# Sustainable Remediation Forum (SURF)
# SURF 8: October 6 and 7, 2008
# Philadelphia, Pennsylvania

SURF 8 was held in Philadelphia, Pennsylvania, on October 6 and 7, 2008. Those individuals that participated in the two-day meeting are listed in Attachment 1 along with their contact information. The meeting marked the eighth time that various stakeholders in remediation—industry, government agencies, environmental groups, consultants, and academia—came together to develop the ability to use sustainability concepts in remedial decision-making. Previous meeting minutes are available at <**www.ibackup.com**>. The username is surfarchive, and the password is surf.

## Meeting Opening

The meeting began with Dave Ellis (DuPont) welcoming all participants. Dave explained that the dates of the meeting were selected to coordinate with a meeting of the Environmental Protection Agency's (EPA's) Climate Change and Contaminated Lands (CCCL) working group and that the group would be joining the meeting for the first day only. Dave then welcomed all participants and introduced Deb Goldblum (EPA Region III). Deb also welcomed meeting participants to Philadelphia, home of the Fightin' Philadelphia Phillies. She then introduced Abe Ferdas, the EPA Region III Director of Land and Chemicals Division.

Abe spoke of his work in Superfund for 13 years, where he pushed for achievable remedial designs to pave the way for property re-development. As Director of the Region III Superfund program, he explored ways to make remedies efficient and green. Although he has seen significant progress over the years, he challenged meeting participants to think about how to use sustainability and energy conservation to improve the environment. Abe noted that, in the past, problem owners spent a lot of money and EPA handed out a lot of consent orders. Now, with the challenges before us, he stressed a cooperative approach, where individuals from both sides work together to achieve cleanup.

This idea was reiterated when Mike Rominger (meeting facilitator) stated the meeting theme of "Breaking Down Barriers." Mike told participants to think about what is preventing them from achieving sustainable remediation.

Then, Mike discussed meeting logistics and ground rules (e.g., expectation that attendees will be active participants, show respect for others, appreciate and encourage divergent opinions, refrain from marketing, and be familiar with previous meeting minutes so the meeting can focus on new information). He also noted that it was assumed that nothing discussed or presented contains confidential information. Prior to the meeting, export control compliance was verified. Mike also read the following antitrust statement:

> "It is not the purpose of this meeting to discuss an existing or planned situation involving any party, whether a participant here today or not, concerning the price, customer base, volume, market, quality, design or cost structure of any commercial product or service, or to plan any course of action having an exclusionary or discriminatory effect."

Mike thanked the Meeting Design Team for their work in planning the meeting agenda. SURF 8 Meeting Design Team members were as follows: Brad Barquest (United Technologies Corporation), Julia Bussey (Geomatrix Consultants), Brandt Butler (URS Diamond), Dave Ellis (DuPont), Karin Holland (Haley & Aldrich), Lowell Kessell [GoodEarthkeeping Organization Inc. (GEO)], Phil McKalips (Environmental Standards), Dick Raymond (TerraSystems), Mike Rominger (On-Board Services), Carol Winell (GEO), and Dave Woodward (EarthTech|AECOM).

The draft mission statement from the February 2007 meeting was read as follows: "To establish a framework that incorporates sustainable concepts throughout the remedial action process that provides long-term protection of human health and the environment and achieves public and regulatory acceptance." Sustainable concepts were further defined as those that "balance economic viability, conservation of natural resources and biodiversity, and enhancement of the quality of life in the surrounding community." Participants were reminded that this mission statement serves as a starting point and could be revised.

Efforts to achieve "sustainable neutral behavior" continued at this meeting. Name badges and tent cards were reused. Many participants stayed at the hotel where the meeting was held, so transportation to the meeting was minimized. In addition, interested meeting participants walked to a happy hour and dinner after the first day of the meeting. Efforts to achieve sustainable neutral behavior are ongoing and will continue at future meetings.

The white paper and associated survey were discussed as follows during the meeting opening to inform new participants of current SURF activities:

- The draft title of the white paper is *Integrating Sustainability Principles, Practices, and Metrics into Remediation Projects,* and Dave Ellis described the purpose of the white paper as collecting, clarifying, and communicating the thoughts and experiences of SURF members on sustainability in remediation. Dave stated that he was impressed with the first draft of the paper and stressed that EPA's input is welcome. Dave reminded all participants that the white paper is not a policy statement. Participants discussed the publication and status of the white paper on Day 2 of the meeting (see "Sustainable Remediation White Paper").
- A survey was sent to both SURF members and more than 160 regulators to assess the level of knowledge and understanding of sustainable remediation and to provide information for the development of the sustainable remediation white paper. The results are highlighted in a later presentation summary and were incorporated into the white paper. In general, Elie Haddad (Locus Technologies) said that nongovernmental survey respondents wanted regulations for sustainable remediation and governmental survey respondents did not want regulations to address the issue. One participant mentioned that one of the questions was to define "sustainable remediation;" most survey respondents provided a relatively consistent definition.

Finally, participants introduced themselves and stated where they were on their first birthday to spur conversation and break the ice.

## News Items

Participants discussed the following news items at the beginning of the meeting:

- Stephanie Fiorenza (BP) told participants about the Site Assessment and Mitigation Forum that was held on September 14, 2008, in San Diego, California. The agenda on the first morning was dedicated to sustainable remediation and included presentations given by SURF members Curt Stanley (Shell Global Systems), Paul Hadley [California Department of Toxic Substances Control (DTSC)], and Stephanie Fiorenza. The conference was well attended, and presentations are available at <**http://www.sdcounty.ca.gov/deh/water/sam_update_agenda.html**>.
- Paul Hadley recommended the book *Making Sustainability Work: Best Practices in Managing and Measuring Corporate Social, Environmental, and Economic Impacts* by Marc J. Epstein. He described the book as a 30,000-foot overview of sustainability, with a roadmap for industry of how to implement sustainable principles and some recommendations for service providers on how to help clients integrate sustainable concepts into their businesses.
- Elie Haddad (Locus Technologies) described an all-day Green Remediation Symposium that will be held on February 4, 2009, in Sacramento, California. The symposium is presented by the California Department of Toxic Substances Control (DTSC), and the DTSC is co-hosting the event with the Groundwater Resources Association. The topics will include examining current advances in the field, as well as case studies. The symposium will be held in an auditorium in the Cal/EPA Building in Sacramento and will also be web-cast. Further details, including registration and how to participate via web-cast, will be available in the near future.
- Carol Dona (U.S. Army Corps of Engineers) mentioned a Navy-led, tri-services proposal submitted to the Environmental Security Technology Certification Program (ESTCP) to incorporate sustainability into the Department of Defense (DOD) environmental remediation optimization process.
- Paul Tornatore (Haley & Aldrich) mentioned an International Conference on Water Scarcity, Global Changes, and Groundwater Management Responses that is being held in Irvine, California, on December 1 through 5, 2008. The conference is sponsored by United Nations Educational, Scientific, and Cultural Organization (UNESCO), the University of California (Irvine), and the United States Geological Survey (USGS). Additional information is available at <**www.waterunifies.com**>.
- Dave Woodward (EarthTech|AECOM) pointed out that the Minnesota Pollution Control Agency has developed a tool kit to select, develop, and implement pollution prevention or sustainable options at remediation sites. The tool kit consists of four steps and includes PDF documents that can be downloaded for use. Additional information is available at <**http://www.p2pays.org/ref/11/10552.htm#steps**>.
- Stephanie Fiorenza (BP) told participants of the Soils, Sediments, and Water Conference presented by the Association for Environmental Health and Sciences (AEHS) on March 10 through 13, 2009. SURF members Lowell Kessel (GEO), Carol Winell (GEO), and Karin Holland (Haley & Aldrich) are involved in a platform session, and Paul Nathanail (University of Nottingham) is presenting a poster.

Stephanie also told participants that there would be a roundtable discussion on sustainable remediation.

- Carlos Panchon (EPA Office of Superfund Remediation and Technology Innovation) and Erica Becvar [Air Force Center for Engineering and the Environment (AFCEE)] reminded participants that the next meeting of the Federal Remediation Technology Roundtable (FRTR) will address sustainable remediation and will be held in December 2008 in Arlington, Virginia. All are invited to participate. Information on previous meetings is provided at <**www.frtr.gov**>.
- Dave Ellis mentioned the Battelle '09 conference that will be held in Baltimore, Maryland, from May 5 through 9, 2009. A panel discussion on sustainable remediation will be chaired by Dave and Deb Goldblum (EPA Region III). In addition, many SURF members will be presenting at the conference. More information is available at <**http://www.battelle.org/Conferences/bioremediation/index.aspx**>.
- Dave Woodward (EarthTech|AECOM) told participants that the bailout bill passed by the Senate includes renewable energy tax credits that are seen as essential for continuing the growth in wind, solar, and other alternative energy industries.
- Erica Becvar (AFCEE) mentioned that a short course for the AFCEE sustainability tool will be available during the next AFCEE workshop, which will be held the week of April 4, 2010, in San Antonio, Texas. Case studies of sustainable remediation will also be presented during the workshop.
- Dave Ellis (DuPont) invited SURF members to attend and/or consider speaking at the Remediation Technology Summit (RemTECH09), where there will be a session devoted to sustainable remediation. The summit is presented by *Pollution Engineering* and Georgia Tech and will be held March 3 to 5, 2009, in Atlanta, Georgia. Additional information is available at <**http://www.bnpevents.com/PE/RTS/CallForPresentations.htm>**.
- Tiffany Swann (GSI Environmental) told participants about the upcoming Partners in Environmental Technology Technical Symposium & Workshop in Washington, DC. The event is sponsored by the Strategic Environmental Research and Development Program (SERDP) and ESTCP and will be held December 2 through 4, 2008. Posters about sustainable remediation will be featured. Additional information is available at <**http://www.serdp-estcp.org/symposium2008/**>.

## Presentations

Brief presentations of project examples were the focus of the meeting. Because of the amount of presentations (i.e., over 10 presentations on Day 1 alone), discussions were limited to the allotted presentation time. Each presentation and subsequent discussion is summarized in the subsections below.

### *Environmental Impact of Remediation Systems at Leaking Underground Storage Tank (LUST) Sites*

Stephanie Fiorenza (BP) presented a retrospective study that will be conducted to evaluate the environmental impacts of remediation technologies commonly used at service stations. Data on energy and resource usage and the carbon footprint of technologies, such as soil vapor extraction and pump and treat, will be examined from industry records. Stephanie explained that these data will provide insight into the overall environmental impacts of different remediation technologies. Presentation slides are provided in Attachment 2.

Discussions focused on clarifying the parameters evaluated. Stephanie stated that the only parameter evaluated to date was carbon dioxide, but that all parameters (e.g., efficiency, constituents), media (e.g., water, air), and land use will be evaluated. One participant mentioned the implications of the evaluation when considering state funding for UST cleanups. For instance, if sustainable remediation is proven to be the less expensive alternative, states may approve the remedy because the remedy is a more efficient use of their resources. Stephanie stated that the focus of the project is on assessing data.

### *Use of Sustainable Principles in Off-Gas Treatment Selection for Soil Remediation*

Lowell Kessel (GEO) presented a framework to incorporate sustainability into the remediation selection criteria, focusing specifically on off-gas treatment selection for soil vapor extraction (SVE) remediation technology. Carol Winell (GEO), Karin Holland (Haley & Aldrich), and Jeremy Squire (Haley & Aldrich) also contributed to this case study, which included using carbon footprint calculations and considering waste reuse or recycling. Lowell explained that the focus on off-gas treatment is important as it limits the analysis to a specific remedial approach for more in-depth analysis and applies a technology that is generally considered an old and standard approach to the in situ remediation of soils at a contaminated site. Presentation slides are provided in Attachment 3.

Discussions focused on clarifying the definition of sustainable remediation as presented. Lowell explained that the definition used was a combination of the one used in SURF's mission statement, with additions from the project team.

### *DuPont and California DTSC Sustainability Pilot Project*

Dave Ellis (DuPont) presented a pilot program planned for a former DuPont titanium dioxide manufacturing facility located in Oakley, California. Working closely with the California DTSC Green Team, DuPont is using a small tetrachloroethylene release on the east side of the site to evaluate the sustainability of site assessment tools and of a variety of potential remedial actions. Dave said that the pilot program is expected to last about one year and should result in a group consensus on remedial action selection for the site. The two meetings to date have focused on defining the project scope and developing the detailed scope for a sustainable investigation. Preliminary sustainability findings are that equipment mobilization distances are the primary differentiator of energy usage and that fixed base or field laboratory analyses are very small contributors to the footprints of site assessments. Presentation slides are provided in Attachment 4.

Discussions focused on the preliminary findings. One participant mentioned that field laboratory costs in the service station industry prove to be large contributors to the footprints of site

assessments. Another participant said that the challenge is balancing the carbon footprint and the cleanup time.

### *Evaluation of Sustainability Metrics at a Site in Sicily, Italy*

Alessandro Battaglia (ENSR|AECOM Italia) described a case study in which a sustainability tool was applied at a site in Sicily, Italy. The tool was used to quantify sustainability metrics and evaluate different remediation scenarios for the site, which contained soil contaminated with total petroleum hydrocarbons, heavy metals, and tar. Alessandro explained the sustainability metrics evaluated, which included carbon dioxide emissions, carbon footprint, consumption of resources, and worker injuries. Presentation slides are provided in Attachment 5.

Discussions focused on clarifying the results presented, which are included in Attachment 5. On participant asked if life cycle analysis (LCA) was used in the evaluation. Alessandro responded that LCA was not considered.

### *SURF UK: An Update*

Frank Evans (National Grid) presented the background of SURF UK, progress to date, organizational structure, and working mission statement. The organization defines "sustainable remediation" as the practice of demonstrating, in terms of environmental, economic, and social indicators, that an acceptable balance exists between the effects of undertaking the remediation activities and the benefits the same activities will deliver. Frank presented the current mission statement as follows: "To develop a framework in order to embed balanced decision making in the selection of the remediation strategy to address land contamination as an integral part of sustainable development." Development of the framework is in progress and comments will be discussed at the next SURF UK meeting in November 2008. Some organizations are working to develop the framework and others are providing either peer review or supporting case studies. Frank said that the goal is to have a finalized framework by Spring 2009 and, in doing so, provide the UK a platform and context within which to consider sustainability appraisals. Presentation slides are provided in Attachment 6.

Discussions focused on the reaction of the regulatory agency to the framework concept. Frank stated that the UK Environment Agency supports the framework concept and is a supporter of the existing framework, *Model Procedures for the Management of Land Contamination* (CLR 11). CLR 11 provides the technical framework for applying a risk management process when dealing with land affected by contamination. One participant mentioned that the agency seems happy to participate and is supportive in principle, but they have no predefined notions of the resulting output.

### *EPA CCCL Working Group*

Cathy Allen [EPA Office of Solid Waste and Emergency Response (OSWER)] introduced the series of presentations from the EPA's CCCL working group. Cathy stated that the group was formed one year ago with the objective to implement activities that measurably reduce greenhouse gas emissions while improving the EPA's ability to clean up contaminated sites and return these sites to communities for beneficial reuse. Cathy discussed her perspective and goal for this part of the meeting, which was to have honest feedback about whether current CCCL group efforts are focused on the right areas. She also gave participants the following three points

for discussion after the CCCL group presentations: (1) identify barriers, (2) identify opportunities to move forward, and (3) identify areas where SURF members and CCCL working group members can partner to achieve progress. These points were discussed as a group and are summarized in the table below.

| Presentation Topic | Barriers | Opportunities for Progress | Partnership Areas |
|---|---|---|---|
| Renewable Energy | - Lack of focus on remediation field<br>- Potential encroachment of air space at U.S. Air Force bases<br>- Lack of regulatory framework to provide incentives (e.g., Superfund sites)<br>- Overemphasis on climate change parameters at expense of other sustainable parameters | - Provide regulatory and/or financial incentives<br>- Identify and compare costs of renewable energy applications vs. conventional applications<br>- Create initiative with leader within industry | - SURF members could help create regulatory framework or roadmap for incentives |
| Green Remediation: EPA Update | - Lack of understanding about what it means to maximize the net environmental benefit | - Integrate certification as part of program<br>- Focus on largest potential return (i.e., remedy selection vs. engineering optimization)<br>- Track health and safety on a remedy-specific basis | - CCCL Working Group will provide feedback to SURF members on how they can help. |
| Green Remediation: Restoration Alternatives | - Management of hydrological regime in concert with carbon sequestration<br>- Lack of standards for composting<br>- Need for extensive long-term monitoring | - Certify projects and offer offsets as an incentive<br>- Develop composting standards | (None discussed) |

### *Renewable Energy Development on Contaminated Lands and Mining Sites*

Penny McDaniel (EPA OSWER) told participants that the EPA's OSWER Center for Program Analysis (OCPA) is seeking opportunities to facilitate the reuse of contaminated properties and active and abandoned mine sites for clean and renewable energy generation. The EPA estimates that there are approximately 480,000 sites and almost 15 million acres of potentially contaminated properties across the United States that are tracked by EPA. [This estimate includes Superfund, Resource Conservation and Recovery Act (RCRA), Brownfields, and abandoned mine lands.] Penny stated that cleanup goals have been achieved and controls put in

place to ensure long-term protection for more than 850,000 acres. The OCPA has screened all EPA-tracked sites for clean and renewable energy development (e.g., solar, wind, and biomass) potential and has developed static and interactive state-specific maps and financial incentive sheets for clean and renewable energy development. Maps, incentive sheets, and site-specific information are available at <**www.epa.gov/renewableenergyland**>. Presentation slides are provided in Attachment 7.

Discussions focused on the next steps of the project, which involve evaluating the economics of clean/renewable energy vs. conventional energy and incorporating distribution networks into the mapping program to determine projected growth patterns.

### *Green Remediation: EPA Update*

Carlos Panchon [EPA Office of Superfund Remediation and Technology Innovation (OSRTI)] reviewed the EPA's OSWER priority areas in green remediation, recapped the major activities completed over the last year, and identified priority areas for the future. Presentation slides are provided in Attachment 8.

Discussions focused on the role of societal and economic benefits in the process. Carlos responded that those benefits are integrated when determining the site strategy. One participant mentioned that the real issue is the whether the definition of sustainable remediation includes all three benefits (i.e., environmental, societal, and economic) or only environmental benefits.

### *Green Remediation: Restoration Alternatives*

Harry Compton [EPA Emergency Response Team (ERT)] focused his presentation on the use of residuals as soil amendments on mine sites. Two case studies were presented: Bunker Hill in the Coeur d'Alene River Basin (Idaho) and the Upper Arkansas River (Colorado). Harry described Bunker Hill as the second largest Superfund site in the U.S. said that the mining and smelting of zinc and lead occurred at the site from 1916 to the 1980s. Harry provided the details of the project, which tested the feasibility of using biosolids compost in combination with other residuals to accelerate revegetation and limit the ecosystem impact of metals-contaminated wetlands. In the other case study presented, historic mining activities near Leadville, Colorado, resulted in the deposition of mine tailings in the Arkansas River. Over the years, these high pyrite wastes were eroded and re-deposited along an 11-mile stretch of the river, contaminating a number of areas. Harry presented the details of the case study, which demonstrated the potential for using residuals to remediate soils and establish and sustain a desirable plant community. Presentation slides are provided in Attachment 9.

Discussions focused on ecological and human health risk. Harry stated that all relevant pathways for ecological risk were evaluated and that no unacceptable risk was present. Human health risks were assessed, but not in as much detail as the ecological risk.

### *Guidance on Incorporating Sustainability into Army Environmental Remediation Projects: Practical Aspects of Incorporation and Application*

Carol Dona (U.S. Army Corps of Engineers) briefly reviewed the decision flow chart for the incorporation of sustainability into Army environmental remediation projects presented at the last SURF meeting. She focused on the following three areas within the decision flow chart: (1) the selection, use, and limitations of current contractual options when incorporating

sustainability during the planning process; (2) the potential modification and use of the Environmental Management System to determine the relative importance of different sustainability parameters; and (3) the potential use of multivariable evaluation or optimization to incorporate a composite sustainability parameter and/or individual sustainability parameters into the conventional nine criteria evaluation process currently used for Superfund or RCRA sites. Presentation slides and decision flow charts are provided in Attachment 10.

Discussions focused on the similarity of the structure of the decision trees presented here and in the previous presentation about the proposed conceptual framework in the UK. Although different nomenclature is used (i.e., "threshold" vs. "core"), the basic structural components are similar.

### *Update: Building Sustainability into the Air Force Remediation Process*

Chuck Newell (GSI Environmental) updated participants about the capabilities of a tool developed by GSI Environmental that helps U.S. Air Force remediation professionals incorporate sustainability concepts into their decision-making process. Chuck said that the tool is intended to be used as a planning tool for the future implementation of remediation technologies at a particular site, as well as an evaluation tool to optimize remediation technology systems already in place. The tool is built on the Microsoft Excel platform and will be available for free from the U.S. Air Force to all interested parties. Specifically, the tool allows users to estimate sustainability metrics for the following technologies: soil vapor extraction, excavation, enhanced bioremediation, and pump and treat. To make the tool more user friendly, the framework consists of two tiers, each requiring a different level of information and effort. Chuck provided an example to demonstrate the application of the tool. Presentation slides are provided in Attachment 11.

Discussions focused on when the tool would be available for use. The tool will be available for download either directly at the following web site or as a link: <**http://www.afcee.af.mil/resources/technologytransfer/programsandinitiatives/sustainableremeditation/index.asp**>. Beta testing of the tool will begin in January 2009, and the projected release date is March 2009.

### *Consensus Standards*

Gordon Gillerman [National Institute of Standards and Technology (NIST)] briefed participants on the basics of standards and conformity assessments to enhance SURF members' understanding of how these tools could be applied to issues in the remediation sector. Gordon reviewed the definitions of the various types of standards and explained that, in the U.S., there is a unique decentralized standards development system. The value of accredited standards development was presented, as well as the definition of conformity assessment and associated terminology. Gordon explained the types of conformity assessment in detail (i.e., supplier's declaration, inspection, testing, certification, registration, and accreditation). Finally, a graph comparing perceived risk and the independence and rigor of the conformity assessment was discussed as one factor that should guide the application of conformity assessment systems for particular needs. Gordon indicated that NIST can provide some support to the EPA and SURF on standards and conformity assessment issues if desired. Presentation slides are provided in Attachment 12.

Discussions focused on measuring perceived risk and the length of the standard development process. Gordon stated that confidence needs are determined by the stakeholders and that it is important to determine what will satisfy their need for confidence. He said that the record time for standard development is 14 months, but also reassured participants that involved parties feel that the result is worth the effort. Gordon stressed that work, such as pilot projects, can progress in parallel to standard development.

### *Green Cleanup Standard Update*

Deb Goldblum (EPA Region III) presented an update of a Green Cleanup Standard that has been proposed by the Waste and Chemicals Management Division and the Hazardous Site and Cleanup Division of EPA Region III. The objective of the Green Cleanup Standard is to design a framework that increases the awareness of options for "greening" cleanups and provides incentives for greener cleanups. Deb stated that the EPA Region III is exploring development of the standard with contracting support from EPA Headquarters, assistance from the NIST, a work group representing all of the cleanup programs, and input from states through the Association of State and Territorial Waste Management Officials (ASTSWMO).

