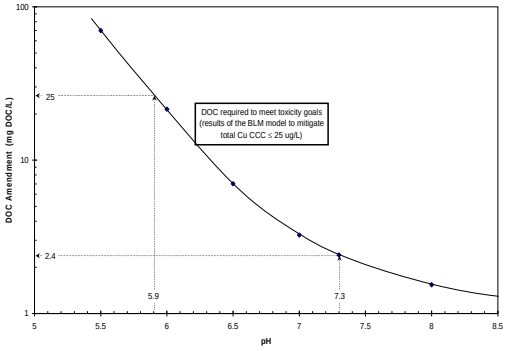
- Inputs
  - Temperature
  - pH
  - Alkalinity
  - Dissolved organic carbon
    - Humic acid content
  - Ca, Mg, Na, and K
  - SO4, S, and Cl
- Outputs
  - Copper speciation
  - Site-specific criteria



Dissolved Organic Carbon Addition

- Use BLM to identify primary site specific parameters controlling criteria
  - DOC and pH
  - HydroQual, Inc. Ver 2.1.2

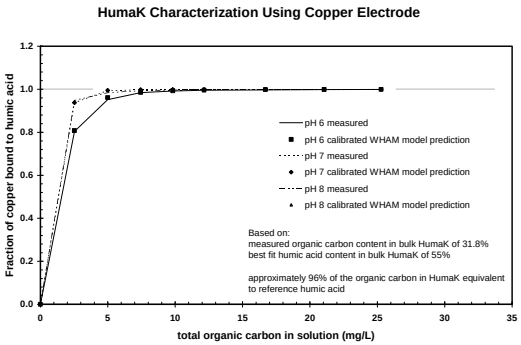




This is not a product endorsement, Trade name included for information purposes only

Dissolved Organic Carbon Addition

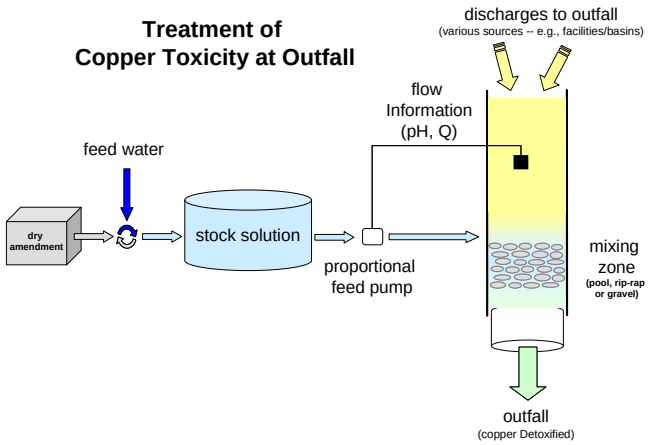
- Lab test to confirm decrease in free copper
  - Humic acid titration
    - Huma K, water soluble powder containing humic acid
    - Leonardite, compressed plant organic mater



This is not a product endorsement, Trade name included for information purposes only