As background, Deb explained that the EPA Region III entered into a pilot with DuPont in April 2007 to assess the feasibility of integrating a sustainability factor into the remedy selection process. The pilot resulted in a more robust evaluation and in selected remedies with reduced carbon footprints and energy consumption. In addition, the sustainability framework promoted broader thinking and more innovative cleanup options because it included life-cycle analysis and an evaluation of environmental factors (e.g., resource use/reuse), which are not considered during the traditional remedy selection process. Deb said that, over the last year, the pilot was presented at over a dozen venues with positive feedback. However, a dialogue often ensued about how to apply sustainability more universally without slowing the pace of cleanups or using extensive agency resources to review a broader range of factors as part of a remedy decision. The proposed Green Cleanup Standard will address this issue. Presentation slides are provided in Attachment 13.

For the discussion, Deb asked SURF members to answer the following two questions from their perspective as a stakeholder:

- What do you think the objective of the standard should be?
- What do you think the standard should look like (e.g., what metrics, what format [Leadership in Energy and Environmental Design (LEED) vs. tiered vs. a combination]?

Deb requested that individuals forward written responses to these questions to her by the end of November 2008 (see Attachment 1 for contact information).

### *Use of Standard Life-Cycle Analysis Tools*

Dave Ellis (DuPont) proposed setting an industry standard for assessing sustainability by using life-cycle analysis (LCA). Dave explained that the lack of a standardized approach for proving sustainability coupled with the diverse styles of how regulators process information is hindering the overall effort to move to the next level—regulatory acceptance. Dave proposed that, because of the proliferation of sustainability tools, SURF members are creating more of a problem than

they are solving. LCA packages have professional standards and components are peer-reviewed so that consistency is not an issue. Dave recommended that all SURF members adopt LCA to facilitate the widespread acceptance of sustainable remediation and then asked participants for feedback. (Participants had already begun lining up for a chance to speak at the microphone!)

Participants seemed to agree that a standard approach is necessary, but disagreed whether LCA was the solution. During the discussion, participants listed advantages and limitations of using LCA as a tool for remediation sustainability assessments (see table below). Those participants that were cautious about the proposal cited a fear of creating another battleground for endless arguments between the regulator and the problem owner (e.g., similar to risk assessment). One participant countered that his greatest fear is creating a battleground because of so many tools. All participants seemed to agree that all of the hard work performed thus far should not be lost, but that it is necessary for regulators to have a believable basis upon which to evaluate sustainability. One regulatory participant reminded everyone not to slow down regulatory resources with guidance and administrative hurdles. Regardless of the approach, one participant thought that the process of developing a standard tool will take two to five years.

| Advantages | Limitations |
|---|---|
| More comprehensive | Lacks adaptability and flexibility |
| Provides consistency | Expensive |
| Recognized as accepted approach | Lack of transparency and simplicity |
| Complies with professional standards | Requires specialized expertise for use |
| Peer-reviewed components | Not tailored to remediation industry |

During the discussion, participants recommended the following actions as possible next steps or approaches to addressing the lack of standardization:

- Agree on the metrics that are included in a sustainability evaluation/assessment.
- Adapt the standard LCA to include intangibles.
- Perform a few case studies using LCA, then compare to currently available tools.
- Use LCA to create rules of thumb.
- Address this issue at the next SURF meeting.

One regulatory participant reiterated the importance of standardization by reminding participants of the misperception that "sustainable remediation" is code for "cheaper cleanups." While standardization is necessary, the participant stressed the need to educate stakeholders as well. Another participant stated that identifying the common values of stakeholders is also important.

### *Illinois EPA Greener Cleanups Initiative*

Dave Reynolds (EarthTech|AECOM) presented the work that his company and the Illinois EPA have been performing to determine how greener cleanups can result in environmental benefits beyond regulations. Dave explained that "greener cleanups" refer to a method of site remediation that (1) makes the actual cleanup more efficient and less polluting and (2) results in a site where the development is designed to reduce the environmental impacts of future use. The

project began with a white paper providing an overview of Illinois EPA cleanup programs, potential opportunities, and possible barriers. A subsequent workshop of stakeholders and practitioners allowed for in-depth discussion of the issues and opportunities, and site visits to active Brownfield clean ups and interviews with project managers revealed an array of strategies for "greening" activities. Dave said that the 35 strategies for "greening" Brownfield cleanup activities unearthed through this process evolved into a matrix that the agency supplies to contractors. The matrix provides in-depth information and guidance, can be applied during any project phase, and is available at <**http://www.epa.state.il.us/land/greener-cleanups/matrix.pdf**>. Dave also said that the project included developing training tools for agency managers involved in various state cleanup programs. Presentation slides are provided in Attachment 14.

Gary King (Illinois EPA) told participants that other states are using the matrix and that the Illinois EPA is beginning to apply it to the UST Program. When asked how the initiative was funded, Gary responded that the money came from the EPA through the Brownfields program. Other questions involved clarifying the basis for the number of dots on the matrix. Gary said that the amount of dots on the matrix was selected on a qualitative basis.

## Sustainable Remediation White Paper

SURF members continue to work on a white paper about sustainable remediation. At a previous meeting, facilitators for major chapters were assigned, and participants volunteered to help specific facilitators based on the chapter topic and their area of interest or expertise. More detailed information about the genesis of the white paper and its content is provided in previous meeting notes at <**www.ibackup.com**>.

### *White Paper Publication*

In previous meetings, SURF members discussed the possibility of publishing the white paper in a journal, assuming that the copyright would remain with SURF. At this meeting, Dave Ellis (DuPont) introduced John Simon, Editor-in-Chief of *Remediation*. John told participants that the publisher of *Remediation*, John Wiley & Sons, had agreed to publish the white paper without requiring SURF to relinquish the copyright. John explained that all that was needed was SURF's approval for "permission to publish."

With that in mind, participants discussed the possibility and logistics of publishing the white paper in the journal. After some discussion, participants agreed that, because of the amount of information contained in the paper, an entire issue of the journal would need to be dedicated to it. Additional discussions focused on the distribution of the journal. John told participants that the journal's current paper copy distribution is 2,000, although he said that the majority of the distribution occurs through packages sold to universities and research centers. In addition, John said that tens of thousands of downloads occur via the Internet.

At the end of the discussion, participants voted (with a show of hands) to publish the white paper in *Remediation*.

### *White Paper Status*

A first draft of the white paper was compiled and distributed to chapter facilitators in the beginning of September 2008. Chapter facilitators forwarded the draft to their teams at their

discretion. At SURF 8, participants gathered into breakout groups according to their assigned chapters. New SURF members joined a breakout group based on their interest in the chapter topic and the existing size of the chapter team present at the meeting. Chapter facilitators led the breakout group discussions, and each group used the face-to-face time to discuss outstanding issues specific to their chapter. In addition, chapter facilitators met separately during the meeting to discuss the feasibility of finishing the paper by February 1st to allow publication in the Spring 2009 issue of *Remediation*. After some discussion and the development of interim deadlines, the chapter facilitators committed to the February 1st deadline. Chapter facilitators committed to the following interim deadlines:

- October 27, 2008: Recommendations and conclusions to Paul Hadley (California DTSC) and Dave Ellis (DuPont)
- November 17, 2008: Polished chapters to Kathy Adams (Writing Unlimited)
- November 24, 2008: Assembled edited document sent to internal SURF reviewers at the discretion of chapter facilitators
- December 8, 2008: Review comments sent to chapter facilitators
- January 5, 2009: Revised chapters to Kathy Adams
- January 21, 2009: Final document complete; final check by chapter facilitators
- February 1, 2009: Submit document to journal

### *Survey on Sustainable Remediation*

Elie Haddad (Locus Technologies) presented the results of a survey that was sent to both SURF members and more than 160 regulators to assess the level of knowledge and understanding of sustainable remediation and help in the development of the white paper. Presentation slides are provided in Attachment 15. Detailed survey responses are provided at <**www.ibackup.com**> in the SURF 8 folder.

## Definition of Sustainable Remediation

At the last meeting, participants seemed to agree that consensus on the definition of sustainable remediation was necessary. During this meeting, there was a discussion about the over 30 different definitions of sustainable remediation. Paul Favara (CH2M Hill) volunteered to use the definitions provided by SURF members and regulators from the survey to develop the top five definitions. Then, Paul will send the top five definitions to members of the SURF Work Group for selection of an appropriate definition.

## SURF Work Group Organizational Update/Discussion

Dave Woodward (EarthTech|AECOM) presented an update of the progress of the SURF Work Group. The group was formed at the last meeting to address SURF's expanding membership and future direction. The group consists of a balanced team of problem owners, consultants, and regulators who were charged with gathering to discuss organizational issues. Dave presented the historical and future perspectives of SURF and the challenges associated with the organization's growth. He described various organizational structures as options to the current challenges. Dave posed discussion questions to participants, stating that the feedback received would be used

by the Work Group to propose solutions. The discussion questions are listed below, along with a summary of the feedback received. Presentation slides are presented in Attachment 16.

- Are you willing to pay a personal or organizational membership fee?
  All participants seemed to agree that a personal or organizational membership fee for SURF was reasonable and acceptable.
- What is the SURF life cycle?
  After some discussion, the majority of participants seemed to believe that the SURF life cycle is between two to five years at a minimum. One participant said that, although we see progress within SURF, many individuals remain unaware about sustainable remediation. Other participants mentioned that they believed the life cycle would be longer than five years, using the history of monitored natural attenuation and risk-based corrective action as examples. Some participants believe that the publication of the white paper and launch of the web site are "just the beginning" of SURF's leadership in sustainable remediation. Others suggested that SURF differentiate its as-yet identified offerings in two to three years versus other organizations.
- How do we want to "get the word out" (e.g., lobbying, web site)?
  All participants seemed to agree that lobbying was not an option. Another participant asked the group if the goal is simply to "get the word out" or to provide further education and refinement of concepts. No consensus was reached.
- Do we want/need to certify, standardize, endorse, etc.?
  Participants did not discuss this question in detail. Some sort of standardizing was favored, but certifying and endorsing did not seem to be popular among the majority of participants.
- Do we want to sponsor or prepare training materials?
  The majority of participants seemed to agree that there is a need for training materials and additional outreach to stakeholders. Whether SURF would sponsor or prepare the materials was not discussed. Some participants believed that the role of SURF is to educate stakeholders about sustainable remediation, and sponsoring or preparing training materials seemed to fit within this role.
- Is lack of direct funding limiting us?
  Participants discussed how the lack of direct funding could be limiting SURF activities. Participants mentioned that, if funding were available, SURF could provide grants for sustainability pilots and projects, and fund travel for governmental and nongovernmental organization participants.
- Should there be participation requirements?
  Because of time constraints, participants did not discuss the issue of participation requirements (e.g., meeting attendance, active in committees/initiatives) in detail. Through a show of hands, all participants agreed that SURF members who have been actively participating in previous meetings and efforts should be given preference to attend meetings. In the past, meeting attendance has been determined on a first come, first serve basis until attendance is full (based on the meeting room size).

Additional discussions focused on the advantages and disadvantages of the various structures presented. Participants discussed the following advantages of a professional organization structure: (1) fills the current void (i.e., no professional society for remediation exists), (2) facilitates membership fee reimbursement, (3) allows a mechanism for contributions, (4) encourages change through education, and (5) provides memberships at different levels. The advantages of cooperative research and development agreements were discussed as follows: (1) channels substantial amounts of government money and (2) allows funding for travel for governmental and nongovernmental organizations. One participant suggested contacting fellow SURF member Bill Hyatt (K&L Gates) to determine the legal implications of the different organizational structures presented.

Regardless of the structure, participants stressed the importance of flexibility. To this end, participants discussed the option of identifying a third party (e.g., Battelle) to host SURF. The third party would provide funding while allowing the organizational structure to remain flexible. Participants seemed intrigued by this idea.

Other discussions concentrated on using alternative approaches or variations of existing organizational models. One participant mentioned that it may be easier to latch onto another organization (e.g., ITRC) than create a new one. Participants responded by stressing the need to retain the opinion of all stakeholders currently represented by SURF as well as the character of SURF. Participants also were concerned of the hefty charges required for companies to participate in some organizations like ITRC. Another participant suggested using the U.S. Green Building Council as a model because it, similar to SURF, was built on sweat equity. SURF members responded that, if such a model is used, it will be important to maintain a broad sustainability focus vs. focusing solely on greenhouse gases. Another participant suggested housing SURF within another nonprofit organization or university so that overhead costs are minimized.

Additional discussions focused on the importance of revisiting the mission statement. One participant mentioned that a cohesive mission and vision would allow participants to know the direction of the organization and then select the appropriate organizational framework. Education and awareness were suggested as possible concepts to include in the revised mission statement.

## SURF Web Site

Lowell Kessell (GEO) presented the proposed format of the web site for SURF, which is located at <**www.sustainableremediation.org**>. The web site currently contains a description of the forum, mission statement, location for report downloads, and contact information. Lowell stated that GEO had donated the domain name and the initial web site design, but that the cost for additional web site maintenance would need to be paid in the future (i.e., approximately $75/month). Lowell posed questions to participants to obtain feedback on the web site content and management, potential web site advertising opportunities, and potential advertisement of the site. Presentation slides are provided in Attachment 17.

Discussions focused on the questions that Lowell posed to participants. A couple of participants volunteered to pay for the web site maintenance, but another participant stressed that payment needs to somehow represent all SURF members. One participant suggested a counter be added to the web site, and Lowell agreed. At the end of the discussions, participants seemed to agree

that it was advantageous to schedule the web site to launch when (1) the mission statement is finalized, (2) the white paper is complete, and (3) consensus has been reached about the use of advertising on the site. In the meantime, Lowell asked for participants to send him comments about the existing web site framework, content, and selected colors within one week after the meeting. Participants agreed that the feedback received and issues discussed should be resolved by the SURF Work Group.

## Remote Attendance at SURF Meetings

SURF members discussed ways to improve remote attendance at SURF meetings. One remote participant mentioned that the use of the microphone was extremely helpful, but suggested the following to improve remote participation: (1) upload *all* presentations onto <**www.ibackup.com**> and (2) check in with remote participants more often. Another participant suggested using AT&T web meeting through a SURF participant's mobile broadband card to facilitate real-time communication with remote participants.

## Path Forward

The following path forward items were identified at the meeting:

1. The next meeting is tentatively scheduled for February 24 and 25, 2009, in California. Meeting logistics will be forwarded as they become available. A draft agenda will be developed by the Meeting Design Team and will be circulated via e-mail. Active feedback and suggestions are encouraged.
2. Based on feedback at the meeting, volunteers for the design team are as follows: Buddy Bealer (Shell Oil Products), Brandt Butler (URS Diamond), Carol Dona (U.S. Army Corps of Engineers), Paul Favara (CH2M Hill), Karin Holland (Haley & Aldrich), Dave Ellis (DuPont), Phil McKalips (Environmental Standards), Mike Miller (CDM), Maile Smith (Northgate Environmental Management), Dan Watts (New Jersey Institute of Technology), and Dave Woodward (EarthTech|AECOM). Additional members are welcome. Meeting Design Team members should expect to spend about eight hours on the effort between now and the next meeting.
3. The following items were suggested as possible agenda items at the next meeting: (1) open forum discussion with EPA about sustainable remediation vs. green remediation and (2) identification of sustainability metrics. Possible additional agenda items are listed in the SURF 7 meeting notes in Attachment 12.

# Attachment 1
# SURF 8 Participant Contact Information

# SURF 8 Participant Contact Information

| Participant | Affiliation |
|---|---|
| ***Participant for Days 1 and 2*** | |
| Adams, Kathy | Writing Unlimited |
| Ashby, Bryan | DE Dept. of Natural Resources and Environmental Control |
| Baker, Ralph | TerraTherm |
| Battaglia, Alessandro | ENSR ı AECOM |
| Bealer, Buddy | Shell Oil Products |
| Barquest, Brad | United Technologies Corporation |
| Becvar, Erica | Air Force Center for Engineering and the Environment |
| Boyle, Sue | GEI Consultants |
| Bussey, Julia | Geomatrix Consultants |
| Butler, Brandt | URS Corporation |
| Caputi, Jeff | Brown and Caldwell |
| Coffman, Robert | ENVIRON |
| Curnock, David | United Technologies Corporation |
| Dona, Carol | U.S. Army Corps of Engineers |
| Dulcey, Richard | ERM |
| Ellis, Dave | DuPont |
| Espino Guerrero, Catalina | Chevron |
| Evans, Frank* | National Grid Property, Ltd. |
| Fabersunne, Mikos* | California Dept. of Toxic Substances & Control |
| Favara, Paul | CH2M Hill |
| Fiorenza, Stephanie | British Petroleum |
| Fisher, Angela | GE Global Research |
| Haddad, Elie | Locus Technologies |
| Hadley, Paul* | California Dept. of Toxic Substances & Control |
| Holland, Karin | Haley & Aldrich |
| Houlihan, Mike | Geosyntec Consultants |
| Hyatt, Bill | K&L Gates |
| Keller, Joe | Groundwater & Environmental Services |
| Kessel, Lowell | GoodEarthkeeping Organization Inc. |
| Koenigsberg, Stephen | ENVIRON |
| MacGregor, Janine | NJ Dept. of Environmental Protection |
| McKalips, Phil | Environmental Standards |
| Miller, Mike | CDM |
| Newell, Chuck | GSI Environmental |
| Raymond, Dick | Terra Systems |
| Reynolds, Dave | EarthTech ı AECOM |
| Rivadineyra, Issis | Naval Facilities Engineering Service Center |
| Rominger, Mike | DuPont Retiree |
| Roush, Randy | Pennsylvania Dept. of Environmental Protection |
| Shanks, Jeff | Waste Management |
| Simon, John | WSP Environment & Energy |
| Smith, Maile | Northgate Environmental Management |
| Swann, Tiffany | GSI Environmental |
| Tornatore, Paul | Haley & Aldrich |
| Ung, Poh Boon | ARCADIS |
| Watts, Dan | New Jersey Institute of Technology |
| Wice, Rick | Shaw Environmental & Infrastructure Group |
| Willard, Charles | National Grid |

# SURF 8 Participant Contact Information

| Participant | Affiliation |
|---|---|
| Winell, Carol | GoodEarthkeeping Organization Inc. |
| Woodward, Dave | EarthTech ı AECOM |
| ***Participant for Day 1 Only*** | |
| Allen, Catherine | U.S. EPA OSWER |
| Armann, Steve | U.S. EPA Region 9 |
| Chu, Ed | U.S. EPA OSWER |
| Compton, Harry | U.S. EPA ERT |
| Ferdas, Abe | U.S. EPA Region 3 |
| Gaffney, Kristeen | U.S. EPA Region 3 |
| Gillerman, Gordon | NIST |
| Goldblum, Deborah | U.S. EPA Region 3 |
| Greaves, Robert | U.S. EPA Region 3 |
| Hoffman, Anne Marie | U.S. EPA FFRRO |
| Hueni, Camille | U.S. EPA Region 6 |
| Jones, Leslie | U.S. EPA Region 3 |
| Josiam, Raji | U.S. EPA Region 6 |
| King, Gary | State of IL, ASTSWMO |
| Mahmud, Shahid | U.S. EPA OSRTI |
| McDaniel, Penny | U.S. EPA OSWER |
| Miullo, Nat | U.S. EPA Region 8 |
| Novotny, Sandra | EMS, Inc. |
| Pachon, Carlos | U.S. EPA OSRTI |
| Podgurski, John | U.S. EPA Region 1 |
| Rasmussen, Sara | U.S. EPA OSWER |
| Rossomando, Chris | EMS, Inc. |
| Thomas, Marc | U.S. EPA OSW |
| Williams, Donald | U.S. EPA Region 6 |

Notes:

* Participated via teleconference

OSWER = Office of Solid Waste and Response

ERT = Emergency Response Team

NIST = National Institute of Standards and Technology

FFRRO = Federal Facilities Restoration and Reuse Office

ASTSWMO = Association of State and Territorial Solid Waste Management Officials

OSRTI = Office of Superfund Remediation and Technology Innovation

# Attachment 2
# Environmental Impact of Remediation Systems at Leaking Underground Storage Tank Sites

# Environmental Impact of Remediation Systems at LUST sites

**Stephanie Fiorenza, BP**

## Participants

- **Lead:**
  - **Region 9 EPA UST Program**
- **Consultant:**
- **Oil Companies:**
  - **BP**
  - **Shell**
  - **Chevron**
  - **ExxonMobil**
- **Government Agency Collaborators:**
  - **Region 9 EPA RCRA Group**
  - **CA State Water Resources Control Boards UST Program**
  - **CA DTSC Green Remediation Team**

## Why Retail Sites?

- **Large number of sites**
- **Large experience base with technologies, data**
- **Similar Chemicals of Concern**
- **Similar size sites**
- **Can we make generalizations about the technologies? Develop rules of thumb?**

## What will be studied?

- Retrospective analysis
- Closed or monitoring-only sites
  - **Utility records, invoices, reports to regulatory agencies**
- Multiple sites from multiple companies
- Entire life cycle of site

## Technologies

- Soil Vapor Extraction and off gas treatment
- Excavation
- Fluid extraction techologies
- Pump and Treat
- Air Sparging
- Managed Natural Attenuation and Monitoring-only

A partial list

## Parameters

- **Resources impacted:**
  - **Land**
  - **Water**
  - **Air**
- **Materials consumed:**
  - **Energy**
  - **Products**
- **COC mass removed**

## Other Parameters

- Other Resources
  - Discharge to POTW
  - Waste generation
- Societal
  - Risk – worker, mileage, exposure
  - Community impacts – noise, traffic
- Economic (?)