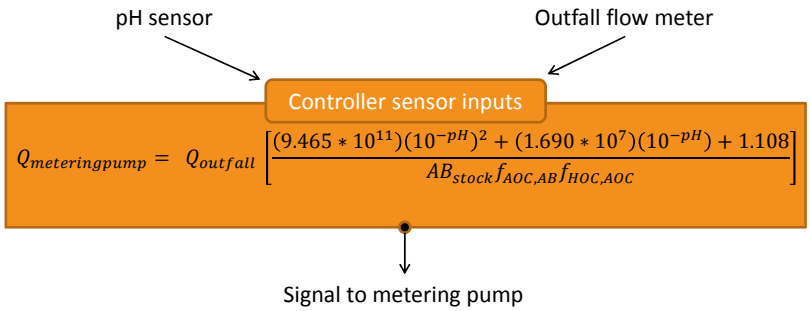
Dissolved Organic Carbon Addition

- Conceptual model



Dissolved Organic Carbon Addition

– Conceptual model
  - Programmable logic controller

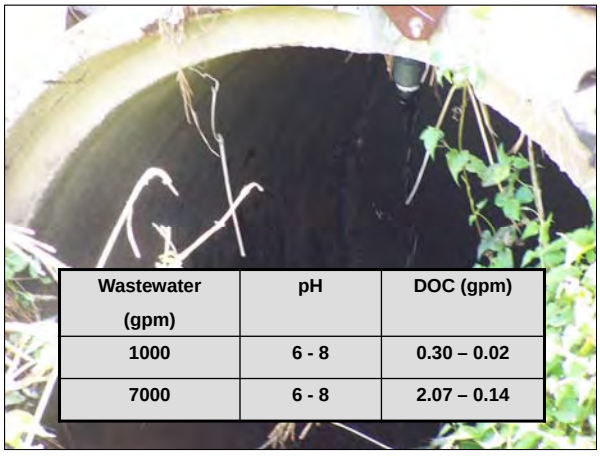


$AB_{stock} f_{AOC,AB} f_{HOC,AOC}$

Data from laboratory

Dissolved Organic Carbon Addition

– Installed system

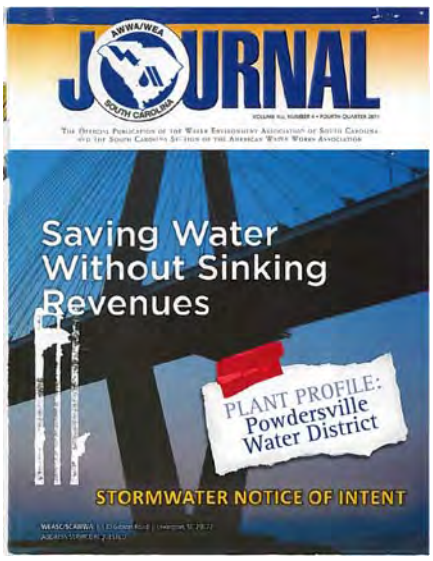


Wastewater (gpm)	pH	DOC (gpm)
1000	6 - 8	0.30 – 0.02
7000	6 - 8	2.07 – 0.14

Dissolved Organic Carbon Addition

– Installed system

Success



Summary

- New science (BLM) created need for improved wastewater management
- BLM provided solution
  - Addition of natural organic matter, humic acid
  - Metered addition based on actual need
  - "Treated" water chemistry much closer to prevailing chemical conditions in receiving ecosystem than alternatives
- Detoxification of copper by humic acid addition approved by SCDHEC

Thank you

- Questions

ralph.nichols@srnl.doe.gov
(803)725-5228

Copper

- Essential element part of enzymes and glycoprotiens
  - Promotes Fe adsorption
  - Maintains myelin in nervous system
  - Bone and brain tissue formation
- Fish toxicity
  - Gill surfaces form complexes with free copper sorbs to fish gills
  - Altered fish gill function results in resulting in respiratory failure

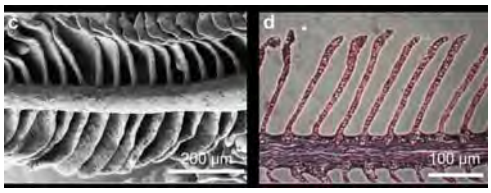


Photo: Keunhwan Parka, Wonjung Kimb, and Ho-Young Kima. *Optimal lamellar arrangement in fish gills*. PNAS (2014), vol. 111 no. 22

Attachment 12
Green and Sustainable Remediation Practice at Navy Sites

GSR Practice at Navy Sites

Kim Parker Brown, MS, PE
NAVFAC HQ

February 2015
Crystal City, VA

Navy's GSR Approach

Implemented as part of the Department of the Navy's (DON's) existing optimization program

Considers GSR throughout all phases of remediation

Incorporates options to maximize the overall environmental benefit of environmental response actions

Navy GSR Guidance

- GSR Metrics (Section 2.0)
- Metric Calculation Methods and Tools (Section 3.0)
- GSR during Site Characterization (Section 4.0)
- GSR during Remedy Selection (Section 5.0)
- GSR during Remedial Design and Construction (Section 6.0)
- GSR during Remedial Action – Operation (RA-O) and Long Term Management (LTMgt) (Section 7.0)
- General Footprint Reduction Methods (Section 8.0)

Navy GSR Metrics

NAVFAC GSR Metrics

- Energy Consumption
- GHG Emissions
- Criteria Pollutant Emissions
- Water Impacts
- Resource Consumption
- Worker Safety
- Ecological Impacts
- Community Impacts

SiteWise™ GSR Tool

- **SiteWise™ developed jointly by Battelle, Navy, and Army Corps of Engineers (USACE)**
- **Series of Excel™ spreadsheets to calculate the environmental footprint of remediation in terms of sustainability metrics**
- **User-friendly *streamlined life-cycle analysis (LCA)***
  - **Considers *life-cycle impacts* from remedial actions**
- **Version 3 released to public in June 2014**
- **Posted to the NAVFAC GSR Portal**
  - **SiteWise™ is being applied industry wide: Navy, Army, USACE, U.S. EPA, State regulators, and private industry**

Navy Case Study Review

A total of 60 GSR case studies were identified across NAVFAC

- 32 case studies had readily available project documentation

32 case studies were used to track trends in GSR implementation

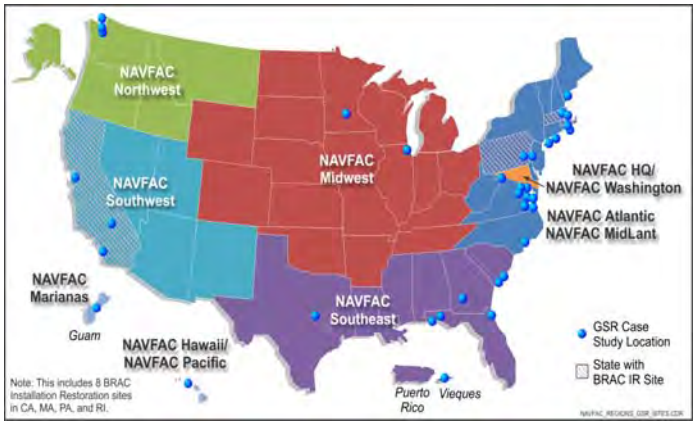
- 90% of the case studies calculated the primary metrics for GSR
- 72% identified specific footprint reduction measures

Among those sites where a remedy was selected

- 84% resulted in the selection of the lowest footprint remedy
- 69% resulted in the selection of the lowest cost remedy

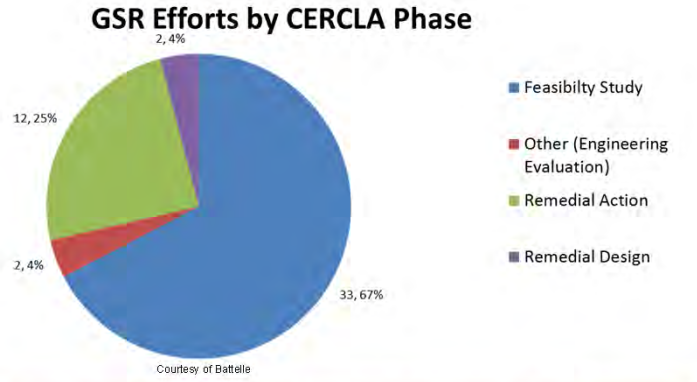
Full details available: Green and Sustainable Remediation Practices at NAVFAC Environmental Restoration Sites - A Review (June 2014)

Case Study Review: GSR Case Study Locations



Courtesy of Battelle

Case Study Review: Project Phase



Courtesy of Battelle

Majority of the GSR evaluations collected were performed at the Feasibility Study (FS) phase – 67%

Case Study Review: Top 10 Best Management Practices

Footprint Reduction Recommendation (BMP)	Number of Times BMPs Featured in Case Studies
Material and waste minimization	23
Optimized equipment use	17
Emission control measures	14
Optimized transportation	14
Alternative fuels	14
Monitoring program optimization	13
Alternate material use	12
Remedy optimization	10
Renewable energy	7
Optimized water consumption	4

NAVFAC GSR Resources

Visit our Web page at:
https://www.navfac.navy.mil/go/erb

Questions?

Attachment 13
The Boeing Company: Sustainable Remediation Program Overview

Engineering, Operations & Technology
Environment, Health & Safety

Sustainable Remediation

Overview & Guidelines for Implementation

EHS Remediation

January 2015 Update

Boeing Environmental Strategy

Be the most environmentally progressive aerospace company.

Focus

- **Design in** Environmental Performance
- Innovate for **sustainable** operations
- Inspire Global **Collaboration**

Performance Measures

- Energy and Emissions
- Materials and Waste
- Community
- Water

Building a better planet

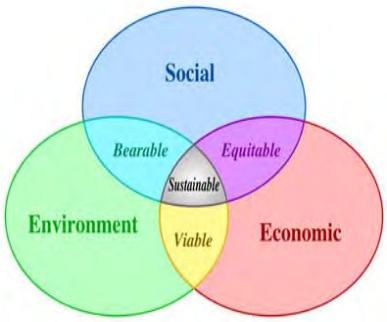
Sustainable Remediation

Protecting human health and the environment while maximizing the environmental, social and economic benefits throughout the remediation project life cycle.

(Sustainable Remediation Forum, 2013)

Tenants

- Compliance
- Environmental footprint reduction
- Project life cycle integration
- Partnering with all stakeholders
- Public awareness
- Safety
- Risk management
- Return on Investment (ROI)



Increasing the environmental, economical and social benefits of site cleanups.