## Approach

- **Checklist developed by team**
  - Impact – soil area, plume volume
  - Hydrogeology
  - # wells, kwh, driving distance
- **Checklist completed by filled in industry &/or their consultants**
  - Using utility records, invoices, reports to regulatory agencies
- **EPA consultant inputs data and conducts analysis**

## Sustainability Analysis of a Service Station Undergoing Active Remediation

- **Pump and Treat followed by Granular Activated Carbon**
  - 3 total fluids pneumatic pumps in 3 wells
  - 2 GAC filters in series
  - Average extraction rate 0.2 gpm
  - Average flow 131,160 gal/yr
  - **Average TPH Recovered 96 lbs/yr**
  - Average TPH Discharged 0
- **Soil Vapor Extraction followed by Catalytic Oxidation**
  - Soil Vapor extracted from 6 wells with a blower (10 HP)
  - Average Air Flow Rate 280 cfm
  - **Total TPH Recovered 2232 lbs/yr**
  - Total TPH Destroyed 1932 lbs/yr
  - Total TPH Discharged 300 lb/yr
- **Average Electricity Usage 139,200 kwh/yr** ($0.1275/hr)
- **O&M**
  - Visits to site 2 times per month
  - Distance 35 miles one way

## $CO_2$ Equivalents

| | 1 Year | 5 Years |
|---|---|---|
| Gasoline | 1.1 | 5.5 |
| COC Degradation | 3.2 | 16 |
| Groundwater | -0- | -0- |
| Soil | -0- | -0- |
| Electric Grid | 116.9 | 584.5 |
| Total (tons $CO_2$) | 121.2 | 606 |
| COC Removal (lbs) | | |
| Soil | 2,232 | 7,503* |
| Groundwater | 96 | 322 |
| COC lb/ton $CO_2$ | 19.2 | 12.9 |

*Assumes loss of efficiency

## High Carbon Footprint Activities

- **Running the systems (grid electricity)**
- **Catalytic oxidation unit emissions**
- **Driving to and from site for maintenance (gasoline)**

**Result:**

- **100.4 lbs $CO_2$ generated per lb hydrocarbon removed**

## Other Examples

- **Vacuum truck removal of product**
  - 1.75 Million lbs $CO_2$/lb COC (1 yr, 12 events)
- **P & T-** 4000 lb $CO_2$/lb COC (lifetime, 4 yrs)
- Prospective:
  - **ISCO** - 6000 lbs $CO_2$; 700 lbs $CO_2$ /lb COC*
  - **MNA** + BR wells – 6600 lbs $CO_2$; 28K lbs $CO_2$ /lb COC; 63% $CO_2$ from well installation
  - **SVE** – 200 tons $CO_2$; excavation – 300 T

## Products and Goals

- Catalogue of impacts per technology
- Catalogue of impacts per activity
- Catalogue of impacts during lifecycle
- Better understanding of efficiency, operational performance – is there a tipping point?
- Informed decision-making

# Attachment 3
# Use of Sustainable Principles in Off-Gas Treatment Selection for Soil Remediation

# Use of Sustainable Principles in Off Gas Treatment Selection for Soil Remediation via SVE

Lowell Kessel and Carol Winell from Good EarthKeeping Organization Inc. and
Karin Crosby and Jeremy Squire from Haley & Aldrich Inc.

Good Earthkeeping Organization

HALEY & ALDRICH

## Outline

2

- What is Environmental Sustainability?
- Dissecting the Feasibility Analysis
- Carbon Footprint Model
  - Form and Function
  - Parameters
  - Assumptions
  - Calculations
  - Off-Gas Treatment Applications
- Three GHG Footprint Case Studies
- Considering Resource Conservation



## What is Environmentally Sustainable Remediation?

3

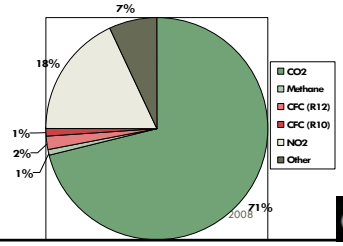
*"Soil and Groundwater remediation which potentially provides the best outcomes for the economic, social, institutional and environmental aspects of human society in addition to the non-human environments both now and into the indefinite future"*



## What is carbon footprinting?

4

***It's the measurement of the impact on the environment in terms of the amount of greenhouse gases produced, measured in units of carbon dioxide released directly and indirectly by an individual, organization, process, event or product (Carbon Trust, 2007).***




## Outline

5

- What is Environmental Sustainability?
- Dissecting the Feasibility Analysis
- Carbon Footprint Model
  - Form and Function
  - Parameters
  - Assumptions
  - Calculations
  - Off-Gas Treatment Applications
- Three GHG Footprint Case Studies
- Considering Resource Conservation



## Feasibility Analysis

6

The precise cost-effective transition point depends on site-specific technical and economic conditions, including:

- Contaminant Properties
  - Henry's Law
  - vapor pressure
  - boiling point
  - molecular weight
  - LEL
- Concentration level
- Cost of utilities (i.e., electricity, supplemental fuel)
- Disposal/recycling costs
- Transportation/location of site
- Regulatory requirements/permitting

## Remediation Cost Comparison Assumptions

7

- Capital (equipment procurement and setup costs)
  - Motors, blowers, compressors, thermal units, etc.
  - Piping
  - Installation
  - Instrumentation
  - Delivery
- Operation and maintenance costs
  - Expendables
  - Reporting
  - Site visit activities
  - Field staff transportation
  - Waste transportation and disposal
  - Laboratory
  - Electricity ($0.12 per kwh) / energy/
  - Supplemental Fuel costs (Natural Gas at $0.015 per cubic foot)
  - Field equipment
  - Equipment maintenance or replacement
  - Subcontractor or subconsultant markup (15%)



## Where are the sustainable Aspects?

8

- When does sustainable practices become important in a feasibility analysis?
- How can it be measured?
  - GHG footprint?
  - Natural resources consumption?
  - Energy consumption?



## Outline

9

- What is Environmental Sustainability?
- Dissecting the Feasibility Analysis
- Carbon Footprint Model
  - Form and Function
  - Parameters
  - Assumptions
  - Calculations
  - Off-Gas Treatment Applications
- Three GHG Footprint Case Studies
- Considering Resource Conservation



## Carbon Footprint Model

10

- **Form and Function**
- Parameters
- Assumptions
- Calculations
- Applications



11

**GHGs Emission Calculations for Off-Gas Treatment Technology Process**

**Carbon Dioxide**

**On-Site Combustion**

| Fuel | Fuel Consumption (gallons/cu ft yr) | Fuel Consumption (gallons/cu ft yr) | Emission Factor (kg $CO_2$/gallon) | metric tons/kg $CO_2$ | $CO_2$ Emissions Subtotal |
|---|---|---|---|---|---|
| Diesel | | 0 | 10.15 | 0.001 | 0 |
| Propane | | 0.02278 | 5.79 | 0.001 | 0.00 |
| Motor Gasoline | | 0 | 8.87 | 0.001 | 0 |

| Fuel | Fuel Consumption (cu ft/yr) | Fuel Consumption MMBTU/cu ft | Emission Factor (kg $CO_2$/MMBTU) | metric tons/kg $CO_2$ | $CO_2$ Emissions Subtotal |
|---|---|---|---|---|---|
| Natural gas | 58882 | 0.0010300 | 52.78 | 0.001 | 48 |

Stationary Combustion Emissions Subtotal = 48

**Mobile Combustion**

| Fuel | Annual Miles driven | Vehicle MPG | Emission Factor (kg $CO_2$/gallon) | metric tons/kg $CO_2$ | $CO_2$ Emissions Subtotal |
|---|---|---|---|---|---|
| Vehicle - weight 6,000 lbs and less - gas | 1733 | 16.8 | 8.55 | 0.001 | 0.9 |
| Vehicle - weight 6,000 lbs and less - diesel | | 16.6 | 9.96 | 0.001 | - |
| Vehicle - weight 6,001 - 10,000 lbs - gas | | 13.7 | 8.55 | 0.001 | - |
| Vehicle - weight 6,001 - 10,000 lbs - diesel | | 13.7 | 9.96 | 0.001 | - |
| Vehicle - weight 10,001 - 14,000 lbs - gas | | 10.4 | 8.55 | 0.001 | - |
| Vehicle - weight 10,001 - 14,000 lbs - diesel | 600 | 11.8 | 9.96 | 0.001 | 0.5 |
| Vehicle - weight 14,001 - 16,000 lbs - gas | | 8.9 | 8.55 | 0.001 | - |
| Vehicle - weight 14,001 - 16,000 lbs - diesel | | 10.3 | 9.96 | 0.001 | - |
| Vehicle - weight 16,001 - 19,500 lbs - gas (mid-size truck) | | 8.6 | 8.55 | 0.001 | - |
| Vehicle - weight 16,001 - 19,500 lbs - diesel (mid-size truck) | 1733 | 9.3 | 9.96 | 0.001 | 1.9 |
| Vehicle - weight 19,501 - 26,000 lbs - gas | | 7.5 | 8.55 | 0.001 | - |
| Vehicle - weight 19,501 - 26,000 lbs - diesel | | 8.3 | 9.96 | 0.001 | - |
| Vehicle - weight 26,001 - 33,000 lbs - gas (full size truck) | | 7.0 | 8.55 | 0.001 | - |
| Vehicle - weight 26,001 - 33,000 lbs - diesel (full size truck) | 3333 | 7.5 | 9.96 | 0.001 | 4.4 |
| Vehicle -weight 33,001 lbs and up - gas (big rig) | | 6.5 | 8.55 | 0.001 | - |
| Vehicle -weight 33,001 lbs and up - diesel (big rig) | | 5.9 | 9.96 | 0.001 | - |

Mobile Combustion Emissions Subtotal = 7.7

**Indirect Emissions**

| Electricity | Annual KWh | lbs $CO_2$/KWh | lbs/metric ton | $CO_2$ Emissions Subtotal |
|---|---|---|---|---|
| On-site | 306,600 | 0.87 | 2,204.62 | 121 |
| Off-site | | 0.87 | 2,204.62 | - |
| Manufacturer | | 0.87 | 2,204.62 | - |

12

| Indirect Emissions Subtotal = | | | | 121 |
|---|---|---|---|---|

**Fugitive Emissions**

| Contaminant volatilization due to soil mixture by cubic yards | Carbon atoms (mol | Concentration (ppmV) | Cubic YD of soil x minutes of aeration | lbs/metric ton | $CO_2$ Emissions Subtotal |
|---|---|---|---|---|---|
| Compound Name | Carbons/Mol | | | | |
| Gasoline | 8 | | | - | - |
| Diesel | 12 | | | - | - |

Fugitive Emissions Subtotal = -

**Thermal Oxidation Processing Emissions**

| Estimated Time of Remediation (Years) | System Flow Rate (SCFM) | Constituent Concentration (ppmV) | Est. Mass of $CO_2$ EQ (pounds) | $CO_2$ Emissions Subtotal (Metric Tons) |
|---|---|---|---|---|
| 1.00 | 100 | | | |
| Compound Name | Carbons/Mol | | | |
| PCE (Tetrachloroethylene) | 2 | 2,750 | 32,954 | 15 |
| Compound Name | Carbons/Mol | | | |
| TCE (Trichloroethylene) | 2 | 2,750 | 32,954 | 15 |
| TCE (Trichloroethylene) | 2 | | | |
| Compound Name | Carbons/Mol | | | |
| Methylene Chloride (DCM; Dichloromethane) | 1 | | - | - |
| Compound Name | Carbons/Mol | | | |
| HCFCs (Hydrochlorofluorocarbons) | 2 | | - | - |
| Compound Name | Carbons/Mol | | | |
| DCE (Dichloroethene) | 2 | | - | - |
| Compound Name | Carbons/Mol | | | |
| CFCs (Chlorofluorocarbons; Freon 113) | 1 | | - | - |

Processing Emissions Subtotal = 30

Total $CO_2$ footprint 207

| Other GHGs | Metric Tons | Global Warming Potential | $CO_2$ EQ Subtotals |
|---|---|---|---|
| CH4 | 0.006 | 23 | 0.148 |
| N20 | 0.001 | 296 | 0.23 |
| HFCs | SEE BELOW | | - |
| PFCs | SEE BELOW | | - |
| SF6 | | 22000 | - |

Total GHG footprint 207

## Carbon Footprint Model

13

- Form and Function
- **Parameters**
- Assumptions
- Calculations
- Applications



## Sources

14

- World Business Council for Sustainable Development (WBCSD) /World Resources Institute (WRI), 2004
- California Climate Action Registry (CCAR), 2007
- The Climate Registry, TCR, 2008
- GHGs listed in the Kyoto Protocol to the United Nations Framework Convention on Climate Change



## Parameters

15

- GHGs listed in the Kyoto Protocol to the United Nations Framework Convention on Climate Change
  - Carbon dioxide
  - Methane
  - Nitrous oxide
  - Sulfur hexafluoride
  - Hydrofluorocarbons (HFCs)
  - Perfluorocarbons (PFCs)



## Carbon Footprint Model

16

- Form and Function
- Parameters
- **Assumptions**
- Calculations
- Applications



## Carbon Footprint Model Assumptions

17

- Direct emissions-emissions generated from technology and its application (e.g. thermal combustion)
- Indirect emissions- emissions consequential to the implementation of the technology (e.g. electricity)
- Focus on on-site off-gas treatment technologies and associated transport
- Complete life cycle of technologies not included (e.g. raw material extraction)
- Stationary and mobile combustion emissions, process emissions and indirect emissions
- Fugitive emissions *de minimus*



## Carbon Footprint Model Assumptions continued

18

Emission sources

- Stationary combustion emissions
- Mobile combustion emissions
- Indirect emissions
- Physical or chemical processing emissions
- Fugitive emissions
- De Minimus Emissions

## Carbon Footprint Model

19

- Form and Function
- Parameters
- Assumptions
- **Calculations**
- Application



## Calculations

20

*Calculation of Mass Removal Rate for SVE*

- M = Q* (L/ft^3) *VOC conc*T
- M = Mass of recoverable contaminant in source area
- Q = Flow Rate in liters
- VOC = influent VOC concentration in lbs (convert to lbs by multiplying the VOC in ppmV by the number of moles 165.8 for PCE and 131.4 for TCE) / (mole ratio 24.45)* 0.0000000022
- T = time in minutes



## Calculations cont.

21

*Calculation for Natural Gas Requirement for thermal oxidizer*

$$Q = \frac{Dw\ Qw\ [Cp(1.1Tc-The-0.1Tr)-Hw]T}{Dsf\ [Hsf-1.1Cp\ (Tc-Tr)]}$$

Dw = density of waste air stream (usually 0.0739 lb / scf)
Q = total volume of supplementary fuel, CF of methane
Cp = Mean heat capacity
Tc = combustion temperature
The = temperature of waste air stream
Tr = reference temperature, 77degree F
Hw = heat content of waste air stream, Btu/lb (2,141 for PCE and 3,140 for TCE)
T = total time of operation, minutes
Dsf = density of supplementary fuel, lb/scf (0.0408 lb/scf for methane)
Hsf = heating value of supplementary fuel, Btu/lb (21,600 Btu/lb for methane)



## Calculations cont.

22

*Calculation for Fuel Combustion*

Total GHG emissions = emission factor x fuel consumed x 0.001
(metric tons) (kg / gallon) (gallons) (metric tons/kg)
Where,
kg = kilogram
0.001 metric ton = 1 kg

*Calculation for Electricity*

Total GHG emissions = electricity use x electricity emission factor / 2,204.62
(metric ton) (kWh) (lbs /kWh) (lbs/metric ton)
Where,
kWh = kilowatts hour
lbs = pounds
2,204.62 lbs = 1 metric ton



## Carbon Footprint Model

23

- Form and Function
- Parameters
- Assumptions
- Calculations
- **Applications**



## History of Soil Vapor Extraction

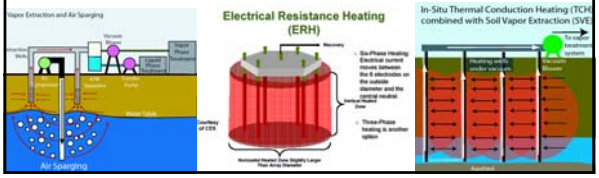
24

- Duane Knople one of the first to use SVE in 1972 (Thornton and Wootan, 1982)
- 25% of most U.S. soil remediation utilizes SVE (EPA, 2000)
- 15% of U.S. superfund sites utilizes SVE (FY 82-02; EPA, 2004)
  - 70% of which uses GAC
  - 25% uses Therm-Ox or Cat-Ox

## Off-Gas Treatment Applications

25

- Soil Vapor Extraction (SVE)
- Multi-phase extraction (MPE)
- Air/ozone sparge/SVE
- In-Situ Thermal Remediation (ISTR) using electrical resistance heating (ERH) or thermal conduction heating (TCH)




## Off-Gas Treatment Technologies

26

**Traditional (>95%)**

- Granular activated carbon (GAC)
- Direct-flame thermal oxidizers
- Flameless thermal oxidizers (FTO)
- Catalytic oxidizers (Cat-Ox)
- Hybrid thermal/catalytic
- Internal Combustion Engine (ICE)

**Non-traditional (<5%)**

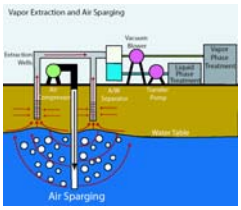
- Biofiltration
- Vapor condensation
- $C^3$ Technology



## Why Consider GHG Footprinting for SVE?

27

- **Conceptualize the impact to global warming**
- Regulatory requirements
- Community action groups
- Years of SVE operation- Emissions are cumulative
- Social responsibility
- Carbon credit value$$$






## Outline

28

- What is Environmental Sustainability?
- Dissecting the Feasibility Analysis
- Carbon Footprint Model
  - Form and Function
  - Parameters
  - Assumptions
  - Calculations
  - Off-Gas Treatment Applications
- Three GHG Footprint Case Studies Considering
- Resource Conservation



## GHG Footprint Case Studies

29

| | Case Study 1 | Case Study 2 | Case Study 3 |
|---|---|---|---|
| GAC | 400 | 1,300 | 1,800 |
| TO | 200 | 300 | 800 |
| C3 | 150 | 300 | 600 |
| | *C3 has lowest footprint* | *C3 and TO have equivalent footprint* | *C3 has lowest footprint* |
| | Equivalent size systems | Equivalent size systems | Thermal system oversized to 600 scfm |
| System Size: | 100 SCFM | 200 scfm | 200 scfm |

*Annual footprint estimates do not include equipment and component manufacturing

And are measured in metric tons of CO2



## Case Study 3 Footprint Analysis

30

- **TABLE 1. Carbon Footprint Evaluation**

| Off-Gas Technology | Carbon Footprint in metric tons of $CO_2$ | Potential for Resource Conservation |
|---|---|---|
| 200 SCFM GAC system | ~1800 | Limited, footprint for mining and consumption of natural resources not quantified |
| 600 SCFM Thermal Oxidation | ~800 | Limited, footprint for disposal of acid waste not quantified |
| 200 SCFM C3-Technology | ~600 | Moderate to high, if recovered chemical was recycled it would provide a credit to the footprint |

## GAC Environmental Impact

31

- Derived from coal mining (**i.e. natural resource**) or carbonization of other organic materials
- Transported from distant countries, processed, distributed and delivered to sites
- GAC regeneration energy is significant
- Out of State transportation

= Large carbon footprint



## Thermal Oxidation Env. Impact

32

- Supplemental fuel usage is most significant carbon footprint lever
- Direct incineration results in CO2 emissions
  - Potential formation of dioxins and furans and untreated VOCs
  - CO, CO2, and nitrogen / sulfur oxides
- Salts collected from acid scrubber
- Moderate carbon footprint can be high



## C3 Technology Env. Impact

33

- Electricity use on-site is most significant factor
- Low to Moderate carbon footprint
- No incineration of organics on-site
- VOCs containerized for transport off-site for **recycling, reuse or incineration**



## Outline

34

- What is Environmental Sustainability?
- Dissecting the Feasibility Analysis
- Carbon Footprint Model
  - Form and Function
  - Parameters
  - Assumptions
  - Calculations
  - Off-Gas Treatment Applications
- Three GHG Footprint Case Studies
- Considering Resource Conservation



## Considerations

35

**GAC**

Raw materials mining and consumption

**Thermal Oxidation**

Supplemental fuel required to operate

**C3 Technology**

* Electricity usage

** *Opportunity for reuse / recycle or fuel replacement*



## Conclusion

36

- Technical Feasibility
  - Refrigeration reveals significant opportunity
- Cost Analysis
  - Refrigeration offers cost savings
  - Time of remediation may be reduced $$
- Environmental Sustainability
  - No emissions on site
  - Chemical recovery = resource conservation
  - Cost recovery by sale / reuse of chemical

## Conclusion (continued)

37

- Carbon Footprint Model
  - Calculator with standard calculations
  - Clearly defined assumptions with boundaries
- Resource Conservation
  - Reduce
  - Reuse or recycle or sell$$



## Questions

38



## Thank you!

39

References


- AFCEE, 1996. *A General Evaluation of Bioventing for Removal Actions at Air Force / Department of Defense Installations Worldwide: General Engineering Evaluation / Cost Analysis (EE/CA).* June.
- Downey, D.C., Pluhar, C.J., and Archabal, S.R., *A Performance and Cost Evaluation of Purus Padre® Regenerative Resin for Treatment of Hydrocarbon Vapors from Fuel-Contaminated Soils.* Prepared for AFCEE.
- **Sustainability Reporting Guidelines.** Version 3.0, *The Global Reporting Initiative*, The Netherlands. 2000-2006.
- U.S. EPA, 2006. *Off-Gas Treatment Technologies for Soil Vapor Extraction Systems: State of the Practice*, March.
- U.S. EPA, 2004. *Treatment Technologies for Site Cleanup: Annual Status Report. 11th Edition.* EPA-542-R-03-009. February.
- U.S. EPA, 2004 *Introduction to Energy Conservation and Production at Waste Cleanup Sites.* Engineering Forum Issue Paper. Document 542-S-04-001. Michael Gill and Katarina Mahutova. May
- U.S. EPA, 2001. *Remediation Technology Cost Compendium-Year 2000.* Document EPA-542-R-01-009. September.
- EPA.GOV, Climate Leaders Reporting- Inventory Management Plan Checklist. Version 03/10/2005

# Attachment 4
# DuPont and California DTSC
# Sustainability Pilot Project

# Sustainability Pilot Project
# DuPont - Oakley, CA

**DuPont, California DTSC, EPA Region 9**





## Primary Pilot Project Contributors

| | |
|---|---|
| **Chuck Orwig** | **DuPont** |
| **Dave Ellis** | **DuPont** |
| **Peter Ruttan** | **DTSC** |
| **Paul Hadley** | **DTSC** |
| **Mikos Fabersunne** | **DTSC** |
| **Karen Scheuermann** | **EPA 9** |
| **Brandt Butler** | **URSD** |
| **George Gregory** | **URSD** |
| **Gordon Burnett** | **URSD** |





## Green Team Pilot Project - Investigation

**Goal: To enable commercial or industrial site development, conduct an investigation to identify, evaluate, and select an effective, sustainable remedy for residual PCE in the $TiO_2$ Manufacturing Area.**

**Objectives:**

1. **Determine the nature and extent of residual PCE in the $TiO_2$ Manufacturing Area**
   - > C/I criteria in top 6 feet of soil? Wet season depth to GW = 5-6 feet bgs.
   - Capillary fringe influence on groundwater – data collection during pilot to be used in GW CMS. How to integrate pilot with GW CMS (or keep both on separate administrative tracks)?
   - Indoor air pathway – soil vapor investigation work plan is already developed. No further investigation required because VI pathway is pre-empted by future vapor mitigation control systems?
2. **Analytical parameters will include all pertinent chemical and physical data necessary for a remedy effectiveness evaluation**
3. **Sustainability objective: Evaluate and document, to the degree required by DTSC, both the efficiency and effectiveness of proposed investigation techniques (or other parameters specified by DTSC)**



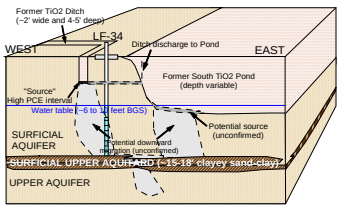


## Oakley Site
## Sustainable Remediation Focus Area






## Conceptual Source – What do we know?




**Known knowns**

- **PCE is dense (specific gravity of 1.62)**
- **Dredge spoil was deposited in water – no compaction - loose**
- **Fine, permeable surficial sand**
- **Ditch was wood-lined; now backfilled with sand**
- **Geoprobe location in Phase 2 RFI hit wood fibers and wet, very light gray silt at about 5 feet BGS, wood fibers were soaked in brown liquid (PCE of 1,400 mg/kg in sample of soil right beneath wood). 1'-1.5' BGS sample had much lower concentration (0.012 mg/kg PCE)**

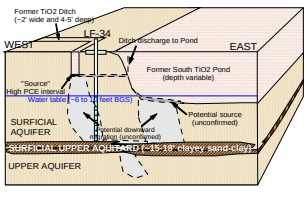
**Assumptions:**

- **Source (brown liquid) very easy to miss with random sampling – must find ditch to find high concentrations. Soil "near" source has PCE, but not very high concentrations, step outs should be tight with the source.**
- **Assume PCE could have entered into at least the south pond at the discharge points and if so would have settled through the dredge spoil.**





## Conceptual Source – What are we looking for?




**Known Unknowns**

**Source Migration Issues**

- **How far "upstream" of the Reaction Purification & Oxidation Sump and Tank (SWMU 4.23 and 4.25) is the PCE in the ditch?**
- **How deep has PCE source gone?**
- **Where has it reached the water table?**
- **What is the extent of soil with >10 mg/kg of PCE?**

**Additional Source Release Issues**

- **Did the Secondary Containment Pond also receive PCE? Other sumps?**

**DQO: Find Ditch & Source then determine extent of >10 mg/kg PCE soil** (from groundwater team: establish link between PCE source in soil and in groundwater)

## South Pond – 1960's



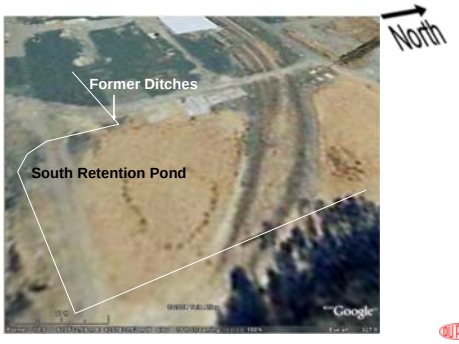



## 1960's Ditches and Discharges






## South Pond Today








## Proposed Milestones and Timing

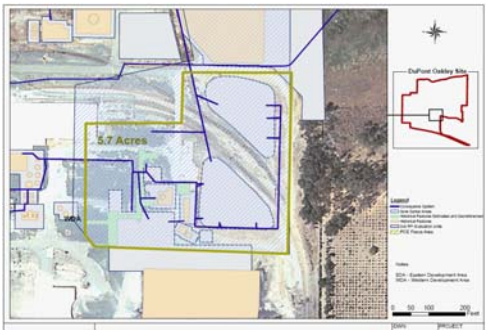
| Milestone | Focus | Approximate Date |
|---|---|---|
| Meeting 1 | Kickoff Green Investigation and Remediation Pilot | July 2008 |
| Meeting 2 | Green Investigation to Determine Exposure Pathways | August-September 2009 |
| Meeting 3 | Review Green Investigation and Screen Technologies for Threshold Criteria | November-January 2009 |
| Meeting 4 | Preliminary Review of Green Remediation Screening and Selection Criteria | January-March 2009 |
| Meeting 5 | Detailed Review of Green Remediation Screening and Selection Criteria | March-May 2009 |
| Meeting 6 | Remedy Consensus and Final Activities | May-July 2009 |
| Submittal | Submit Required Documentation | August-November 2009 |

*Overall timing: 12 to 16 months*





## Proposed Investigation Boundaries








## Decision Units

**"Decision Units" were used to identify similar areas throughout the site in which all analytical results can be averaged (considered together) to determine if the 95% UCL is less than 10 ppm.**

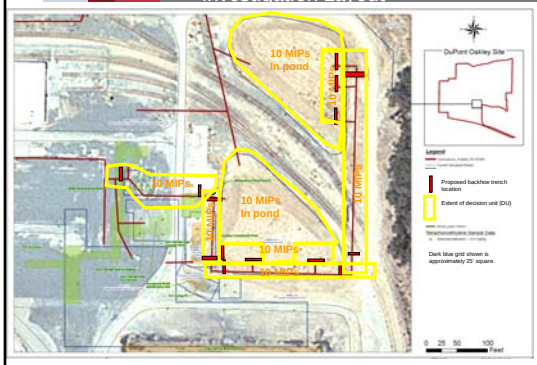
**10 ppm is the proposed criterion for saying 'no further action necessary'.**

**These decision units were determined by group discussion.**

**However, DuPont will investigate further/remediate when any measurement is greater than 20 ppm.**

## Investigation Layout






1) Perform backhoe trenching to confirm location of ditches
2) Perform MIPs to establish "hot zones"
3) Collect 4 samples per DU (~36 soil samples for the entire area)





## Oakley Hybrid Investigation

| Decision Unit | Description | Proposed Sampling |
|---|---|---|
| RP&O Trench | Wood-lined ditch was approximately 2 feet wide and 200 feet long; Near SWMU 4.23 and 4.25; | Trench across east and west ends; 10 MIPs locations; collect four soil samples using a geoprobe rig. |
| West Trench | Wood-lined ditch was approximately 2 feet wide and 130 feet long | Trench across north and south ends; 10 MIPs locations; collect four soil samples using a geoprobe rig. |
| South Trench | Wood-lined ditch was approximately 2 feet wide and 230 feet long | Trench across east and west ends; 10 MIPs locations; collect four soil samples using a geoprobe rig. |
| East Trench | Wood-lined ditch was approximately 2 feet wide and 350 feet long | Trench across north and south ends; 10 MIPs locations; collect four soil samples using a geoprobe rig. |
| South Pond | SWMU 4.19 – Former South Retention Pond; approximately ½ acre | 20 MIPs locations; collect four soil samples using a geoprobe rig. These locations include the nine MIPs near the discharge points. |
| South Pond Discharge points | Three discharge points within the South Pond DU. MIP locations performed near the discharge points are included in the 20 proposed for the South Pond | Trench across each discharge point; three MIPs locations in close to each discharge to best define impact near the discharge |
| North Pond | SWMU 4.20 – Former North Retention Pond; approximately ½ acre | 20 MIPs locations; collect four soil samples using a geoprobe rig. These locations include the nine MIPs near the discharge points. |
| North Pond Discharge points | Three discharge points within the North Pond DU. MIP locations performed near the discharge points are included in the 20 proposed for the North Pond | Trench across each discharge point; three MIPs locations in close to each discharge to best define impact near the discharge |





## Oakley Hybrid Investigation






## Analysis of Method 8260 Waste Streams

**Interviewed several chemists. "Gee – I don't think anyone has really looked into this before!" was a common input**

**Most suggested wastes depend on storage and preservation methods, detection limits, lab-specific practices**

**Relatively little liquid wastes (few ml per sample) expected, more if serial dilutions necessary, but overall still not a lot. Some field methods – those requiring decontamination – may generate more liquid waste than labs!?!?**

**Chemists felt more energy went into storage facilities and maintaining lab temperature than into analytical equipment**

**Overall the wastes and energy used should be much less than other aspect of site characterization**

**Overall it appears labs contribute little negative environmental burden relative to other activities**

**To quantify these general observations would likely take a good deal of effort**





## Sustainability Estimation for Field Methods

| Measures of Sustainability | | GeoProbe Mobilization | Drill Rig Mobilization | MIP Survey Mobilization | Gore Sorbers Mobilization | Backhoe Excavation Mobilization | Geophysics Mobilization | On-site Lab Mobilization |
|---|---|---|---|---|---|---|---|---|
| Greenhouse Gas $CO_2$ Equivalents (Tons) | | 0.21 | 0.41 | 0.26 | 0.10 | 0.45 | 0.21 | 10.94 |
| Energy Usage (kWh) | | 746 | 1,491 | 932 | 373 | 1,491 | 746 | 39,144 |
| Resource Usage | Soil (tons) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Land (acre) | na | na | na | na | na | na | na |
| Project-Specific Measures | | | | | | | | |
| Occupational Risk | Exposure Hours | 5 | 7 | 5 | 2 | 5 | 5 | 84 |
| | Total Mileage | 120 | 360 | 240 | 120 | 240 | 240 | 4,200 |
| Local | Dust Generation | - | - | - | - | - | - | - |
| | Noise Level | - | - | - | - | - | - | - |
| | Traffic Congestion | - | - | - | - | - | - | - |
| | $PM_{2.5}$ (ton) | 0.01 | 0.03 | 0.02 | 0.01 | 0.02 | 0.02 | 0.37 |
| | $PM_{10}$ (ton) | 0.07 | 0.21 | 0.14 | 0.07 | 0.14 | 0.14 | 2.49 |
| | $NO_x$ (ton) | 0.00 | 0.01 | 0.01 | 0.00 | 0.01 | 0.00 | 0.26 |
| | $SO_x$ (ton) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 |
| | VOCs (ton) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 |
| Consumables | Gasoline (gal) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Diesel (gal) | 15 | 32 | 20 | 8 | 32 | 15 | 840 |
| | PVC (ton) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | HDPE (ton) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Carbon (ton) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Concrete (cy) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Drying Agent (ton) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Grid Energy (kWh) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |





## Sustainability Estimation for Field Methods

| Measures of Sustainability | | GeoProbe | Drill Rig | MIP Survey | Gore Sorbers | Backhoe Excavation | Geophysics | On-site Lab | Well Installation |
|---|---|---|---|---|---|---|---|---|---|
| | | production per day | production per day | production per day | production per day | production per day | production per day | production per day | production per day |
| Greenhouse Gas $CO_2$ Equivalents (Tons) | | 0.58 | 0.44 | 0.57 | 0.10 | 0.44 | 0.10 | 0.26 | 0.66 |
| Energy Usage (kWh) | | 2,423 | 1,852 | 2,072 | 416 | 1,666 | 416 | 932 | 3,464 |
| Resource Usage | Soil (tons) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Land (acre) | na | na | na | na | na | na | na | na |
| Project-Specific Measures | | | | | | | | | |
| Occupational Risk | Exposure Hours | 27 | 27 | 36 | 36 | 27 | 27 | 39 | 33 |
| | Total Mileage | 25 | 25 | 25 | 50 | 25 | 50 | 0 | 38 |
| Local | Dust Generation | - | - | - | - | - | - | - | - |
| | Noise Level | - | - | - | - | - | - | - | - |
| | Traffic Congestion | - | - | - | - | - | - | - | - |
| | $PM_{2.5}$ (ton) | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 |
| | $PM_{10}$ (ton) | 0.03 | 0.03 | 0.03 | 0.00 | 0.03 | 0.00 | 0.00 | 0.05 |
| | $NO_x$ (ton) | 0.01 | 0.01 | 0.01 | 0.00 | 0.01 | 0.00 | 0.01 | 0.01 |
| | $SO_x$ (ton) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | VOCs (ton) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Consumables | Gasoline (gal) | 5 | 5 | 5 | 10 | 5 | 10 | 0 | 13 |
| | Diesel (gal) | 39 | 39 | 49 | 0 | 39 | 0 | 20 | 35 |
| | PVC (ton) | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 |
| | HDPE (ton) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Carbon (ton) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Concrete (cy) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Drying Agent (ton) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Grid Energy (kWh) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## First Investigation Sustainability Estimates: 10-3-2008

| Investigation Plan Analysis | | Visually Certain Approach | Quantitative Approach | Hybrid Approach |
|---|---|---|---|---|
| GEOPROBE - borings | | 0 | 80 | 12 |
| DRILL RIG - borings | | 0 | 0 | 0 |
| MIP - locations | | 0 | 0 | 80 |
| GORE SORBERS - units installed | | 0 | 0 | 0 |
| BACKHOE - trenches | | 24 | 0 | 14 |
| GEOPHYSICS - acres surveyed | | 0 | 2 | 0 |
| ON-SITE LAB - field days | | 0 | 0 | 0 |
| OFF-SITE LAB - samples | | 48 | 160 | 24 |
| OTHER - not active | | 0 | 0 | 0 |
| OTHER - not active | | 0 | 0 | 0 |
| **Measures of Sustainability** | | | | |
| Greenhouse Gas $CO_2$ Equivalents (Tons) | | 3.27 | 8.36 | 11.68 |
| Energy Usage (kWh) | | 11,711 | 37,778 | 43,739 |
| Resource Usage | Soil (tons) | 0 | 0 | 0 |
| | Land (acre) | na | na | na |
| Project-Specific Measures | | | | |
| Occupational Risk | Exposure Hours | 195 | 508 | 687 |
| | Total Mileage | 342 | 1,000 | 1,016 |
| Local | Dust Generation | - | - | - |
| | Noise Level | - | - | - |
| | Traffic Congestion | - | - | - |
| | $PM_{2.5}$ (ton) | 0.05 | 0.11 | 0.12 |
| | $PM_{10}$ (ton) | 0.41 | 0.98 | 1.00 |
| | NOx (ton) | 0.07 | 0.11 | 0.25 |
| | SOx (ton) | 0.01 | 0.01 | 0.02 |
| | VOCs (ton) | 0.01 | 0.03 | 0.04 |
| Consumables | Gasoline (gal) | 35 | 96 | 102 |
| | Diesel (gal) | 212 | 312 | 788 |
| | Grid Energy (kWh) | 384 | 1,280 | 192 |





## Proposed Path Forward and Timing

| Milestone | Focus | Approximate Date |
|---|---|---|
| Meeting 1 | Kickoff Green Investigation and Remediation Pilot | July 2008 |
| Meeting 2 | Green Investigation to Determine Exposure Pathways | August-September 2009 |
| Meeting 3 | Review Green Investigation and Screen Technologies for Threshold Criteria | November-January 2009 |
| Meeting 4 | Preliminary Review of Green Remediation Screening and Selection Criteria | January-March 2009 |
| Meeting 5 | Detailed Review of Green Remediation Screening and Selection Criteria | March-May 2009 |
| Meeting 6 | Remedy Consensus and Final Activities | May-July 2009 |
| Submittal | Submit Required Documentation | August-November 2009 |

*Overall timing: 12 to 16 months*

# Attachment 5
# Evaluation of Sustainability Metrics at a Site in Sicily, Italy

# SURF 8

## Evaluation of Sustainability Metrics at a Site in Sicily (Italy)

**Alessandro Battaglia, Erika Germiniani, Paolo Belfanti**
**ENSR Italia**

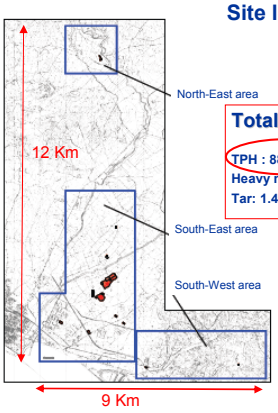
## The site: Gela Plain – Integrated Soil remediation Project

ENSR | AECOM




## Site location

ENSR | AECOM




**Total contaminated soil: 883.200 m³**

**TPH : 880.300 m³**
**Heavy metal: 1.440 m³**
**Tar: 1.460 m³**



## Integrated Remediation Strategies

ENSR | AECOM

STRATEGY **A**: Thermal desorption + Landfarming ex situ

STRATEGY **B**: Landfarming ex situ + Vertical barrier

STRATEGY **C**: Landfarming in situ + Vertical barrier



## Identification of Remediation activities

ENSR | AECOM

- Excavation
- Transportation
- Landfarming in-situ
- Landfarming ex-situ
- Thermal treatment
- Construction of vertical barrier
- Site restoration

**Others can be considered**



## Inventory of metrics

ENSR | AECOM

- Gas emissions
  - $CO_2$, CO, $SO_x$, $NO_x$
- Dust emissions
  - TSP (Total Suspended Particulate Matter), Ø< 40 µ:
    - Gross particulate
    - **$PM_{10}$ Ø < 10 µ**
    - **$PM_{2,5}$ Ø < 2,5 µ**
- Consumption of Resources
  - Energy (mechanical, electrical, thermal – produced by combustion)
  - Soil (decrease in ability to utilize this resource)
  - Water

ENSR | AECOM

# Inventory of metrics

- Waste production
- Workplace accidents
- Contaminated soil to be disposed in a landfill
- Expected number of work-related accidents and deaths

**Should be compared with decrease in risk due to remediation**



## Quantification of Effects

ENSR | AECOM

**Input data** → **Calculation equations** → **Output data**

Sources:
- U.S. EPA
- APAT (Italian Env.. Agency)
- INAIL (Italian workers compensation agency)
- Trade associations
- Site-specific data
- Etc...

Developed by ENSR Italia

Quantification of the effects of the remediation activities (calculation matrices as Excel spreadsheet)

Only **FIRST ORDER EFFECTS** are calculated, which include effects associated to the remediation activities without accounting for effects due to the production of goods needed for the implementation of those activities



## Quantification of Effects – calculation equations

ENSR | AECOM

***THERMAL TREATMENT***

**GAS EMISSIONS**

***Inputs***

| | | |
|---|---|---|
| $V$ | = total treatment volume | ($m^3$) |
| ρ | = average soil density | ($Kg/m^3$) |
| $T$ | = plant throughput | (ton/day) |
| $\Delta T$ | = soil temperature increase | (°C) |
| $K$ | = energy content of diesel fuel | ($MJ/L_{diesel}$) |
| $c$ | = specific heat of soil | ($MJ/Kg°C$) |
| $Eff$ | = combustion efficiency | (-) |
| $FE_{CO_2}$ | = emission factor for $CO_2$ (see note 1) | ($Kg/L_{diesel}$) |
| $FE_{CO}$ | = emission factor for CO | ($Kg/L_{diesel}$) |
| $FE_{NO_X}$ | = emission factor for $NO_X$ | ($Kg/L_{diesel}$) |
| $FE_{SO_X}$ | = emission factor for $SO_X$ | ($Kg/L_{diesel}$) |

***Intermediate quantities***

| | | |
|---|---|---|
| $M$ | = mass of soil to be treated $= \rho \cdot V$ | (ton) |
| $C$ | = daily diesel fuel utilization rate $= \frac{c \cdot \Delta T \cdot T}{K \cdot Eff}$ | ($L_{diesel}$/day) |
| $N_g$ | = treatment time $= \frac{V}{T}$ | (day) |
| $L$ | = total liters of diesel fuel utilized $= N_g \cdot C$ | ($L_{diesel}$) |

***Outputs***

| | | |
|---|---|---|
| $E_{CO2}$ | = $CO_2$ emissions = $FE_{CO_2} \cdot L$ | (Kg) |
| $E_{CO}$ | = CO emissions = $FE_{CO} \cdot L$ | (Kg) |
| $E_{NOx}$ | = $NO_X$ emissions = $FE_{NO_X} \cdot L$ | (Kg) |
| $E_{SOx}$ | = $SO_X$ emissions = $FE_{SO_X} \cdot L$ | (Kg) |

Remediation activity (soil thermal treatment)

Metric (gas emissions)



## Quantification of Effects – calculation matrices

ENSR | AECOM

***3.1 - THERMAL TREATMENT***

**GAS EMISSIONS**

| Inputs Symbol | Value | Units | Descriptions | Notes |
|---|---|---|---|---|
| V | 676.000 | $m^3$ | total treatment volume | |
| ρ | 1,700 | $kg/m^3$ | average soil density | |
| T | 336 | ton/day | plant troughput | dati medi relativi al trattamento di idrocarburi presenti per un terreno caratterizzato da un'umidità naturale del 20% |
| ΔT | 300 | °C | soil temperature increase | |
| K | 38.79 | MJ/L | energy content of diesel fuel | "energy contenent of Diesel fuel", Energy Information Administration, EIA (http://www.eia.doe.gov/kids/energyfacts/sciences/energy_calculator.html#diesel-calc) |
| c | 1.8 | MJ/Kg °C | specific heat of soil | calore specifico medio per un terreno sabbioso limoso, con una frazione argillosa (da Università di agraria di Torino) |
| Eff | 0.9 | - | combustion efficiency | stimata un'efficienza di combustione del 90% |
| $FE_{CO2}$ | 2.66 | Kg $CO_2$/L-diesel | emission factor for $CO_2$ | "Emissions Factors &AP 42,EPA, Fifth Edition" "External Combustion Sources", "Fuel Oil Combustion", background document: Table 3 (http://www.epa.gov/ttn/chief/ap42/ch01/bgdocs/b01s03.pdf) |
| $FE_{CO}$ | 6.00E-04 | Kg CO/L-diesel | emission factor for CO | "Emissions Factors &AP 42,EPA, Fifth Edition" "External Combustion Sources", "Fuel Oil Combustion", Table 1.3-1 (http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s03.pdf) |
| $FE_{NOx}$ | 2.37E-03 | Kg $NO_X$/L-diesel | emission factor for $NO_X$ | |
| $FE_{SOx}$ | 9.00E-04 | Kg $SO_X$/Ldiesel | emission factor for $SO_X$ | |

***Intermediate quantities***

| | | |
|---|---|---|
| M | 1,152.920 | ton |
| C | 5,157 | $L_{diesel}$/day |
| $N_g$ | 3,430 | day |
| L | 17,826,021 | $L_{diesel}$ |

***Outputs***

| | | |
|---|---|---|
| $E_{CO2}$ | 47,417.215 | Kg $CO_2$ |
| $E_{CO}$ | 10,698 | Kg CO |
| $E_{NOx}$ | 42,248 | Kg $NO_X$ |
| $E_{SOx}$ | 16.043 | Kg $SO_X$ |

| | |
|---|---|
| $CO_2$ emissions | |
| CO emissions | |
| NOx emissions | |
| SOx emissions | |



## Summary of metrics (Strategy A)

ENSR | AECOM

| Stressors | Units | ACTIVITIES DURING ACTIVE REMEDIATION: EXCAV. | TRANSP. | THERMAL TREATMENT | LANDFARMING TREATMENT | TRANSP. | BACKFILLING | SHEETPILING | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Gas emissions*** | | | | | | | | | | |
| $CO_2$ | kg | 1.4E+06 | 6.6E+05 | 4.7E+07 | 5.1E+05 | 6.6E+05 | 7.0E+05 | 3.0E+04 | 50.200 | |
| CO | kg | 6.0E+04 | 2.9E+03 | 1.1E+04 | 3.2E+02 | 2.9E+03 | 6.0E+04 | 1.3E+04 | 138 | t |
| $NO_X$ | kg | 4.9E+04 | 2.4E+03 | 4.3E+04 | 1.3E+03 | 2.4E+03 | 4.9E+04 | 1.0E+04 | 159 | |
| $SO_X$ | kg | 6.9E+03 | 1.6E+02 | 1.1E+04 | 1.9E+01 | 1.6E+02 | 7.7E+02 | 2.0E+02 | 19 | |
| ***Work accidents*** | | | | | | | | | | |
| expected number of accidents | - | 3.4E+00 | 1.9E-02 | 2.7E+00 | 2.7E+00 | 1.9E-02 | 3.4E+00 | 4.4E-01 | 12.2 | - |
| expected number of deadly accidents | - | 1.0E-02 | 9.1E-04 | 8.2E-03 | 4.1E-04 | 9.1E-04 | 1.0E-02 | 1.3E-03 | 0.031 | |
| ***Dust emissions*** | | | | | | | | | | |
| $E_{PM10}$ | kg | 5.6E+06 | 1.6E+05 | 5.1E+01 | 4.3E-01 | 1.6E+05 | 5.6E+06 | 4.6E+05 | 11.300 | t |
| $E_{TSP}$ | kg | 7.8E+05 | 1.6E+04 | 7.1E+00 | 6.0E-02 | 1.6E+04 | 7.8E+05 | 6.4E+04 | 1,900 | |
| ***Energy consumption*** | | | | | | | | | | |
| mechanical/combustion/electrical energy | MJ | 2.0E+07 | 3.7E+06 | 7.8E+08 | 1.6E+06 | 3.7E+06 | 1.0E+07 | 1.9E+05 | 8.20E+08 | MJ |
| ***Water consumption*** | | | | | | | | | | |
| groundwater and superficial water | $m^3$ | 2.6E+05 | - | - | 1.3E+05 | - | - | 1.5E+04 | 394.000 | $m^3$ |
| ***Carbon footprint*** | | | | | | | | | | |
| oak wood | | | | | | | | | 440 | ha |
| agricultural land | | | | | | | | | 620 | |