Goals

- Incorporate options to minimize the environmental footprint of remedy implementation.
- Reduce the demand on the environment and natural resources during cleanup.
- Integrate sustainable practices throughout the life cycle of a remediation project.
- Achieve remedial action goals and comply with environmental regulations.

Value Proposition

Alignment with corporate environmental goals

- Reduce our environmental footprint in a timely and protective manner
- Increase our social responsibility & community involvement

Innovation & Collaboration

- Provide a forum for various stakeholders — industry, government agencies, environmental groups, consultants and academia — to collaborate, educate, advance and develop consensus on the application of sustainability concepts throughout the lifecycle of remediation projects.

Success

Partnering with Boeing business units, regulatory agencies, the public and other stakeholders to identify environmental, land use and economic goals in all phases of remediation projects (investigation to closure).

Strategies

EHS Remediation will partner with Boeing business units, regulatory agencies, the public and other stakeholders to develop sustainable remediation alternatives.

- Reduce resource, total pollutant and waste burdens on the environment
  - Reduce air emissions and greenhouse gas production
  - Minimize impacts on water quality and water cycles
  - Conserve natural resources and use energy efficiently
  - Minimize degradation or enhance ecology of affected areas
- Achieve greater long-term return on investment
  - Support the use and reuse of remediated parcels
  - Increase operational efficiencies of the remediation activity
  - Stay abreast of policy, technology and industry standards associated with sustainable practices

Responsibility & Implementation Guidelines

EHS Remediation will work with contractors, agencies and stakeholders to gain appreciation and acceptance of sustainable remediation practices to reduce the environmental footprint of cleanup while protecting human health and the environment.

Consider and incorporate sustainable remediation practices and principles throughout a project life cycle:

- Project management plans
- Site investigation
- Remedy selection
- Construction, operation and maintenance
- Public participation
- Site closure

Core Elements of Sustainable Remediation

Energy	Air	Water	Land & Ecosystem	Materials & Waste
Promote efficiency & renewable sources	Reduce vehicle & system emissions	Reduce, reuse & protect	Minimize harm; foster ecological, economic or social use	Reduce, reuse, recycle; use alternative products
				

Environmental	Economic	Social
Compliance; qualitative goals & targets	*Lifecycle cost; return on investment*	*Equity, community, health & safety and aesthetics*

Embedding Sustainable Remediation into all aspects of cleanup projects.

Energy

Goal: Energy efficiency & renewable sources

Nevada Field Lab

- Solar panels reduce overall power consumption for treatment system and well pumps

Rancho Cordova

- Groundwater extraction well pump control panel cooled by well water, eliminating the need for air conditioning

Air

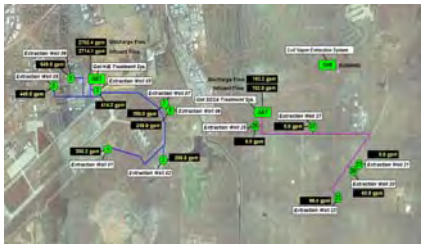
Goal: Reduce vehicle air emissions

Remote controls

- Reduce manpower and travel for system operations and maintenance

Example sites include:

- Nevada Field Lab
- Western Processing
- Rancho Cordova
- Everett Powder Mill Gulch



Water

Goal: Reduce, reuse & protect

Huntington Beach groundwater remediation system

- Reuse approx. 40,000 gallons per day for facility cooling tower operations and irrigation
- 20M gallons reused to-date
- Received 2013 Conservation Award

Fresno groundwater remediation system

- Treated supply water is reused by municipality
- Reuse approx. 1.7M gallons per day

Land & Ecosystem

Goal: Minimize harm and foster return to "natural" ecological state

Santa Susana bioswale

- Use of native plants to mitigate stormwater runoff issues
- Designed to blend into natural surroundings

Chemical Commodities, Inc.

- Restored with native prairie grasses and pollinator habitat
- Received Leading Environmentalism & Forwarding Sustainability (LEAFS) award from EPA Region 7

Waste to landfill

Goal: Reduce, reuse and purchase environmentally preferred products

Spent Carbon Regeneration

- Recycling facilities regenerate spent carbon for reuse

Everett

- Former Gun Club: Over 28,000 tons or **39%** of total non-hazardous soil recycled
- BOMARC site: Over 5,000 tons or **96%** of total non-hazardous soil recycled

Additional Resources

Sustainable Remediation Forum (SURF)

www.sustainableremediation.org

- 100+ member non-profit organization including Boeing, GE, Dupont, Shell, BP, Chevron, consultants, academics, government agencies
- Int'l chapters in Canada, UK, Italy, Brazil, Taiwan, Australia, New Zealand

EPA Green Remediation

http://cluin.org/greenremediation/

ASTM

http://www.astm.org/search/fullsite-search.html?query=Green+and+sustainable+remediation&cartname=mystore TM

ITRC

http://www.itrcweb.org/Team/Public?teamID=7

Attachment 14
Starting with the End in Mind: A Sustainable Approach to Site Cleanup and Reuse

Starting with the End in Mind: A Sustainable Approach to Site Cleanup and Reuse

Russell Downey
Pfizer Global Engineering
24 February 2015

General Principles

- Plan with the end in mind
- ***Identify and engage appropriate Stakeholders early in the process***
- Consider carbon footprint and sustainability in technology screening and remedy selection
- 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 nature

Sustainability Considerations

- Climate change and regional implications of remedy and reuse decisions must consider future projected sea-level rise, precipitation trends, and erosional energy forces
- Where appropriate, seek minimal loss of flood storativity when adjacent to waterways
- Conserve/create habitats worthy of preservation / restoration within regional ecological context

Sustainability Considerations (Cont.)

- Optimize groundwater extraction and treatment to reduce energy consumption and depletion of aquifer levels
  - Use hydraulic barrier controls (e.g. caps, cut-off walls)
  - Consider reinjection of treated groundwater instead of discharge to surface water
- Minimize transportation energy needs and conserve scare offsite clean fill resources and offsite landfill capacity by smartly using recycled materials and local labor/suppliers
- When grading and contouring onsite areas for capping, utilize onsite clean and low-impact recycled concrete, redistributed soil, and other recycled materials and preserve offsite green-fields as fill borrow sources

Pharmacia & Upjohn Company LLC Site

North Haven, CT

- 140 years of industrial uses
- Located adjacent to a river
- Onsite stockpiling of wastewater sludges
- Soil and groundwater are impacted

Community Participation With and Without Stakeholders Engaged

Pre-2003

- No future vision for property beyond remedy
- Remedy and reuse designs are decoupled
- Engagement between responsible party and agencies
- Little local participation
- Result: Negative Press, Adversarial Relationships and Little Progress

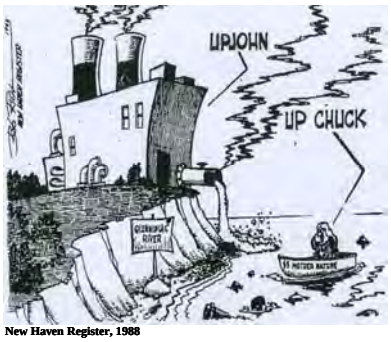
Post-2003

- Vision for property considers eco-transition zone between river & commercial zone
- 17-acres near rail / road access for development
- Engagement inclusive of Town, Citizen Advisory Panel, local commissions
- Sought reuse ideas from economic/enviro groups
- Result: Full support of remedy and Much Progress

Media Attention – Then

Lieberman targets Upjohn for continued violations

April 6, 1988 · THE NORTH HAVEN POST



New Haven Register, 1988

Upjohn cleanup vowed but many are skeptical

New Haven Register AUGUST 25, 1988

Documents pile up against sludge heap at Upjohn Co.

New Haven Register, Monday, December 5, 1988

North Haven Project Goals

- To implement a remediation program that is protective of human health and the environment
- To promote that site remediation activities facilitate reuse and redevelopment of portions of the property
- To preserve and enhance the ecological assets of the property in a manner that creates value in the Quinnipiac River regional ecosystem
- To position the property as an asset to North Haven and the Quinnipiac River region

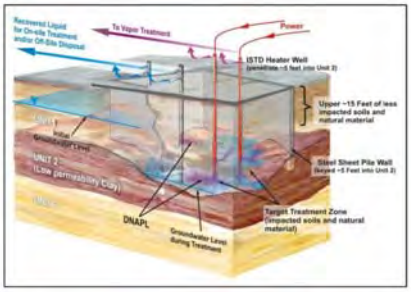
Community Outreach Approach

- 2003 - Pfizer Inc acquired Pharmacia Corporation, parent company of Pharmacia & Upjohn Company LLC
- Share Future Vision Alternatives with Stakeholders (business, recreational, educational, environmental, regulatory & local government) – “Begin with the End in Mind”
- Demonstrate that the preferred remedy is compatible with future land use
- Creation of video for consistent presentation
- Promote Interactive Meetings, Fact Sheets, Newspaper Articles, Open Houses , and Website (www.upjohnnorthhaven.com)