## Carbon Sequestration by Plants

ENSR | AECOM

QUANTIFIED AS THE WOODED OR AGRICULTURAL SURFACE NECESSARY TO ABSORB THE $CO_2$ PRODUCED DURING THE REMEDIATION ACTIVITIES

1) Calculation of $CO_2$ produced per year (from previous analysis)

2) Quantification of the wooded and agricultural biomass necessary to absorb the $CO_2$ produced

3) Quantification of the wooded and agricultural surface based on the vegetation growth rate

ENSR | AECOM

## Biomass and Growth Rate

The quantity of **Carbon** fixed in the form of **biomass** (as dry matter - d.m.) is estimated as

**1 g d.m. = 0,5 g C = 2,02 g $CO_2$**

The vegetation **growth rate** is a function of the vegetation type

Natural woods (e.g. Oak): **9 t d.m./ha-y**

Agricultural land: **6.5 t d.m./ha-y**

Carbon Footprint (ha) = $$\frac{CO_2 prod(ton\ CO_2 / y)}{2.02 \frac{ton\ CO_2}{ton\ d.m.} * GrowthRate(\frac{ton\ d.m.}{ha * y})}$$

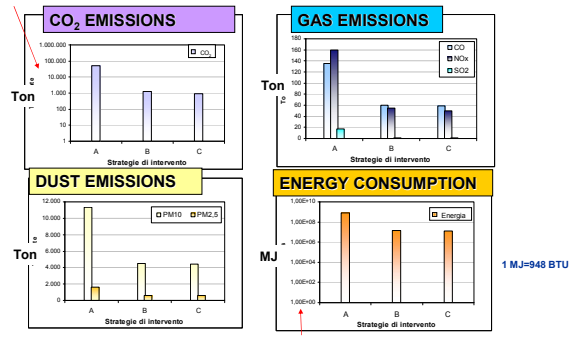
(ha=hectare=2.47 acres)



## Comparative Results

ENSR | AECOM

Note: scale is logarithmic



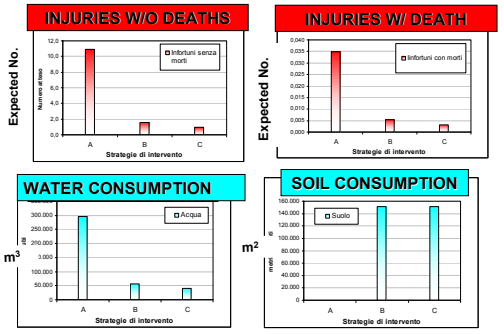

1 MJ=948 BTU

Note scale is logarithmic



## Comparative Results

ENSR | AECOM






## Comparison of Alternatives

ENSR | AECOM

| | A | B | C | Units |
|---|---|---|---|---|
| ***Gas emissions*** | | | | |
| $CO_2$ | **50,900** | 1,300 | 800 | t |
| CO | **136** | 60 | 58 | |
| $NO_x$ | **160** | 55 | 49 | |
| $SO_x$ | **18** | 0.77 | 0.69 | |
| ***Work accidents*** | | | | |
| expected number of accidents | **12.19** | 1.57 | 0.97 | - |
| expected number of deadly accidents | 0.031 | **0.0053** | 0.0031 | |
| ***Dust emissions*** | | | | |
| $E_{PM10}$ | **11,300** | 4,500 | 4,400 | t |
| $E_{PM2.5}$ | **1,600** | 600 | 600 | |
| ***Energy consumption*** | | | | |
| mechanical/combustion/electrical energy | **8.20E+08** | 1.47E+07 | 1.14E+07 | MJ |
| ***Water consumption*** | | | | |
| groundwater and superficial water | **296,000** | 56,000 | 25,000 | $m^3$ |



## Plant contribution to carbon sequestration

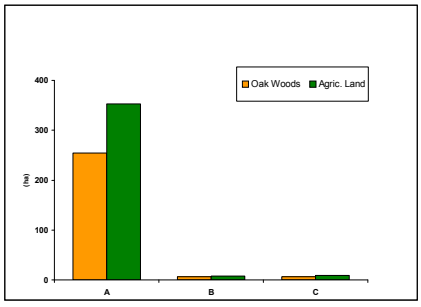
ENSR | AECOM

| STRATEGY | $CO_2$ Production ton/yr | $CO_2$ absorbed ton $CO_2$/ton d.m. | Vegetation Growth Rate (oak woods) t d.m./ha-yr | Vegetation Growth rate (agricultural land) t d.m./ha-yr | Oak wood ha | Agricultural Land ha |
|---|---|---|---|---|---|---|
| A | 4627 | 2.02 | 9 | 6.5 | 255 | 352 |
| B | 108 | 2.02 | 9 | 6.5 | 6 | 8 |
| C | 114 | 2.02 | 9 | 6.5 | 6 | 9 |



## Plant contribution to carbon sequestration

ENSR | AECOM



## Regulatory status

ENSR | AECOM

- Analysis submitted to Italian Ministry of Environment as part of Feasibility Study
- No response yet regarding analysis
- Client requested ENSR to proceed with remedial design of Strategy C (with minor changes)
- Submittal of design document to Ministry will occur shortly



## Path Forward

ENSR | AECOM

- Additional research needed
  - Further study of potential impacts of various remediation activities
  - Further development of equations for their calculation
  - Development of calculation methods for additional remediation activities
  - Update of database
  - Etc.
- Integration with RACER software for the development of a user friendly, practical tool for the evaluation of sustainability metrics associated with remediation activities to support strategic site management choices



ENSR | AECOM

## Contacts


- Alessandro Battaglia, Ph.D., P.E.
  - ENSR Italia – Rome
  - 011 39 06 68 13 69 36
  - abattaglia@ensr.aecom.com
- Erika Germiniani, P.G., Paolo Belfanti, P.G.
  - ENSR Italia – Milan
  - 011 39 02 31 80 771
  - egerminiani@ensr.aecom.com; pbelfanti@ensr.aecom.com

**Attachment 6**
**SURF UK: An Update**

## SuRF UK - An update (October 2008)

Frank Evans

SuRF UK Steering Group

## Outline of Presentation

- Background to SURF UK and progress to date
- Web-site information
- UK Policy Context
- Conceptual Framework

## Background to SURF UK

- Follow-up to US SURF initiative
- Built on June 2007 meeting in London
- Nicola Harries presented output at SURF4 mtg
- SURF UK initiated

## Progress to date

- Establishment of a steering group
- Development of a working mission statement and a definition for SR
- One open forum meeting
- Launch of SURF UK web-site
- Conceptual framework for consultation

## SURF UK: Format & Steering Group

**Steering Group**

**Open Forum meetings x 3**

- Open to all
- May 08, Nov 08, Feb 09

**Consultation via CL:AIRE website (www.claire.co.uk)**

**Links to:**

- SURF US
- NICOLE

**CL:AIRE**

**Environment Agency**

**Industry**

- Shell Global Solutions
- National Grid

**r³ Environmental Technology Ltd**

**SURF US**

**English Partnerships**

## SURF-UK Web-site

- CL:AIRE web-site (www.claire.co.uk)
- What is Sustainable Remediation?
  What are objectives of SURF UK?
- UK policy context
- Copies of slide and notes from three meetings
  June07, May 08 and CONSOIL2008
- Outline brief for framework
- Work plan (March 09) and links to relevant documents

## What is Sustainable Remediation?

**SURF-UK Definition:**

**....the practise of demonstrating, in terms of environmental, economic and social indicators, that an acceptable balance exists between the effects of undertaking the remediation activities and the benefits the same activities will deliver.**

## SuRF UK – Working Mission Statement

**To develop a framework in order to embed balanced decision making in the selection of the remediation strategy to address land contamination as an integral part of sustainable development**

## SuRF UK – Working Mission Statement

To develop a framework in order to embed balanced decision making in the selection of the remediation strategy to address land contamination as an integral part of sustainable development

**Notes:**

**'framework' not Tool**

**'balanced' mean consider social, environmental and economic**

**'strategy' includes design and implementation**

**'land contamination' includes groundwater issues**

**'development' in context of sustainable development not just building schemes**

## UK Policy Context

- **Global: Sustainable Development**
- **National: Sustainable Development Strategy**
- **Brownfield Regeneration**
- **Sustainable planning, waste, construction strategies**

## Global Definition: Sustainable Development

**Links to Sustainable Development**

'Development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (1987, Brundtland)

- Environment/Planet
- Economy/Profit
- Society/People

## UK Policy Context: Sustainable Development


...to enable all people throughout the world to satisfy their basic needs and enjoy a better quality of life without compromising the quality of life of future generation (2005, HM Government, Securing the Future)

## UK Policy Context: Sustainable Development

5 Principles

- Live within environmental limits
- Achieve a just society,
- By means of sustainable economy
- Good governance
- Sound science

4 Priorities

- Sustainable consumption and production
- Natural Resource protection and environmental enhancement
- Building Sustainable communities
- Climate change and energy

## Role of Brownfield Land

- Priority indicator in terms of UK Sustainable Development
- Creating Sustainable Communities
- 'Brownfield first' objective – 60% target

**In UK policy terms, developing Brownfield and therefore implicitly, the associated remediation is considered 'sustainable'**

## Sustainability: putting it into practice

- Planning Policy
- New houses Guidelines
- Waste Strategy
- Sustainable Construction
- Land contamination management & Remediation
  - How does it fit in?

## Sustainability: putting it into practice

- Planning Policy: **Brownfield First**
- New houses Guidelines: **Zero carbon development (Lifetime)**
- Waste Strategy: **Zero by 2020**
- Sustainable Construction: **Waste and Emissions targets**
- Land contamination management & Remediation
  - **No one clear overarching policy steer. Indirectly part of several policies and strategies**

## UK Contaminated Land Management

- Risk-based approach to assessment and remediation
- Cost-benefit decision regarding clean-up
- Many remediation activities require formal planning permission – a formal stakeholder consultation with local communities
- Spatial land-use planning takes into account social and economic factors
- **The foundations for managing land contamination are already in place to allow development of sustainable remediation strategies**

## SuRF UK – Develop a framework

To develop a framework in order to embed balanced decision making in the selection of the remediation strategy to address land contamination as an integral part of sustainable development

Notes:

'framework' not Tool

'balanced' mean consider social, environmental and economic

'strategy' includes design and implementation

'land contamination' includes groundwater issues

'development' in context of sustainable development not just building schemes

## Characteristics of a Framework

- **It is a process**
  - e.g. flow diagram
- **Defined stages**
- **Decision-making points**
- **Record of decision**

## Emerging ideas for a Framework?

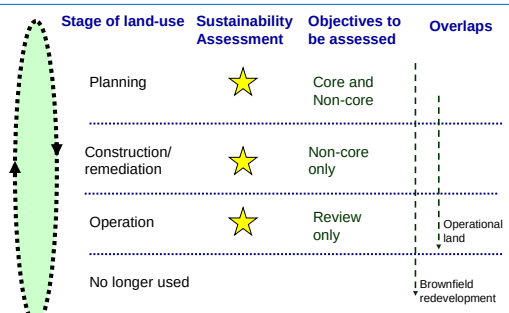
- Technical framework for structured decision-making: defines stages, record decisions, processes and procedures
- Links to decision-making during lifecycle of a property (a time and space boundary)
- To reflect different decision points for considering sustainability
- Recognise that some 'sustainability' decisions are implicitly made (e.g. planning permission)
- Recognise that may need to be a voluntary code – a way of differentiating an organisations sustainable credentials
- Must be verified – case studies, testing

## Sustainable land-use

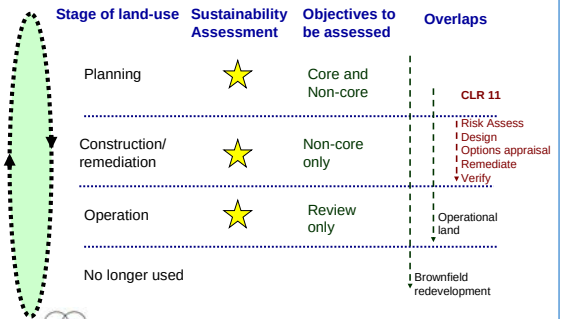

**Any site is a parcel of land that is somewhere in a life-cycle**

**Brownfield land is in at least a 2nd phase of lifecycle**

## Conceptual Framework Proposal




## Conceptual Framework: Overlap with CLR11




## "Core" and "non-core" concept

**Remediation decision-making has several points at which the sustainability of scheme can be considered**

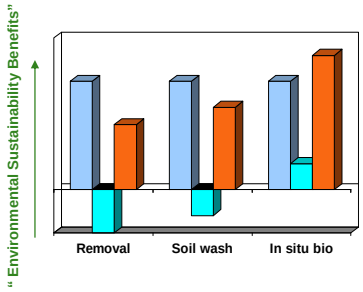
**Why remediate? What clean-up standard? → "core" objectives / effects**

- e.g. brownfield redevelopment to residential / or maybe to open space
- Voluntary remediation of on-going facility
- Merger and acquisition requirement

**How to remediate? → "non-core" or wider effects**

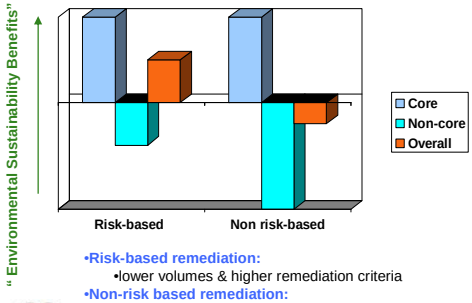
- e.g. excavation and removal, vs. *ex situ* soil washing, vs *in situ* bioremediation for a simple DRO in soil problem

## Core & Non-core objectives



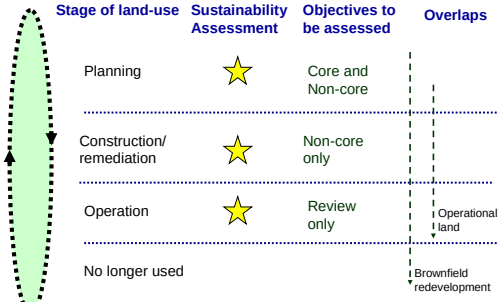

Core objectives already set

## Impact of Risk-based remediation strategies




- **Risk-based remediation:**
  - lower volumes & higher remediation criteria
- **Non-risk based remediation:**
  - higher volumes & lower remediation criteria

## Conceptual Framework: Proposals




## Other considerations

- Likely to support a tiered approach
  - Qualitative-Quantitative
- Selection of indicators
  - Multiple data sources
  - Target-driven, e.g. brownfield policy 60%
  - Effective-driven – less political influence
- What will framework look like?
  - Length
  - Case Studies
  - Tools

## Next Steps

- **Local consultation on framework**
  - **Those who expressed interest via open forum**
- **Circulate ahead of, and present at Nov08 open forum for wider discussion**
- **Work on indicators and tiered structure**
- **Link in case studies and tools**
- **Mar 09: Finalise a framework to provide a platform for sustainable decision-making in respect of land contamination and remediation**

# Attachment 7
# Renewable Energy Development on Contaminated Lands and Mining Sites

# Renewable Energy Development on Contaminated Lands and Mining Sites

October 7, 2008
Philadelphia

Penelope McDaniel
OSWER Center for Program Analysis

## Background

- EPA launched the Siting Renewable Energy on Contaminated Lands and Mining Sites at the 2008 Brownfields Conference in May
- Hosted an expert panel discussion with participants including industry, state and federal government, finance, and renewable energy developers
- Large amount of interest from a diverse audience
- Continued to expand outreach and education, and developed tools to facilitate RE development

## Why Develop Renewable Energy Facilities on EPA Tracked Sites?

- Many EPA tracked lands offer thousands of acres of land
- Situated in areas less likely to be met with aesthetic (NIMBY) opposition
- Have existing electric transmission lines, capacity, roads, and are adequately zoned for such development
- Avoided new infrastructure capital and zoning costs can be significant

## Why Develop Renewable Energy Facilities on EPA Tracked Sites?

- May have lower overall transaction costs compared to greenfields
- Reduce the stress on greenfields land for construction of new energy facilities
- Provide clean, emission-free energy for use on-site, locally, and utility grid

## Why Develop Renewable Energy Facilities on EPA Tracked Sites?

- Over 16 million acres of potentially contaminated properties (approx. 480,000 sites) across the United States are tracked by EPA
  - ~80% (13.6 million acres) are non-urban
  - ~20% (3.2 million acres) are abandoned mine land
- Cleanup goals have been achieved and controls put in place to ensure long-term protection for more than 850,000 acres
- Reintroduce local job opportunities for development, operation and maintenance of, and equipment manufacture for renewable energy facilities

## How Much Energy Can EPA Tracked Lands Support?

<u>Solar Energy Potential</u>

- Solar Energy Generation Capacity on EPA Tracked Lands
  - 2,670,227 MW
- In 2010, EIA projects U.S. solar PV and thermal capacity at 6,100 MW

<u>Wind Energy Potential</u>

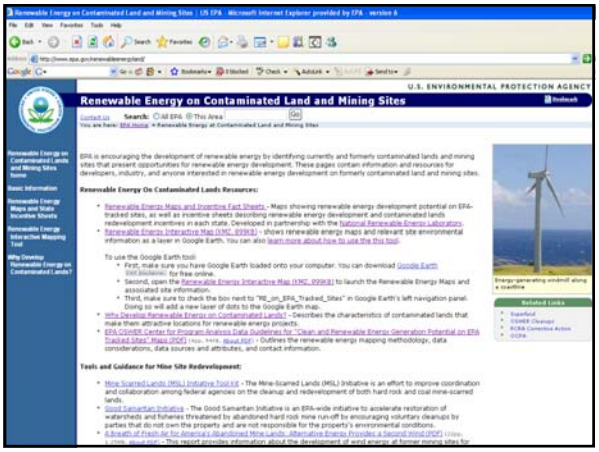
- Wind Energy Generation Potential on EPA Tracked Lands
  - 120,379 MW
- In 2010, EIA projects U.S. wind capacity at 25,610 MW

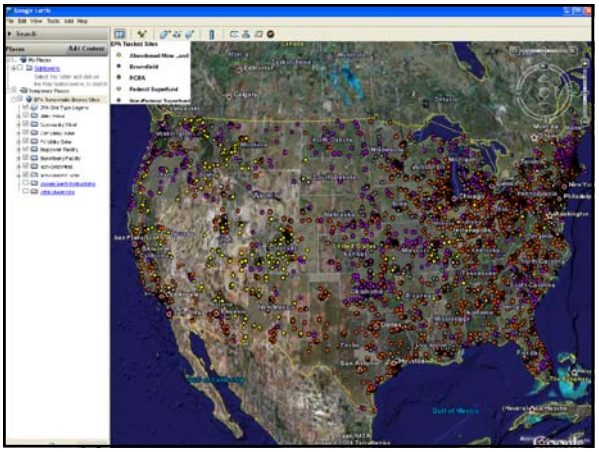
## Google Earth Mapping Tool

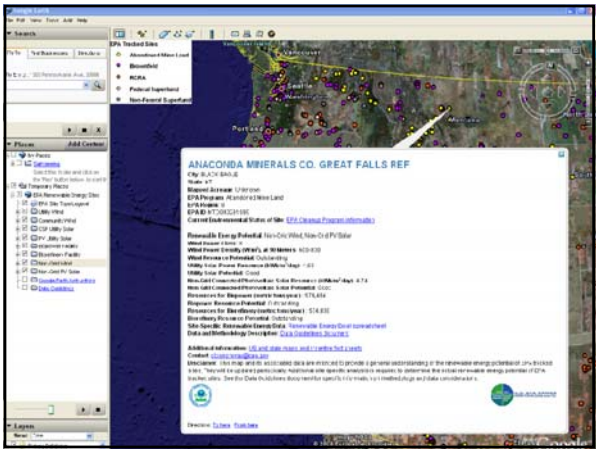
- Successful EPA-NREL joint venture produced an interactive Google Earth mapping application
- Shows opportunities to site renewable energy on contaminated lands and mining sites in each state
- Using criteria, such as distance to electric transmission lines, distance to roads, renewable energy potential, and site acreage, we produced over 170 state-specific maps showing renewable energy development potential on EPA tracked sites
- Produced incentive sheets describing renewable energy development and contaminated lands redevelopment incentives in each state

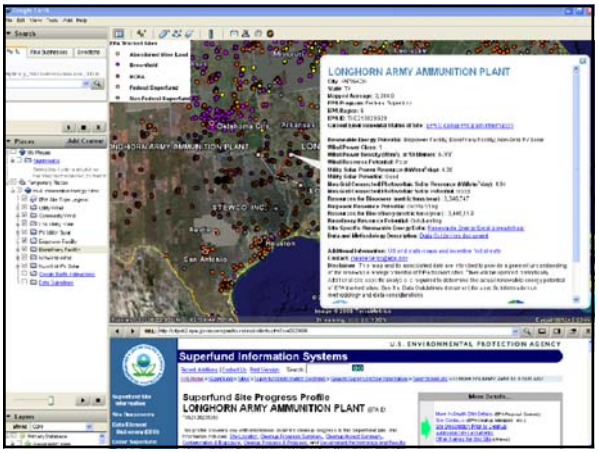
## Google Earth Mapping Tool

- Audience:
  - Developers
  - Environmental managers (state, federal, private)
  - Consultants
  - Private industry
  - Communities
  - Local, state, and federal energy and environment officials
  - Anyone interested in renewable energy projects on contaminated lands and mining sites



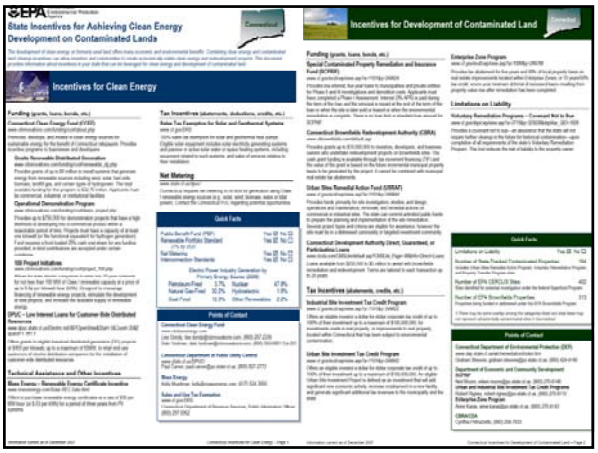





## Incentives

- State Incentives
  - Grants and Loans
  - Tax abatements, deductions, credits
  - Net metering
  - Other incentives: equipment loan programs for wind production
- Federal incentives
  - Production tax credit for renewable energy: $0.95/kWh to $1.95/kWh for sales of electricity for the first 10 years of operation
  - Federal grants and loans
- Database of State Incentives for REs and EE
  - www.dsireusa.org




## Successes

**Bethlehem Steel Superfund Site Lackawanna, NY**

- 8 wind turbines
- 20 MW generation capacity – 7,000 homes
- By 2010 expansion to 18 wind turbines – 45 MW
- Domestically manufactured wind turbines (Cedar Rapids, Iowa)
- Local job creation

## Successes

**Fort Carson, Colorado**

- 2 MW solar array on 12-acre landfill
- Produces 3,200 MW-hrs of electricity each year
- Fort Carson purchases electricity produced from the array at a fixed rate of 5.5 cents per kW-hr for the duration of a 17-year contract
- Expected savings of $500,000 in electricity costs during the contract life

## Successes

**Summitville Mine Site, Colorado**

- Mico-hydro plant will provide enough power to operate the new on-site treatment plant, making the treatment of acid-mine drainage at Summitville mine a zero-net energy operation

## Successes

**Holmes Road Landfill Solar Field, Houston TX**

- Revitalization of a 300-acre former landfill site located near downtown Houston
- EPA awarded a $50k grant to assess solar energy production
  - Evaluating various environmental, engineering, and regulatory issues involved in the project
  - Conducting a solar energy production and financial feasibility study

## More Information

- Renewable Energy on Contaminated Lands and Mining Sites:
  http://www.epa.gov/renewableenergyland
- Further information:
  cleanenergy@epa.gov

## Questions?

Penelope McDaniel
OSWER Center for Program Analysis
*mcdaniel.penelope@epa.gov*

# Attachment 8
# Green Remediation: EPA Update

# Green Remediation: EPA Update

SuRF 8

Philadelphia, PA

October 6, 2008

Carlos Pachon
U.S. EPA Superfund Program
pachon.carlos@epa.gov



## What is Green Remediation?

The practice of considering all environmental effects of a cleanup during each phase of the process, and incorporating strategies to maximize net environmental benefit of the cleanup.

*Focus is currently on remedy implementation vs. remedy selection*



## Is it Our Job?

- **Executive Order 13423, January 26, 2007-Strengthening Federal Environmental, Energy, and Transportation Management**
  - » Section 1. Policy. It is the policy of the United States that Federal agencies conduct their environmental, transportation, and energy-related activities under the law in support of their respective missions in an environmentally, economically and fiscally sound, integrated, continuously improving, efficient, and sustainable manner.
- **EPA Strategic Plan Goal 1: Clean Air and Global Climate Change**
  - » Protect and improve the air so it is healthy to breathe and risks to human health and the environment are reduced. Reduce greenhouse gas intensity by enhancing partnerships with businesses and other sectors.
- **EPA Strategic Plan Goal 5: Compliance and Environmental Stewardship**
  - » Stewards of the environment recycle wastes to the greatest extent possible, minimize or eliminate pollution at its source, conserve natural resources, and use energy efficiently to prevent harm to the environment or human health.



## Green Remediation: Increasing Sustainability in Site Cleanups

- Apply to all cleanup programs
- Exist throughout site investigation, design, construction, operation, and monitoring




## Carbon & Energy Footprints of Superfund Cleanup Technologies

| Technology | Estimated Energy *Annual Average* (kWh*10³) | Total Estimated Energy Use *in 2008-2030* (kWh*10³) |
|---|---|---|
| Pump & Treat | 489,607 | 11,260,969 |
| Thermal Desorption | 92,919 | 2,137,126 |
| Multi-Phase Extraction | 18,679 | 429,625 |
| Air Sparging | 10,156 | 233,599 |
| Soil Vapor Extraction | 6,734 | 154,890 |
| *Technology Total* | *618,095* | *14,216,209* |

| | Annual Carbon Footprint (MT CO2) |
|---|---|
| Sum of 5 Technologies | 404,411 |



## Recap on Strategy for Energy & Carbon Footprint Element

- Optimize systems to maximize efficiency and return per unit energy invested
- Build renewable energy capacity at contaminated sites to power remedies
- Tap into grid renewable energy portfolios
- Define technical and policy GHG offset options, including carbon sequestration from soil amendment treatment projects

## "OSWER" Green Remediation Strategy

*For the purpose of advancing green remediation best practices across cleanup programs OSWER seeks to:*

- »Benchmark and document GR best management practices
- »Assemble a toolkit of enablers
- »Build networks of practitioners
- »Develop performance metrics and tracking mechanisms



## Why a "Strategy"

- A common understanding for better internal communication
- A unified EPA voice and position when working with regulated parties
- Developing shared goals to better measure and communicate progress
- Leverage similar efforts with other organizations (ITRC, SERDP, ASTSWMO, FRTR, SuRF, etc).



## The Green Remediation Toolkit

**Existing**

- Green remediation primer
- Profiles of projects and case studies on EPA green remediation site
- Upcoming internet seminars, and archived discussions (cluin.org)
- Green remediation tech support for Federal and State project managers
- Contracts toolkit for RACs
- Renewable energy fact sheets

**In the pipeline**

- MOU with NERL
- MOU with the USACE recognizing and fostering GR BMPs at Superfund cleanups
- Contracts toolkit for ERRS
- Green remediation certification program
- Remedy specific green remediation "cheat sheets'
- Site cleanup energy audit tool
- Who's who in green remediation (EPA Intranet)
- ER3 for Green remediation



## Green Cleanups Certification: Conceptual Paper

- What are we certifying?
  - » Projects
  - » Individuals
- What does the structure look like?
  - » Leed (rating system)
  - » ISO 14000 (management system)
  - » Other
- Who is the certifier?
  - » Self certification (audits)
  - » 3rd party
- What are the incentives?
  - » Monetary
  - » Emotional
  - » Branding
- What is our approach for a consensus developing process
  - » Standards Developing Organization
  - » Non-profit



## Tracking Green Remediation Activities

| |
|---|
| **Technology Innovation Program Green Remediation (GR) Effort** |
| **Superfund GR Workgroup** |
| **Technical Support Project (TSP) Green Committee** |
| **Green Remediation, Revitalization, and Reuse (GRRR) Team** |
| **Climate Change and Contaminated Lands (CCCL) Workgroup** |
| **Climate Change Coordinating Committee (C4)** |
| **Association of State and Territorial Solid Waste Management Officials (ASTSWMO) Greener Cleanups Task Force** |
| **Interstate Technology and Regulatory Council (ITRC) Green and Sustainable Remediation (GSR) Project** |
| **Federal Remediation Technologies Roundtable (FRTR) GR Focus** |
| **EPA Partnerships with Other Federal Agencies**<br>**Department of Defense**<br>**Department of Energy** |
| **State Initiatives**<br>**Cal/EPA GR Team**<br>**Illinois Greener Cleanups**<br>**Wisconsin Initiative on Sustainable Cleanups (WISC)** |
| **Brownfields Sustainability Pilots: Green Redevelopment** |
| **Tribal Initiatives** |
| **EPA Regional Initiatives:**<br>**Region 3 Pilot Project on Green Cleanup Standards**<br>**Region 9 Cleanup-Clean Air Initiative** |
| **Sustainable Remediation Forum (SuRF)** |

## EPA Green Remediation Primer

- Provides introduction to best practices with examples of how and where they are used
- Focuses on remedy implementation across regulatory frameworks
- Released April 2008, available at: http://cluin.org/greenremediation

# Green Remediation on the Web

www.clu-in.org/greenremediation

# Attachment 9
# Green Remediation: Restoration Alternatives

# Green Remediation

## Restoration Alternatives

Harry R. Compton
Environmental Engineer
U.S. EPA - ERT
Sally Brown
University of Washington

## EPA's OSWER Priorities

- Revitalization
- Recycling
- One Clean-up Program

## Mine Sites

- Lack of vegetation is a result of:
  - Low fertility
  - Poor soil physical properties
  - Acidity
  - Metal toxicities
  - Salts

## Goals of Remediation

- Reduce bioavailability of contaminant in place
  - In-situ treatment in EPA lingo
- Rebuild soil or build new soil
- Restore soil function
  - Sustain plant growth
  - Sustain soil fertility
- Establish native plant ecosystem

## Residuals as Soil Amendments
### Why use wastes?

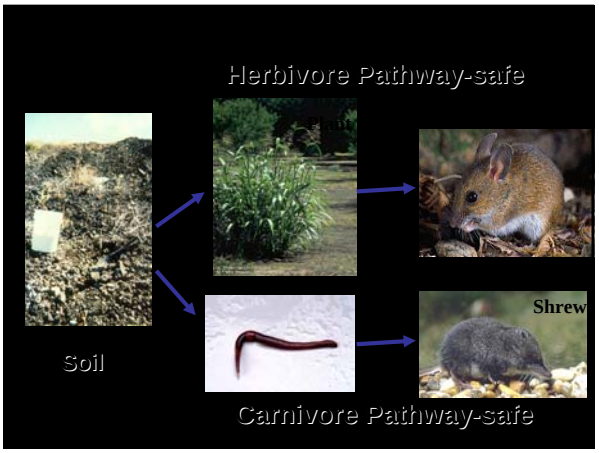
- Alternative to conventional remedial technologies
  - lower costs
  - recycling wastes for a better use
  - Can be economical large scale solutions
  - Use application expertise from generators


Coeur d'Alene Wetlands
1998- 2000


Historic mine tailings washed down and accumulated in deposits up to and exceeding 2'
Deposits are toxic to riparian vegetation
Contaminated soils, barren of vegetation, are highly susceptible to continued erosion by the river


Filling vehicle
Application

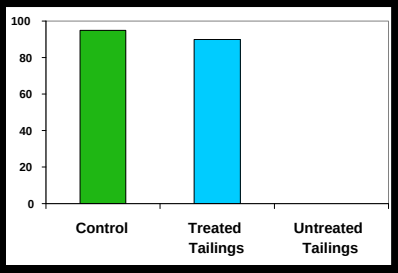

Leadville, CO
1997 - 2000


Herbivore Pathway-safe
Soil
Shrew
Carnivore Pathway-safe

## Re entrainment

- Safe on land, if amended soils are re suspended in Arkansas River

## Re-entrainment Study
## Fathead Minnow % Survival





## Sure Sign of Success

# Attachment 10
# Guidance on Incorporating Sustainability into Army Environmental Remediation Projects: Practical Aspects of Incorporation and Application

US Army Corps of Engineers

**Guidance on Incorporation of Sustainability into Army Environmental Remediation**
**Practical Aspects of Incorporation and Application**

Carol Lee Dona, Ph.D., P.E.
Michael M. Bailey, Ph.D., P.G.
US Army Corps of Engineers
Environmental and Munitions Center of Expertise
Omaha, NE
October 6, 2008



US Army Corps of Engineers

## Overview

- Background and Structure of Army Guidance
- If, When, and How to Incorporate Sustainability
- Path Forward



US Army Corps of Engineers

## Definition - Sustainability (from Army Strategy for the Environment 1-Oct-04)

- A strategy that "simultaneously meets current as well as future mission requirements world-wide, safeguards human health, improves quality of life, and enhances the natural environment"



US Army Corps of Engineers

## Guidance Audience

- Army in-house project delivery teams
- Army contractors
- Army headquarters

❖ Purpose: Provide standard operating and documenting procedures



US Army Corps of Engineers

## Guidance Structure and Application

- Decision flow chart(s) and on-line resources.
- Two basic structural components
  - Threshold (veto) and balancing (modify) criteria
  - Screening and detailed analysis
- Methodology differs between remedial phases
  - Investigative and Remedy Screening
  - Remedy Selection
  - Remedy Implementation
  - Remedy Operation and Maintenance
  - Site Closeout



US Army Corps of Engineers

## Basic Questions for each Phase

- Can sustainability be incorporated?
- What should be incorporated?
- How is sustainability incorporated?

US Army Corps of Engineers

## Can Sustainability Be Incorporated? Contract Considerations

| Contract type | Existing | Future |
|---|---|---|
| Fixed Price | Yes | Yes |
| Cost Reimbursement | Yes | Yes |
| Performance Based | Difficult (contract already negotiated, based on prescribed outcome) | Possible (challenges weighting factors; measurement objectives) |



US Army Corps of Engineers

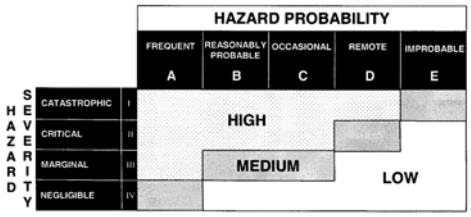
## How is Sustainability Incorporated?

- Tool – Modified Scoring Matrix from Risk Assessment Code (RAC) Scoring and Environmental Management System (EMS) Rating Factors



US Army Corps of Engineers

## RAC Scoring (Former FUDS MMRP Scoring Method)






US Army Corps of Engineers

## Modification of EMS Rating Factors

- Use of Environmental Management System aspects
  - Environmental impact
  - Mission impact
  - Regulatory impact
  - Community Concern
- Cross plot activity level – Combination of frequency (5th EMS aspect) and duration of activity
- Sustainable options identified, then scored and compared.



US Army Corps of Engineers

## Incorporation of Sustainability Threshold Criteria

- Threshold – similar, not same as NCP; if not met, option dropped. Red – no further consideration. Use categories – project specific.

| Threshold Criteria | Rating Scale | | Activity Level: High | Medium | Low | Rare |
|---|---|---|---|---|---|---|
| | | | 4 | 3 | 2 | 1 |
| Mission Impact | Enhances mission | 4 | 16 | 12 | 8 | 4 |
| | Compatible with mission | 3 | 12 | 9 | 6 | 3 |
| | Neutral | 2 | 8 | 6 | 4 | 2 |
| | Some obstacles | 1 | 4 | 3 | 2 | 1 |
| | Significant negative impact | 0 | 0 | 0 | 0 | 0 |
| Regulatory Impact | No regulatory constraint | 4 | 16 | 12 | 8 | 4 |
| | Preferred regulatory practice | 3 | 12 | 9 | 6 | 3 |
| | Accepted regulatory practice | 2 | 8 | 6 | 4 | 2 |
| | To be regulated | 1 | 4 | 3 | 2 | 1 |
| | Not permitted | 0 | 0 | 0 | 0 | 0 |

High / Medium / Low / Do not use



US Army Corps of Engineers

## Incorporation of Sustainability Balancing Criteria

- Balancing – Should option continue to be considered; environmental impact = sustainability

| Balancing Criteria | Rating Scale | | Activity Level: High | Medium | Low | Rare |
|---|---|---|---|---|---|---|
| | | | 4 | 3 | 2 | 1 |
| Community Concern | Incentives for inclusion | 4 | 16 | 12 | 8 | 4 |
| | Strongly in favor | 3 | 12 | 9 | 6 | 3 |
| | Mildly in favor | 2 | 8 | 6 | 4 | 2 |
| | No interest | 1 | 4 | 3 | 2 | 1 |
| | Against | 0 | 0 | 0 | 0 | 0 |
| Environmental Impact | High, beneficial | 4 | 16 | 12 | 8 | 4 |
| | Moderate, beneficial | 3 | 12 | 9 | 6 | 3 |
| | Low | 2 | 8 | 6 | 4 | 2 |
| | No impact | 1 | 4 | 3 | 2 | 1 |
| | Significant negative impact | 0 | 0 | 0 | 0 | 0 |

High / Medium / Low / Consider not using

US Army Corps of Engineers

## What Should Be Included? Screening Level Sustainability Evaluation

- Purpose is to determine which options should be considered further.
- Things to consider - screening:
  - No significant negative impact to mission?
  - Meets regulatory approval?
  - Sustainability considerations positively received by community?
  - Human resources adequate?
  - Screening level environmental impact (Tier 1 Air Force tool)

BUILDING STRONG®

US Army Corps of Engineers

## Comparison of Sustainability against Other Remediation Criteria

- Approach depends on remediation phase, relevant criteria in phase, and existing frameworks

| Phase | No existing framework | Required existing framework | Optional existing framework |
|---|---|---|---|
| Investigative | ✓ | | |
| Remedy selection | | ✓ | |
| Remedy implementation | | | ✓ |
| Operations and maintenance | | | ✓ |
| Closeout | ✓ | | |

BUILDING STRONG®

US Army Corps of Engineers

## Investigative or Closeout Phase Comparison of Alternatives No Existing Comparative Framework

- Direct use of modified rating factor scoring method to score options. Scoring of options. Environmental impact – Tier II Air Force Tool

| Threshold Criteria | Rating Scale | Activity Level: High | Medium | Low | Rare |
|---|---|---|---|---|---|
| | | 4 | 3 | 2 | 1 |
| Mission Impact | Enhances mission | 4 | 16 | 12 | 8 | 4 |
| | Compatible with mission | 3 | 12 | 9 | 6 | 3 |
| | Neutral | 2 | 8 | 6 | 4 | 2 |
| | Some obstacles | 1 | 4 | 3 | 2 | 1 |
| | Significant negative impact | 0 | 0 | 0 | 0 | 0 |
| Regulatory Impact | No regulatory constraint | 4 | 16 | 12 | 8 | 4 |
| | Preferred regulatory practice | 3 | 12 | 9 | 6 | 3 |
| | Accepted regulatory practice | 2 | 8 | 6 | 4 | 2 |
| | To be regulated | 1 | 4 | 3 | 2 | 1 |
| | Not permitted | 0 | 0 | 0 | 0 | 0 |

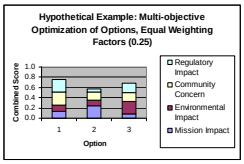
| Balancing Criteria | Rating Scale | Activity Level: High | Medium | Low | Rare |
|---|---|---|---|---|---|
| | | 4 | 3 | 2 | 1 |
| Community Concern | Incentives for inclusion | 4 | 16 | 12 | 8 | 4 |
| | Strongly in favor | 3 | 12 | 9 | 6 | 3 |
| | Mildly in favor | 2 | 8 | 6 | 4 | 2 |
| | No interest | 1 | 4 | 3 | 2 | 1 |
| | Against | 0 | 0 | 0 | 0 | 0 |
| Environmental Impact | High, beneficial | 4 | 16 | 12 | 8 | 4 |
| | Moderate, beneficial | 3 | 12 | 9 | 6 | 3 |
| | Low | 2 | 8 | 6 | 4 | 2 |
| | No impact | 1 | 4 | 3 | 2 | 1 |
| | Significant negative impact | 0 | 0 | 0 | 0 | 0 |

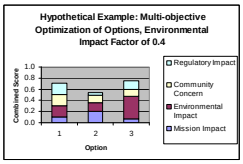
BUILDING STRONG®

US Army Corps of Engineers

## Investigative or Closeout Phase Comparison of Alternatives No Existing Comparative Framework, cont.

- Is there a clear winner?
- No? Establish relative importance of rating factors – assign weighting factors, rescore, compare options through multivariable optimization




BUILDING STRONG®

US Army Corps of Engineers

## Remedy Selection Technology Screening Required Existing Framework (NCP)

- Existing framework, use scoring criteria within framework
- Use implementability, effectiveness and cost as screening criteria
- Consider sustainability as an element of effectiveness

BUILDING STRONG®

US Army Corps of Engineers

## Remedy Selection Detailed Analysis of Alternatives Required Existing Framework (NCP)

- Use scoring criteria within framework, NCP threshold and balancing criteria
- Sustainability a "tenth balancing criterion" – not statutory
- Detailed analysis, sustainability, Tier II Air Force tool
- Clear winner based on statutory criteria evaluation? No? Use sustainable scoring on options as additional balancing criteria
- Alternative – incorporate sustainability into nine NCP criteria.

BUILDING STRONG®

US Army Corps of Engineers

**Remedy Implementation**
**Existing but Optional Framework**
**Value Engineering Studies and Remedial System Evaluations**

- Include many sustainability aspects
- Identify additional sustainability aspects, e.g. greenhouse gas emissions
- Sustainability incorporation in conflict with other VE/RSE considerations, e.g. cost, site close-out time? Weighting factors to compare options
- VE/RSE studies typically not performed if contract is PBC



US Army Corps of Engineers

## Conclusions

- Need to incorporate sustainability in environmental remediation at installation level in master plan, program planning, budget, and human resource allocation
- Contracting structure important – PBCs potentially limit incorporation of sustainability in all remedial phases
- Off-site environmental impacts, e.g. greenhouse gases, most difficult to incorporate in PBCs
- Mission impact and regulatory impact threshold (veto potential) criteria
- Environmental impact and community response balancing criteria; environmental impact expected to remain a balancing criteria until policy or regulations are implemented
- If comparative frameworks exist, sustainability incorporated into the existing frameworks and rating factors
- Modified RAC/EMS rating factor matrix used for screening on all phases and detailed analysis if no existing comparative framework
- Multi-variable evaluation can be used to compare sustainability to other rating factors



US Army Corps of Engineers

## Path Forward

- Draft guidance and contract template scopes of work to be completed December 2008.
- Peer and Corps/Army Headquarters review, 2009; finalization of guidance October 2009.