Sustainability in the Feasibility Study Phase

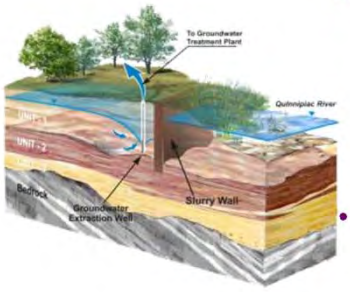
Considered sustainability in the feasibility study and remedy selection process

- Overall chemical mass removal
- Nuisances to community
- Compare carbon footprint of technologies and long-term O&M
- Use resources efficiently with focus on sustainability
- Beneficial reuse of Site
- Public support for remedy



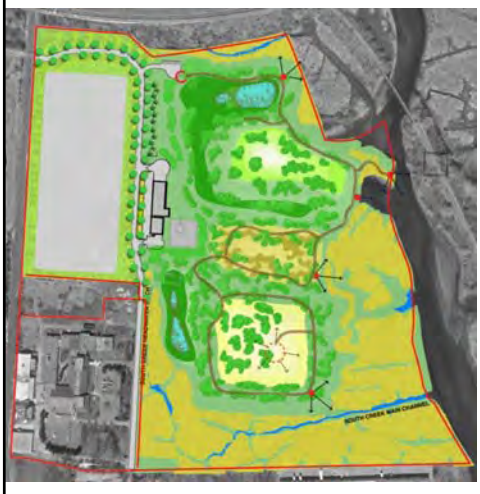
Green Best Management Practices

- Additional BMPs during remedy implementation
  - Managed drill cutting, sediment, and excess soil under on-site caps, rather than off-site disposal



- Used ground granulated blast furnace slag – a repurposed manufacturing byproduct - for hydraulic barrier wall construction; avoiding the use of bentonite, a natural resource
- The subsurface cutoff wall component reduced long-term groundwater extraction rates by 50%

Economic Green BMPs



Economic BMPs

- Local buying commitment
- Local job creation
- Market based and stakeholder driven re-use planning process
- Redevelopment opportunities

Sustainability in Reuse Plan

- 60 acre ecological restoration
  - Re-established lost habitat
  - Creation of on-site wetlands
  - Selected re-vegetation requires minimal mowing
- 17-acres designated for economic development

Media Attention – Now

Old Upjohn site gets attenion; Pfizer speaks

The North Haven Citizen Friday, July 7, 2006

Pfizer Steps Up

Residents will Soon Have Say on Cleanup

North Haven Courier, July 6, 2006

Pfizer updates residents on cleanup

New Haven Register, June 30, 2006

North Haven Citizen, July 7, 2006

EPA Recognition of Achievements

USEPA Citizen Award

Citizens' Advisory Panel

- David Monz, Chairman
- Annette Gattilia*
- Rico Gattilia
- Miriam Brody
- Hugh Davis
- Joelle Innocenti
- Tom Roberts

- Annette worked tirelessly from late 1970's until her recent death (April 28, 2014) to effect the Site remedy. She will be missed but her legacy will live on.

Questions ???

END

Community Engagement Philosophy

- "Starting with the End in Mind: A Sustainable Approach to Site Cleanup and Reuse"

- The presentation will focus on Pfizer's commitment to one of its key values (i.e. Respect for Society) by remediating those complex legacy sites in its remediation portfolio that involve wide-spread community interest through sustainable means and methods. Listening to concerns and soliciting feedback from stakeholders is essential to USEPA and state agency selection of a sustainable remediation approach that the community will accept as being safe, supportive of the community (if practicable) and protective of human-health and the environment while being compatible with future desirable land-use. With the end land-use in mind and working closely with community and local, state, and federal stakeholders, Pfizer has established an approach for implementing best practices in sustainable remediation and restoration as well as long-term operations, maintenance and monitoring. This brief presentation will include guiding principles, best practices, and site-specific examples in both Superfund and RCRA.

Attachment 15
Summary of Input from Breakout Sessions 1 and 2

What We Heard: SURF 27

Propelling forces:

mature and growing recognition

interdisciplinary

small but passionate workforce

SR can save $

builds on success of brownfields

alignment w/ corporate sustainability

fundamental and positive improvement in remediation practice

subject matter experts

inclusive and collaborative

innovative

Restraining forces:

misperception that SR is fluff, excuse for doing less

momentum difficult to maintain

"punish the polluter" mindset

limited resources (time, $, people)

competing voices (ASTM, EPA, ITRC)

ongoing GR vs SR confusion

no mandate

inadequate demonstration of value

lack convincing story for RPs

no academic curriculum

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What We Heard: SURF 28 Day 1