US Army Corps of Engineers

## Acknowledgments


- Doug Hadley, Lindsey Lien - EM CX
- Brenda Bachman - USACE, Seattle District
- Doug Mellema, Bob Pender – USACE, Kansas City District




US Army Corps of Engineers

## Questions

- Contact Carol Lee Dona at (402) 697-2582, carol.l.dona@usace.army.mil



US Army Corps of Engineers

## Additional Slides

US Army Corps of Engineers

## Can Sustainability Be Incorporated, Contracts

- Typical Army Contracts
  - Performance-Based – successful completion of outcome prescribed in contract
  - Fixed Price – specific services defined in the statement of work
  - Cost reimbursement – reimbursement for eligible costs
- Army emphasis on PBC (over 50% existing contracts)

BUILDING STRONG®

US Army Corps of Engineers

## Can Sustainability be Incorporated – Existing Contracts – no Sustainability Clauses

- FP – modification possible during contract (contract modification)
- CR – modification possible (work variance notification)
- PBC – Contractor responsible for project direction to prescribed final outcome
  - Difficult to incorporate sustainability in existing PBCs
  - Contract has already been negotiated with prescribed outcome (successful site remediation) without consideration of sustainability
  - Some sustainability measures possible, particularly those that lower costs; full incorporation difficult

BUILDING STRONG®

US Army Corps of Engineers

## Can Sustainability Be Incorporated – Future Contracts

- All contracts can incorporate some aspects of sustainability
- Evaluation of sustainability can be prescribed in all contracts
- Full implementation more difficult to ensure in PBCs than FP and CR
- PBC challenges
  - Weighting factors against cost in performance objectives
  - Quantification of measurement criteria for accomplishing performance objectives

BUILDING STRONG®

US Army Corps of Engineers

## Screening Level Mission Impact

- Time frame adequate to amend existing contracts/SOPs
- Funds sufficient for sustainability evaluation/implementation
- Basic requirements of mission met
- No significant negative impact to mission
- Human resources adequate to oversee evaluation/implementation

BUILDING STRONG®

US Army Corps of Engineers

## Screening Level Regulatory Impact

- Permitted or expected to be permitted by regulations or no regulatory constraints
- Time frame for regulatory approval within acceptable time frame for completion of action

BUILDING STRONG®

US Army Corps of Engineers

## Screening Level Environmental Impact

- Evaluate using screening level scoring matrix (Air Force tool, Tier 1 ~ two hours)
- No significant damage to environment
- Balancing criteria – zero score does not automatically eliminate option

BUILDING STRONG®

US Army Corps of Engineers

## Screening Level Community Concern

- Assess public opinion in project planning
- No wide-spread public opposition
- Balancing criteria – zero score does not automatically eliminate further consideration of option

BUILDING STRONG®

US Army Corps of Engineers

## Comparison of Sustainability against Other Remediation Criteria

- Detailed evaluation of rating criteria to compare options.
- Approach depends on remediation phase, relevant criteria in phase, and existing frameworks
  - No existing comparative framework: Investigation and Closeout
  - Required existing framework: Remedy Selection (NCP process)
  - Existing but optional framework: Remedy Implementation (Value Engineering) and Operation and Maintenance (Remediation System Evaluation)

BUILDING STRONG®

US Army Corps of Engineers

### No Existing Comparative Framework (Investigative, Closeout) – Detailed Analysis

- Direct use of modified rating factor scoring method
  - Mission impact – relative quality or completion, time and resources expended, enhancements to mission or other missions
  - Regulatory impact – ease of getting regulatory approval, regulatory incentives
  - Environmental impact – detailed analysis (1-2 days Air Force tool, in preparation)
  - Community concern – incentives , e.g. donated land, public approval

BUILDING STRONG®

US Army Corps of Engineers

## No Existing Comparative Framework (Investigative, Closeout) cont

- Add scores of environmental rating factors – Is there a clear winner?
- No? Establish relative importance of rating factors
- Compare options through multi-variable optimization
  - Normalize scores from scoring matrix to 1 by dividing by highest score
  - Assign weighting factors for relative importance of rating factor
  - Add scores together for each option

BUILDING STRONG®

US Army Corps of Engineers

### Existing but optional framework (Remedy Implementation) Value Engineering Studies

- Typically performed after remedy selected but before remedy implementation
- Performed with input from customer throughout process
- VE already includes many sustainability aspects (recycling, use of existing infrastructures and materials, enhancement of remedies to promote ecological well-being, cost reduction, risk reduction, site close-out time, reduced resource consumption, life-cycle costs). Identify any additional sustainability aspects (greenhouse gas emissions).
- Where sustainability incorporation is in conflict with other VE considerations, e.g. cost, identify options. Weighting factors could be used to compare options on relative importance of sustainability to other aspects.
- VE studies typically not performed if contract is PBC.

BUILDING STRONG®

US Army Corps of Engineers

### Existing but optional framework (Remedy Implementation and Operation and Maintenance) Remediation System Evaluations

- Typically performed after remedy is in place.
- Optimization already includes some sustainability aspects (cost reduction, risk reduction, site close-out time, equipment maintenance, resource consumption) . Identify any further sustainability aspects, e.g. greenhouse gases.
- Where sustainability incorporation is in conflict with other RSE considerations, e.g. cost, identify options. Weighting factors could be used to compare options using different relative importance of sustainability to other aspects.
- RSE studies typically not performed if contract is PBC.

BUILDING STRONG®

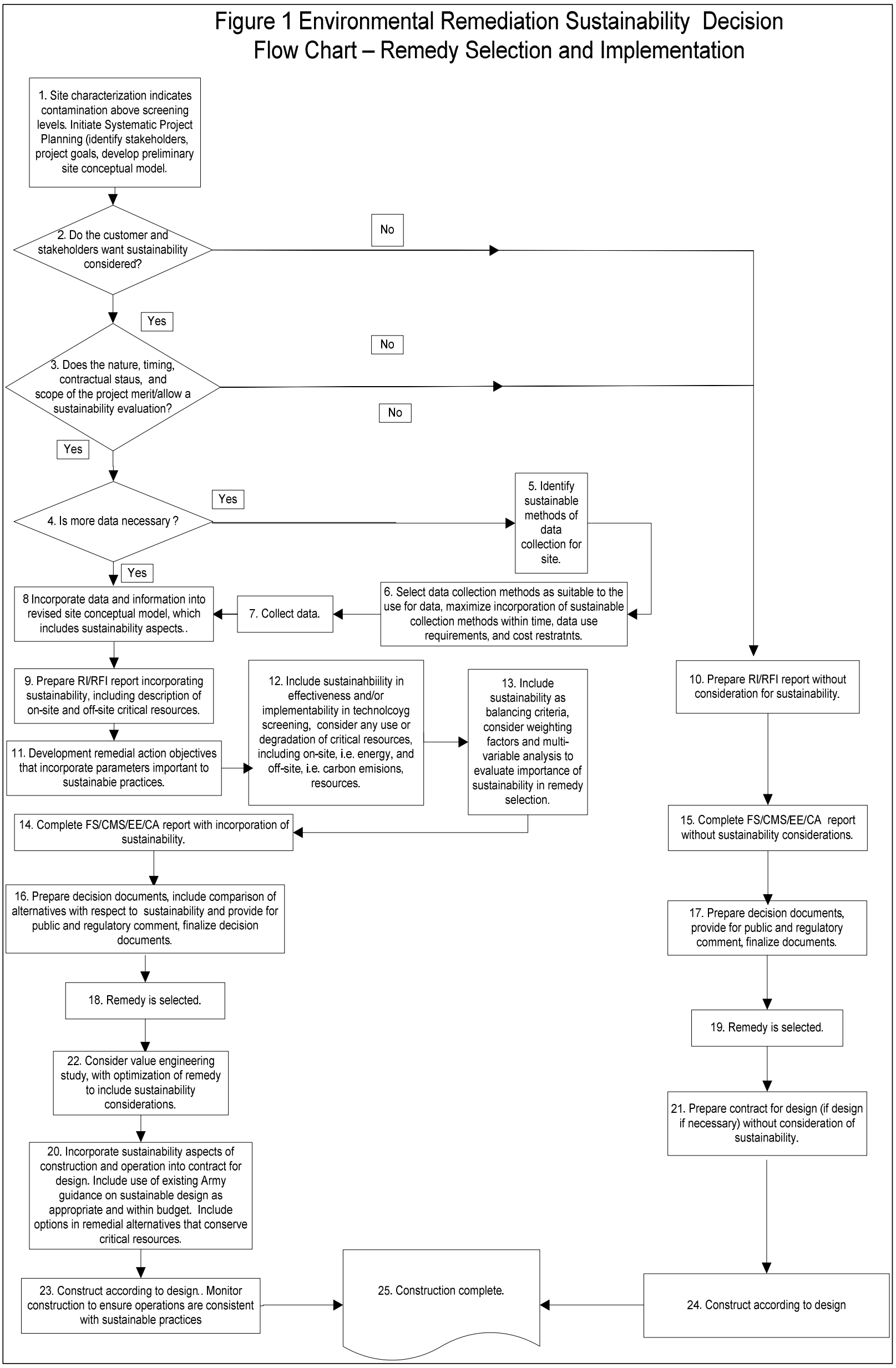
US Army Corps of Engineers

## Acknowledgments

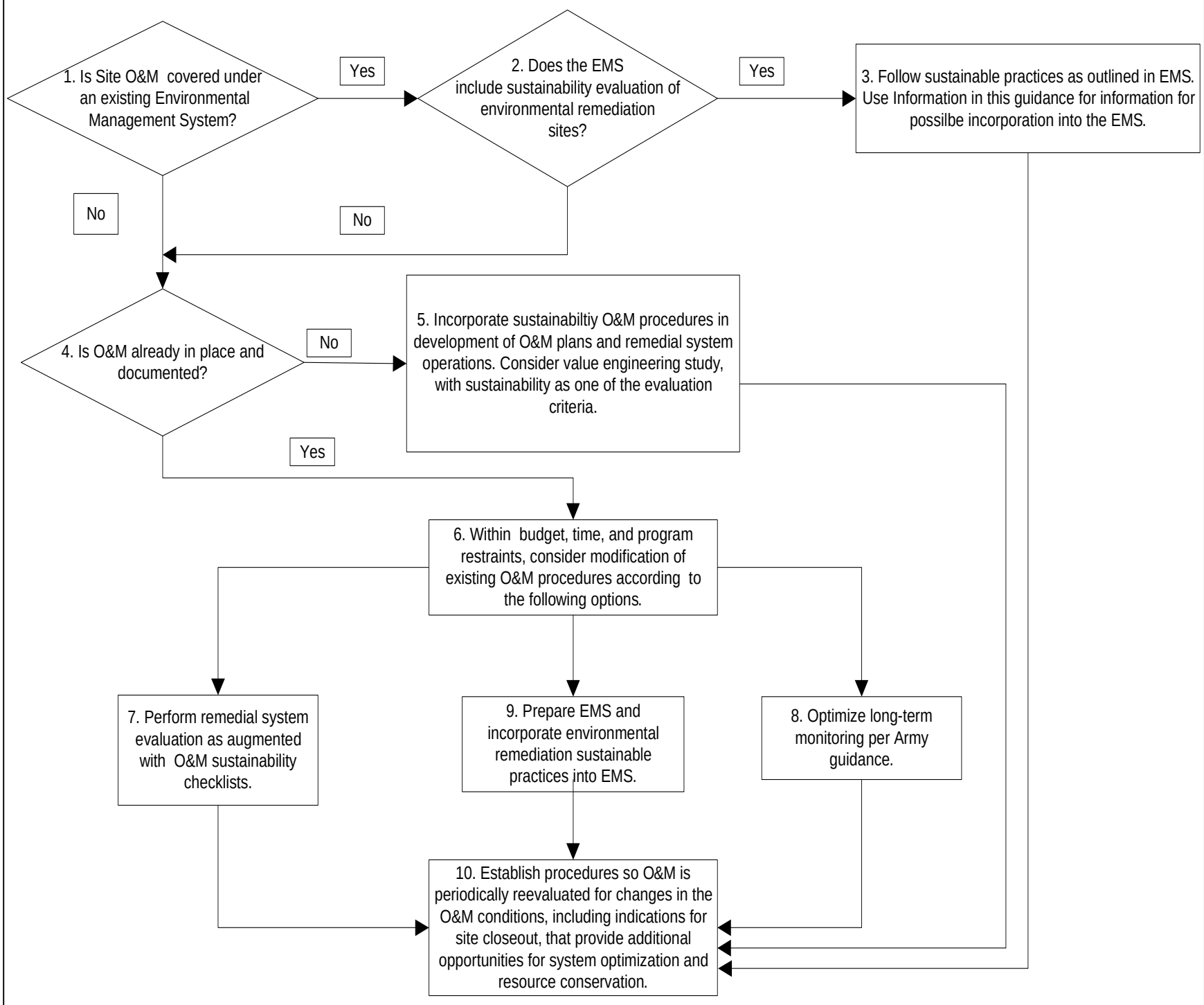

- Doug Hadley, contracting specialist, contract language; Lindsey Lien, environmental enginner, value engineering studies and remedial system evaluations - E&M CX
- Brenda Bachman, biologist, scope development - USACE, Seattle District
- Doug Mellema, innovative technology advocate, Bob Pender, EPA Region 2 project manager, scope language – USACE, Kansas City District


BUILDING STRONG®

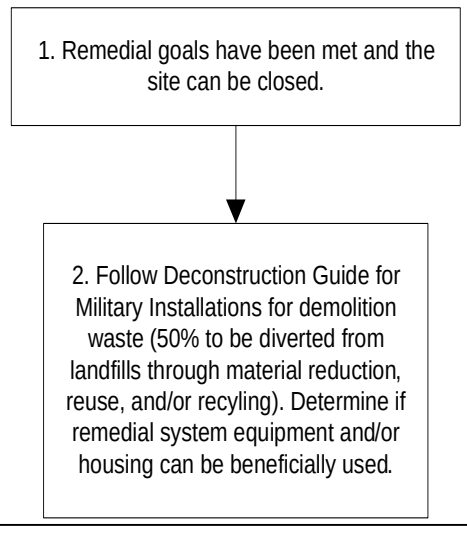
# Figure 1 Environmental Remediation Sustainability Decision Flow Chart – Remedy Selection and Implementation



## Figure 2 Environmental Remediation Sustainability Decision Flow Chart – Remedy Operation and Maintenance




## Figure 3 Environmental Remediation Sustainability Decision Flow Chart – Site Closeout/Transfer



# Attachment 11
# Update: Building Sustainability into the Air Force Remediation Process

## Air Force Center for Engineering and the Environment

*Integrity - Service - Excellence*

# UPDATE: Building *Sustainability* into the Air Force Remediation Process

Charles J. Newell PhD, PE, DEE

SuRF 8

October 6, 2008

EARTH TECH | AECOM GSI ENVIRONMENTAL

## Project Team

- Air Force Center for Engineering and the Environment
  Ms. Erica Becvar
- Earth Tech / AECOM
  Mr. Gerry Moore, Mr. Douglas Ruppel, Mr. Dave Woodward
- GSI Environmental
  Dr. Charles Newell, Ms. Tiffany Swann, Ms. Lila Beckley, Dr. Ata Rahman



*Sustainability in AF Remediation:*

## Problem & Solution

### The Problem…

Historical approach to contaminated sites does not fully consider sustainability concepts.

### A Solution…

Develop tool to help AFCEE environmental professionals incorporate sustainability concepts into their remediation decision making process (e.g., PBEM, RRM, ERP-O) for

i) planning future remediation implementation

ii) optimizing operating remediation sites

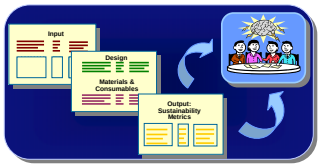


*Sustainability in AF Remediation:*

## Problem & Solution

### Tool Distribution

The tool will be available as freeware from the US Air Force to all interested parties.






*Sustainability in AF Remediation:*

## Solution Method

### What the Tool Does

Estimates sustainability metrics for specific technologies:

1. Excavation
2. Soil Vapor Extraction
3. Pump and Treat
4. Enhanced Bioremediation

Sustainability metrics developed:

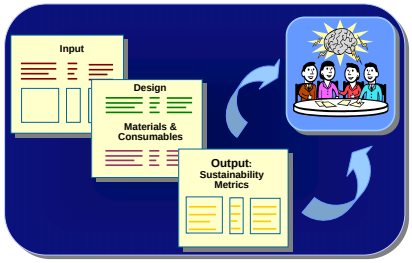
- Carbon dioxide emissions to atmosphere
- Total energy consumed
- Change in resource service
- Technology cost
- Safety / Accident risk

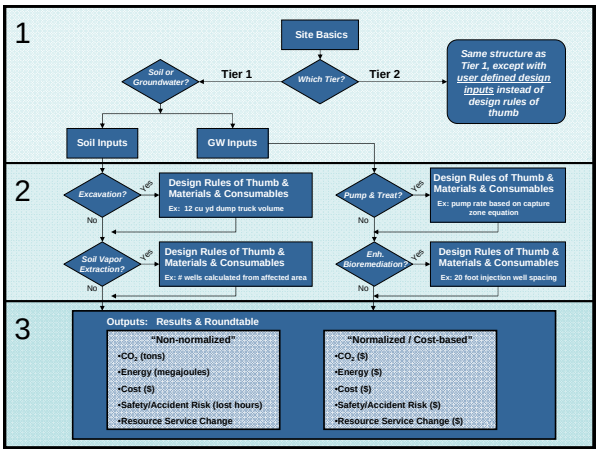


*Sustainability in AF Remediation:*

## Solution Method

### Tool Structure






*Sustainability in AF Remediation:*

## *Solution Method*

### Framework: Tiers of Varying Detail

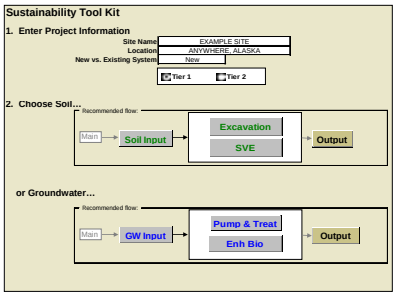
Like RBCA Toolkit!

| | Tier 1 | Tier 2 |
|---|---|---|
| **Calculation Basis:** | "Rules of Thumb" | User-entered design information from detailed design |
| **Time Required:** | 1-2 hrs | 1-2 days |



*Sustainability in AF Remediation:*

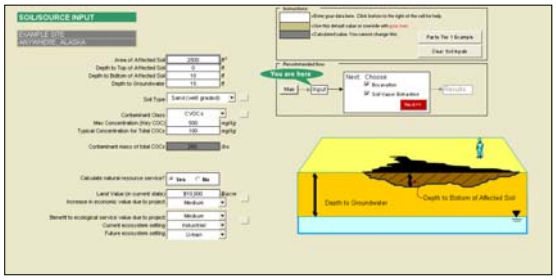
## *Solution Method*






*Sustainability in AF Remediation:*

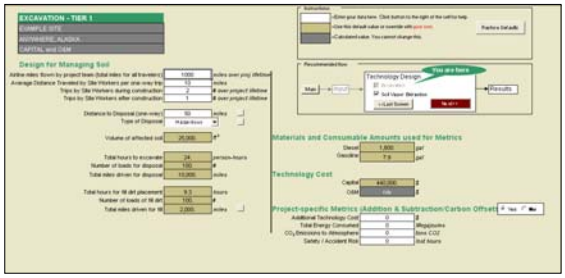
## *Solution Method*






*Sustainability in AF Remediation:*

## *Solution Method*






*Sustainability in AF Remediation:*

## *Solution Method*

### Example Material Calculation and Conversion

$$2{,}500 \text{ lb PVC} \times \frac{2 \text{ lb } CO_2}{1 \text{ lb PVC}} \times \frac{0.453 \text{ kg}}{1 \text{ lb}} \times \frac{0.001 \text{ metric ton}}{1 \text{ kg}} = 2 \text{ metric tons } CO_2 \text{ emitted}$$

"Non-normalized" natural units

$$\times \frac{\$5}{1 \text{ ton } CO_2} = \$10 \text{ } CO_2 \text{ offset}$$

"Normalized" $ units

*Sustainability in AF Remediation:*

## *Solution Method*

### Example Consumable Calculation and Conversion

100 gal gas x $\frac{20.71 \text{ lb } CO_2}{1 \text{ gal gas}}$ x $\frac{0.453 \text{ kg}}{1 \text{ lb}}$ x $\frac{0.001 \text{ metric ton}}{1 \text{ kg}}$

= 1 metric ton $CO_2$ emitted "Non-normalized" natural units

x $\frac{\$5}{1 \text{ ton } CO_2}$ = $5 $CO_2$ offset "Normalized" $ units



*Sustainability in AF Remediation:*

## *Solution Method*

### Energy Consumed Metric Example

32 gal gas x $\frac{150 \text{ MJ}}{1 \text{ gal gas}}$ = 4,800 MJ energy

"Non-normalized" natural units

32 gal gas x $\frac{\$4.00}{1 \text{ gal gas}}$ = $128

"Normalized" $ units

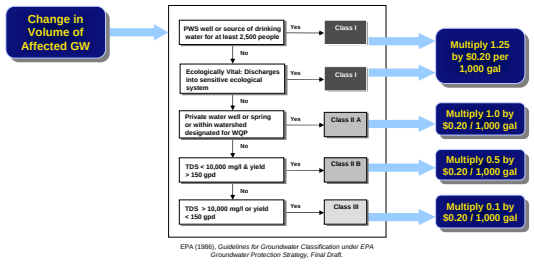


*Sustainability in AF Remediation:*

## *Solution Method*

"Non-normalized" Resource Service metric is based on volume of plume that is restored

"Normalized" Resource Service Groundwater Valuation:




EPA (1986), *Guidelines for Groundwater Classification under EPA Groundwater Protection Strategy, Final Draft.*



*Sustainability in AF Remediation:*

## *Solution Method*

### Technology Cost Example

"Non-normalized" and "Normalized" units are the same

10,000 $yd^3$ x $\frac{\$400}{1 \text{ } yd^3 \text{ Excavation}}$ = $4,000,000

"Non-normalized" natural units

10,000 $yd^3$ x $\frac{\$400}{1 \text{ } yd^3 \text{ Excavation}}$ = $4,000,000

"Normalized" $ units

Unit costs from Federal Roundtable



*Sustainability in AF Remediation:*

## *Solution Method*

### Safety / Accident Risk Example

(1,000 hrs worked + 400 hrs traveled) x $\frac{2.7 \times 10^{-9} \text{ injuries}}{1 \text{ hr worked}}$

+ (100 miles traveled) x $\frac{91 \text{ injuries}}{100{,}000{,}000 \text{ VMT}}$

= $9.5 \times 10^{-5}$ injuries "Non-normalized" natural units

$\frac{48 \text{ lost hrs}}{1 \text{ injury}}$ ($9.5 \times 10^{-5}$ injuries) x $\frac{\$80}{1 \text{ lost hr}}$ = $0.36

"Normalized" natural units

Risk of non-fatal injuries derived from the US Bureau of Labor, 2006



*Sustainability in AF Remediation:*

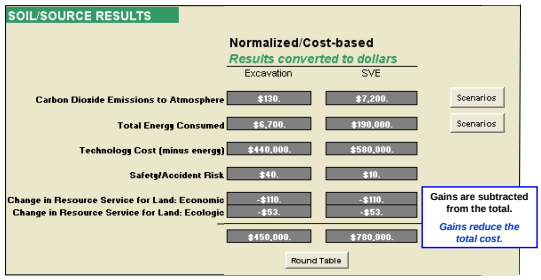
## *Solution Method*

**SOIL/SOURCE RESULTS**

| | Non-normalized *Calculations in natural units* | | |
|---|---|---|---|
| | Excavation | SVE | |
| Carbon Dioxide Emissions to Atmosphere | 21. | 1,200. | *tons $CO_2$* |
| Total Energy Consumed | 270,000. | 390,000. | *Megajoules* |
| Technology Cost (minus energy) | 440,000. | 580,000. | *dollars* |
| Safety/Accident Risk | 0.44 | 0.021 | *lost hours* |
| Change in Resource Service for Land: Economic | Net Gain | Net Gain | |
| Change in Resource Service for Land: Ecologic | Net Gain | Net Gain | |

*Sustainability in AF Remediation:*

## *Solution Method*

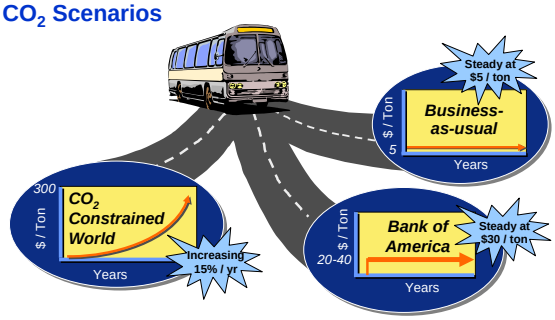





*Sustainability in AF Remediation:*

## *Solution Method*

### $CO_2$ Scenarios

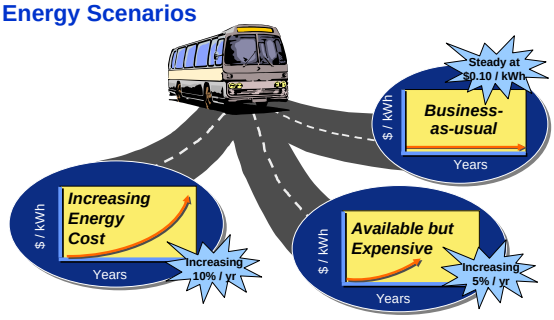





*Sustainability in AF Remediation:*

## *Solution Method*

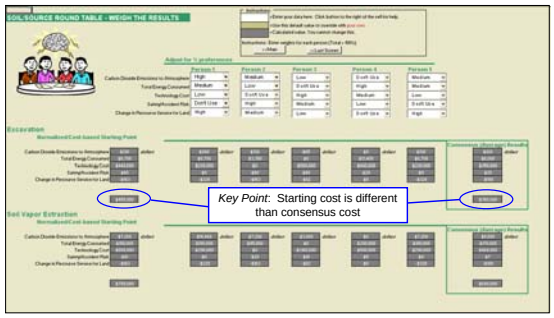
### Energy Scenarios






*Sustainability in AF Remediation:*

## *Solution Method*






## Questions / Discussion

# Attachment 12
# Consensus Standards

## Standards and Conformity Assessment

# SURF

**October 2008**

Gordon Gillerman
Conformity Assessment Advisor
Homeland Security
National Institute of Standards and Technology
gordon.gillerman@nist.gov



## *Activity Overview – Who am I?*

- Assist US Federal Government Agencies including the Department of Homeland Security and the Department of Justice in developing standards and conformity policies and administrative infrastructure
- Design and assist in the implementation of homeland security related conformity assessment programs
- Assist in the development of standards for homeland security
  - Coordinate and network with standards development organizations
  - Promote use of available international and national standards
  - Identify standards suitable for homeland security procurement and grant guidance
  - Participate in the development of key standards



## *Standards for Everyone - Definitions*

- Physical Standard – Reference standard of measure or standard reference material (eg. unit of measure) (example: meter)
- Documentary Standard – Document that describes design, construction, performance or rating requirements of a thing (product, system) or process (examples: ISO 58000 film sensitivity ratings and ISO 9000 quality management systems)
- Environmental or Health Standard – Defines maximum exposure or concentration limit (eg. UV exposure per daily work shift)
- Mandatory Standard – Standard this is enforced by law (eg. CPSC small parts regulations for toys for use by children 3 years of age or under)
- Voluntary Standard – Standard that is not enforced by law directly
- De facto Standard – Standard that is not mandatory, but generally followed
- Consensus Standard – Standard developed with a balance of interests and due processes
- Consortium Standard – Standard developed without a balance of interests
- National Standard – Standard that is developed under accepted national system (example: ANSI accredited standards development process in the U.S.)
- International Standard – Standard that is accepted for multinational application (example: Standard published by the International Organization for Standardization (ISO))



## Standards Stuff

- One, two or several of the previous definitions can apply to individual standards
- The definition of an international standard is a subject of debate. Is it a internationally accepted standard or a standard developed by a process that includes a national participation (voting) system?
- In the U.S. we have a very unique decentralized standards development system.