- There is likely a relationship between state /local adaptation plans and remediation projects
- It's local, it's global; it's an optimization issue, it's a cost issue
- Need more recognition of successful SR projects: case studies, awards
- Need to build public-private partnerships to achieve economic/ redevelopment goals
- Need consensus on important social and economic metrics
- Need to educate the masses; SR practitioners are a small group
- Need a simple/succinct story: branding, PR, and advertisement
- Need champions and enthusiasm
- Policies, tools, and references are all important to the education process; however, we might already have all the policy and tools we need (may need tweaks to improve)

Moving Forward: SURF 28 Day 2

Connecting the Dots: Telling the Sustainable Remediation Story

1. ***Why would someone pay/allow/require us to do SR over the status quo?***
2. ***What are we assuming about the general remediation-practicing public that might not be true, and how do we better educate them?***
3. ***How do we get more RPs and consultants to practice SR?***

Focus on SR in general, its value, and the real and perceived root causes for the challenges facing its growth and forward movement:

- *Why do some of us embrace SR and some don't even know what GR and SR are?*
- *Why do some RPs accept/encourage SR and some are opposed?*
- *What is truly unique and important about SR?*

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Connecting the Dots: Telling the Sustainable Remediation Story

Why would someone pay/allow/require us to do SR over the status quo?

Executive order/mandate
Pushed down in DOD (lip service)
Corporate commitment, reporting requirements
Requirement to document compliance
Saves money; lower life-cycle costs
Alignment w/ corp. sustainability goals, mission
We are already doing it
Minimizes waste stream
Want to be a good env. steward, corp. citizen
Reduce long-term liability
Better way, probably a better outcome
Positive PR, brand protection
License to operate
Social benefits
Public expectations, pressure
Regulation requires it
Opportunities for synergy/innovation
Personal commitment to sustainability
Marginal upfront cost
All parties look good
Opportunity to establish a dialogue with the community
Leaving value for a community
Footprint reduction
Something to trade w/ community, regulators in negotiations

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Connecting the Dots: Telling the Sustainable Remediation Story

Why would someone pay/allow/require us to do SR over the status quo?

…continued…

Helps to change the discussion

Provides an entry point to the topic of trade-offs

Allows RPs to be transparent, contrite

It's an innovation bandwagon

It's positive, legitimate, sincere

Reframes the decision-making criteria

May lead to site closure

It's an approach, not a technology

Renewable energy, redevelopment tax credits

Leads to better decisions by looking at the complete picture

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SUSTAINABLE REMEDIATION FORUM

Connecting the Dots: Telling the Sustainable Remediation Story

What are we assuming about the general remediation-practicing public that might not be true, and how do we better educate them?

Assumptions:

Consultants, RPs –

Have a fundamental lack of understanding

Are not interested, not curious

Are recalcitrant

Have a fear of new/unknown

Think regulators don't want/like it

Don't know anything about sustainability

Have different priorities

(RPs) mistrust consultants

(RPs) make presumptive remedy selections

(Regulators) only want to "check the box"

SR –

Trying to change cleanup standards

Will interfere w/ schedule, take longer

Better technologies cost more

It's greenwashing

It's insignificant at small sites

Might reopen ROD

It's inconsistent, poorly defined

Not better, not cheaper, not faster

SR ≠ Facilities

Is anything different than good engineering

Is about removing less, leaving more

SURF
SUSTAINABLE REMEDIATION FORUM

Connecting the Dots: Telling the Sustainable Remediation Story

What are we assuming about the general remediation-practicing public that might not be true, and how do we better educate them?

Educate by:

Doing it

Don't call it SR; labels are limiting

Get away from terminology, buzzwords

Focus on the message

Explain how SR fits into the regs

Promote ITRC guidance

Clear messaging

Use analogies: MNA, value engineering

In-house training

Webinars that qualify for CEUs

Conference presentations

Demonstrate that it's good business

Demonstrate that SR ≠ pollution prevention, emissions reduction, BMPs, "reduce, reuse, recycle"

Demonstrate that SR ≠ GR

Frame as part of an optimization, efficiency discussion

Show what a "gold standard" SR project looks like

Get more people to SURF meetings

Connecting the Dots: Telling the Sustainable Remediation Story

How do we get more RPs and consultants to practice SR?

- Attend conferences with clients rather than consultants
- Continued education and training
- Mandatory requirements and incentives in contract language
- Case studies
- Unrelenting evangelism
- Demonstrate that natural habitat has $ value
- University outreach
- Regulatory acceptance, guidance, enforcement
- Value proposition
- Identify champions
- RPs to require or incentivize consultants
- Present at other associations
- Benchmark SR projects
- Do it anyway; use scaled approach (ease into it)
- Lead by example
- Provide templates
- Tie to safety
- Get more SURF members
- Recognition, awards
- Spur competition
- Shame: “waste less than your neighbor”, “don’t be the bad guy”
- Show RPMs that they can close more sites
- Reframe as SAFE remediation (**S**ocially responsible, **A**gency compliant, **F**ootprint reducing, and **E**conomically efficient)

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Moving Forward: SURF 28 Day 2

Spotlight on SURF: Lights, Camera, Action!

1. ***What can SURF do that no other professional organization can/will do?***
2. ***What can SURF do to build on our recent successes and/or current activities?***
3. ***What should SURF be doing NOW (in 2015)?***

Discussion is focused on SURF, its value, and feasible ACTIONS that capitalize on SR's value and means and methods to overcome its challenges:

- *SURF meetings and technical conferences*
- *Publications and other written/online communications*
- *Government and academic outreach*

SURF
SUSTAINABLE REMEDIATION FORUM

Spotlight on SURF: Lights, Camera, Action!

What can SURF do that no other professional organization can/will do?

We are the subject matter experts

We developed, know how to use the cutting-edge tools

Only group to focus on sustainability parameters – social, economic

Right mix of players and perspectives – regulators, RPs, consultants, PMs, engineers, geologists, and more!

Mix of projects and problems

We cut across "party lines"

Active, encourages participation

Common goal to move practice forward

Open to non-members, other disciplines

Manageable size, nimble, mobile

Welcoming, inclusive, no barrier to entry

We advocate + educate

Wide reach, can embed w/in orgs, conferences

Brings together different stakeholders

Gives diverse stakeholders a voice

Fosters collaboration

Constantly improving

Unbiased approach

Less wieldy than ASTM, ITRC

Continuity – no sunset

Continuing education

International connection

Think tank atmosphere

SURF
SUSTAINABLE REMEDIATION FORUM

Spotlight on SURF: Lights, Camera, Action!

What can SURF do to build on our recent successes and/or current activities?

Professional networking, technology transfer

Deliver SR award at large tech. conference (e.g., Battelle, Brownfields, RemTech, RE3)

Workshops, trainings at large tech. conference

Tie into industry conferences (e.g., automotive, pharm, developers, conservation groups, LCA, etc.) + awards to RPs

Webinars (self-playing, hosted)

Follow-up actions from breakout sessions

Partnership w/ other science-based non-profit orgs (e.g., AIPG, NSF)

SURF presentation to students

SR course

Follow-up, complete TIs

Sustain momentum once TI deliverables are published

Develop partnerships (e.g., ELI, DOE)

Pick-up on ITRC gap in training

More publications

Partner/foster academic work in emerging technologies

Industry-driven/supported crits (critiques?)

Retain student members post-graduation

Outreach w/in and outside SR community

Continue SRI, add facilitator

Strengthen liaisons with students

SURF
SUSTAINABLE REMEDIATION FORUM

Spotlight on SURF: Lights, Camera, Action!

What can SURF do to build on our recent successes and/or current activities?

…continued…

Communications – consistent, curated

Push meeting content out on social media

Join, follow-up with the FRTR

Present at travelling remediation seminars

In-house training at gov't agencies (e.g., DOD, DOE) or other large organizations

- Basics of SR (how? why? both?)
- Tools, guidance
- LCA

Distribute publications at conferences

Advertise SURF meetings at conferences

Consider meeting locations where most regulators will attend

Take SURF meetings "to the people" when community group opportunities arise

Tie together common threads from multiple TIs and "cross-market" (e.g., social impact + groundwater reuse at gw conference)

Internal marketing/advertisement of SURF meeting participation, presentations

Meetings near industry hubs

Return to popular meeting locations (e.g., Pasadena, DC, Chicago)

SURF
SUSTAINABLE REMEDIATION FORUM

Spotlight on SURF: Lights, Camera, Action!

What should SURF be doing NOW (in 2015)?

- Marketing by individual members
- Set meeting dates, themes, locations, and recruit facilitator
- Communications Plan
- CSI White Paper
- Develop Awards program
- Identify target industries, conferences
- Email SURF 28 attendees w/ thank you, attendee list, TI announcements
- Booth handouts for Battelle
- Newsletter – quarterly, add member profile
- Social Media – consistent, original content
- GSR integration resources
- Evaluate Int'l SURF certification as model
- Prioritize for limited resources
- Better follow-up communication
- "Call for help" email blitz
- Convey how members can get involved
- Hold regulator meetings to push goals
- 1-on-1 outreach to past members, new participants
- Attend FRTR meetings
- Training for SURF members
- Grow membership
- Develop a member package
- Reframe SR as SAFE
- 1-page fact sheet
- 30-minute webinar

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