## *The Value of Accredited Standards Development*

- **Enhances confidence that the process is open, balanced, transparent, consensus based and has adequate due process**
- Reduces potential for perception of bias
- Can make use of established processes
- Generally, more acceptable to government
- May ease the path to the development of an international standard



## *Conformity Assessment*

"demonstration that specified requirements relating to a product, process, system, person or body are fulfilled"

ISO/IEC 17000

## *Helpful Terminology*

**The parties – who done it?**

Conformity Assessment can be conducted by:

*first party* – seller or manufacturer

*second party* – purchaser or user

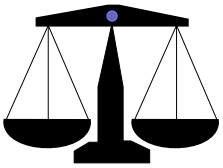
*third party* – an independent entity that has no interest in transactions between the 1st and 2nd parties

*government* – has a unique role in regulation, but is the second party in procurement



## *Types of Conformity Assessment*

- Supplier's Declaration
- Inspection
- Testing
- Certification
- Registration
- Accreditation





## *Typical Use – Suppliers Declaration (1st Party CA)*

Generally used:

- when the risk associated with noncompliance is low
- there are adequate penalties for placing noncompliant products on the market
- there are adequate mechanisms to remove noncompliant products from the market




## *Typical Use – Inspection (1st, 2nd or 3rd Party CA)*

- Used when the critical characteristics can be evaluated via physical examination or measurement.
- May be an element of a certification system.
- May be used to ensure that all parts of a system have been properly installed (ex. code inspection)




## *Typical Use –Certification (3rd Party CA)*


- Used when the risks associated with non-conformity are moderate to high.
- Includes evaluation, compliance decision, attestation of conformity and some form of *surveillance* or follow up.
- Always conducted by a third party.






## *Management System Registration (3rd Party CA)*

- Used to provide an assurance that a process meets requirements
- In the US registration is associated with third party certification of management systems.
- This process includes initial assessment of written management system procedures and implementation
- Audits and reassessment are typically used for surveillance
- Scope of management system is key
- Useful for process critical applications, quality (ISO 9000) and environmental (ISO 14000) management systems.
- Sector specific applications are generally the most effective such as ISO 13485 (medical devices) and TS 9000 (automotive).

## *Typical Use - Accreditation*

- Used to assess and ensure/enhance ongoing conformity assessment body and program for competence, management and technical requirements.
- Used to attain needed confidence in laboratory testing operation and results.
- Used to attain needed confidence in certification system.

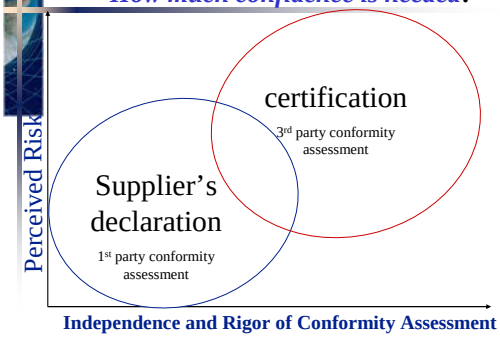


## *Factors in CA System Design*

- **The risks associated with non-compliance should be proportional to the rigor and independence of the CA system.**
- System over-design will add too much cost.
- System Under-design will result in too little confidence of compliance.
- Penalties associated with non-compliance may reduce the needed rigor and independence of the conformity assessment system.
- Timely mechanisms that effectively remove non-compliant products from the market may also reduce the needed rigor and independence of the system.

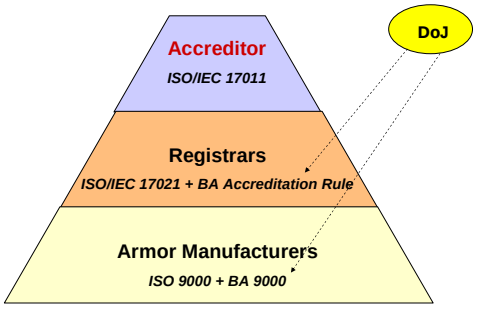


## *Risk and Conformity Assessment How much confidence is needed?*






## *Example – Body Armor Quality Management*



# Attachment 13
# Green Cleanup Standard Update

# Green Cleanup Standards Update

SURF 8 - Philadelphia, PA
Deb Goldblum, Region 3
October 6, 2008

## History

- November 2006 – DuPont introduced the concept of sustainable remediation to Region 3 at semi-annual meeting
- February 2007 –
  - 2nd Sustainable Remediation Forum (SuRF) meeting
  - Land Revitalization Office was tasked with developing clean energy and greenhouse reduction strategy for OSWER
- April 2007 – DuPont/Region 3 RCRA began to test sustainability criteria on Martinsville, VA site

## RCRA Remedy Selection Criteria

**Threshold Criteria**

- Protect Human Health & the Environment
- Control Sources
- Meet Cleanup Objectives

**Balancing Factors**

- Long-term reliability
- Reduction of toxicity, mobility or volume
- Short-term effectiveness
- Ease of implementation
- Cost
- Community acceptance
- State acceptance
- Sustainability

## Green Cleanup Goals

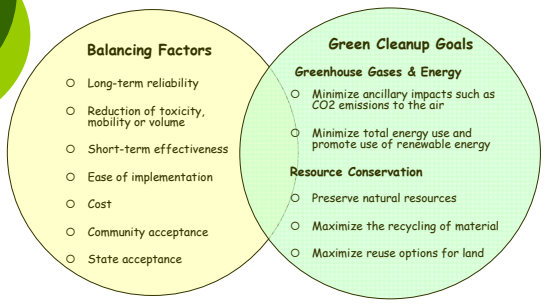
**Greenhouse Gases & Energy**

- Minimize ancillary impacts such as CO2 emissions to the air
- Minimize total energy use and promote use of renewable energy

**Resource Conservation**

- Preserve and restore natural resources
- Maximize the recycling of material
- Maximize reuse options for land

## Integrate Goals



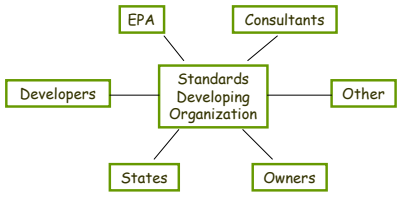

## Green Cleanup Standard

- Developed 1-pager
- OSWER Innovation Proposal
  - -OSRTI (Superfund)
  - -FFRRO (Federal Facilities)
  - -OUST (Tanks)
  - -OSRE (Enforcement)
  - -ASTSWMO (States)
  - -OSW (RCRA)
  - -OBLR (Brownfields)
  - -CPA (Cross program)
  - -Regions 5 & 9
  - -NIST **(National Institute of Standards and Technology)**
- Benchmark Report
- Workgroup Kick-off Meeting - September 22

## A few things about conformity assessment…

National Technology Transfer and Advancement Act (NTAA)

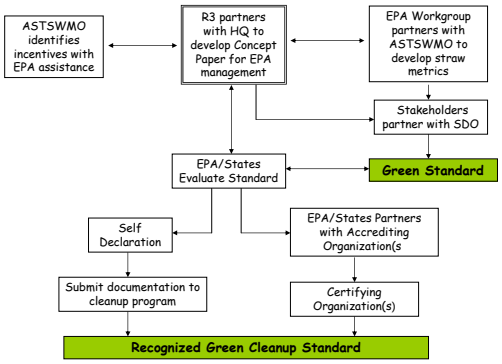
- Enacted February 1996
- Directs NIST to coordinate conformity assessment of federal, state & local gov't with private sector to reduce duplication




## Concept Paper (Road Map)

- Product options for standards
  - Projects
  - Individuals
- Standard structure options
  - Leed (rating system)
  - ISO 14000 (management system)
  - Other
- Certification options
  - Self declaration (audits)
  - 3rd party
- Potential Incentives
  - Financial
  - Emotional
  - Branding
- Straw metrics

## Conceptual Development for Green Cleanups Standard



# Attachment 14
# Illinois EPA Greener Cleanups Initiative

Gary King, Acting Chief, Bureau of Land, Illinois EPA
David Reynolds, PE, Vice President, AECOM Environmental

# Illinois EPA's "Greener Cleanups" Initiative

October 7, 2008

## Agenda

- Illinois EPA's Motivations
- Process
- Results
- Next Steps
- Questions and Discussion

## Illinois EPA's Motivations

- The Bureau of Land's sustainability strategy pre-2007 focused on end use, post-cleanup decisions
  - Green buildings
  - Smart Growth principles
- Major drawbacks to this strategy
  - No oversight or authority to compel change
  - Zero ability to develop internal capacity
  - No integration into everyday work
- Conclusion
  - Need to mainstream sustainable practices into site assessment and remediation, aligning to the Bureau's core mission

## Process

- Illinois EPA staff interviews
- White paper
- Working meeting
- Case studies

## Illinois EPA Staff Interviews

- Conducted by two graduate interns
- Included representatives from each of Illinois EPA's bureaus (air, land, water), RCRA permits section, pollution prevention section, and finance
- Identified possible institutional and legal barriers

## White Paper

- Prepared to support working meeting
- Summarized Illinois EPA cleanup programs
  - Required with oversight
  - Voluntary with oversight
  - Illinois EPA response actions
- Identified potential opportunities
- Summarized staff interview findings

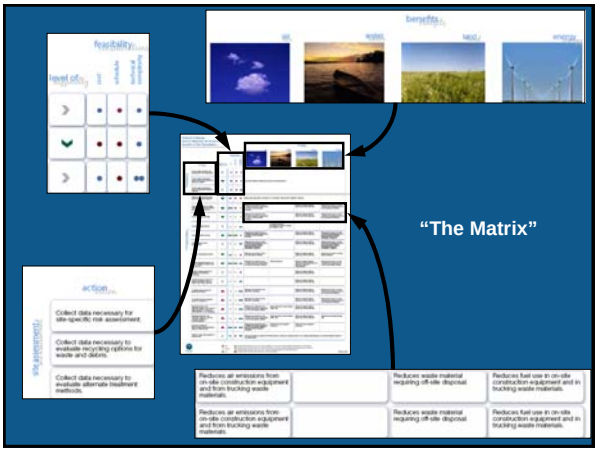
**Working Meeting – June 27, 2007**

- Attended by representatives from US EPA headquarters and various regions; from several state EPAs within Region 5; from City of Chicago; and from the private sector
- Started with a series of background presentations
- Included small groups examining four topics: Regulatory Barriers; Market Barriers; Remedy Selection; and the Greener Cleanup Model
- Concluded with small group presentations and identification of next steps

**Case Studies**

- Included active and completed sites from various cleanup programs
- Started with a pre-site visit questionnaire
- Proceeded to site visits or desk reviews
- Identified both opportunities to green cleanups and existing best practices

**Results – "The Matrix"**




**Next Steps for Illinois EPA**

- Evaluate usefulness of the matrix when applied to specific sites or types of sites, e.g. leaking underground storage tank cleanups;
- Cultivate pilot projects;
- Contribute to development of a green remediation recognition program;
- Contribute to development of performance metrics; and
- Continue staff training and education in green technologies.

Questions and Discussion

October 7, 2008

# Attachment 15
# Survey on Sustainable Remediation

# SURVEY ON SUSTAINABLE REMEDIATION

## Results of Survey Submitted to SURF Members and Regulators

Elie H. Haddad, Locus Technologies
Elizabeth Wells, Regional Water Quality Control Board, San Francisco Region

SURF – 6&7 October 2008

## Survey Background – SURF Members

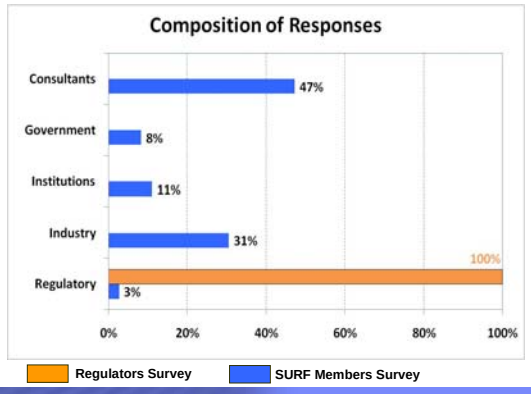
- To help answer questions for the White Paper
- One Set was provided to SURF members on the emailing list
- 36 responses were received from SURF members



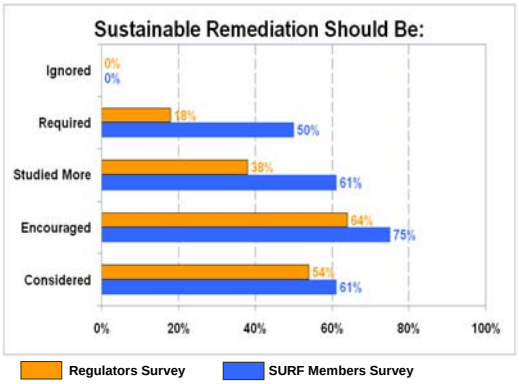
## Survey Background - Regulators

- Another set was Sent to >160 regulators (50 US states and Canada to:
  1. Help gauge level of knowledge and understanding of sustainable remediation by environmental regulators,
  2. Support "Impediments and Barriers" section of White Paper
- Received 56 full responses
- 38 from 19 different states; 14 Federal; 1 Ontario; 3 anonymous
- Important to note not a scientific survey

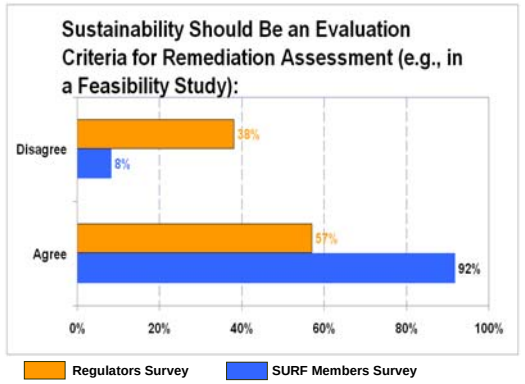






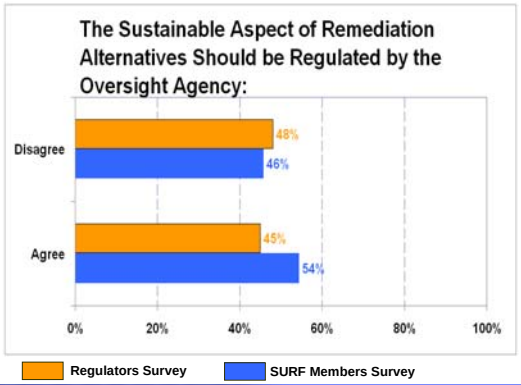


**How do you Think Sustainability should be Measured (SURF Members)?**

- Life Cycle Cost Assessment through various environmental, social, and economic indicators (majority of responses)
- Concerned about combining sustainability factors into NCP criteria in the form of metrics (one response)
- Should start including sustainability as an evaluation criteria in FS (one response)
- Involve all stakeholders – One size fits all will not work (one response)

7 SURF – 6&7 October 2008




8 SURF – 6&7 October 2008

**Under what Mechanism can Sustainable Remediation be Regulated?**

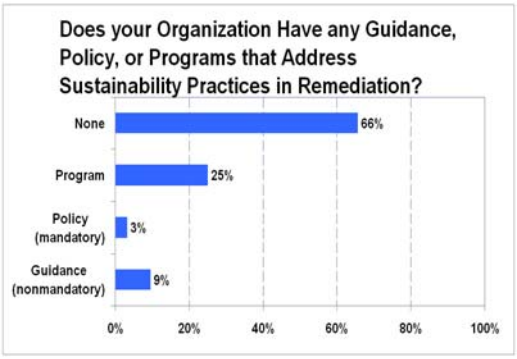
- Law
  - SURF Members (11 responses)
  - Regulators (4 responses)
- Guidelines
  - SURF Members (8 responses)
  - Regulators (10 responses)
- Not the role of the regulator
  - SURF Members (0 responses)
  - Regulators (5 responses)
- Include it in the decision making process that gives sustainability a "weight", and set values so that sustainability alone does not force a particular outcome (one response)
- Involve all stakeholders – One size fits all will not work (one response)

9 SURF – 6&7 October 2008

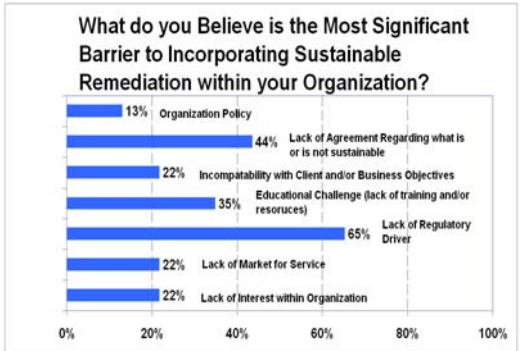
**For Projects that Included Sustainability Element, What were some of the Challenges Encountered (SURF Members)?**

- Regulatory complications/resistance. Time issues lead to complications with communities and regulators
- Doing the work
- Problems when sustainability metrics make the decisions without considering other influencing factors
- Valuation of resources (e.g., how much is groundwater worth?)
- Education of the community and regulators
- How to incorporate sustainability in the remedy selection
- NIMBYism

10 SURF – 6&7 October 2008




11 SURF – 6&7 October 2008

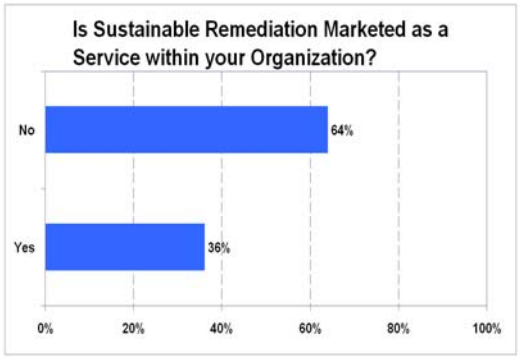



12 SURF – 6&7 October 2008

**Name one Change to Make Sustainable Remediation an Integral Part of Your Organization's Approach to Remediation (SURF Members)**

- **Education (9 responses)**
- **Include sustainability in Project Startup Forms**
- **Incentives for sustainability in regulatory process**
- **Create a web tool to evaluate metrics for each technology**








**Survey questions were prepared with the participation of:**

- Carol Dona, U.S. Army
- John Englert, KL Gates
- William Gates, KL Gates
- Elie Haddad, Locus Technologies
- Mike Houlihan, Geosyntec
- Lowell Kessel, G.E.O.
- Dave Major, Geosyntec
- Chuck Newell, GSI
- Dick Raymond, Terra Systems
- Charlie So, Shaw Environmental
- Curtis Stanley, Shell
- Elizabeth Wells, RWQCB San Francisco Region



## Discussion?

# Attachment 16
# SURF Work Group Organizational Update / Discussion

AECOM ENVIRONMENT

# SuRF Working Group Organizational Update/Discussion

SuRF 8
Philadelphia, PA
October 7, 2008



AECOM ENVIRONMENT

## Historical and Future Perspectives

- SuRF Initiated in 2006
- Rapid Growth in Participation
- International participation – link to SuRF UK
- Core participants + significant regional participation
- SuRF Working Group established at SuRF 7
- Green and Sustainable Remediation is Hot!
- Anticipate continued growth
- Anticipate need for a more tangible group structure or organization
  - credibility, documentation, information exchange, and due to challenges associated with growth



AECOM ENVIRONMENT

## Challenges Associated with Growth

- Organizational Structure
- Meeting Location/Logistics
- Increasing need for tangible results
- Increase in legalities
- Is lack of direct funding limiting us?
  - Typically need for $ drives type of organization
  - Sweat equity vs. skin in game
- Limit direct participation?
  - 1 participant/entity?
  - Challenges associated with remote participation



AECOM ENVIRONMENT

## Some Stimulating Questions

- Are you willing to pay a personal or organizational membership fee?
- What is the SuRF lifecycle?
- How do we want to get word out? (lobbying, web site, etc.)
- Do we want/need to certify, standardize, endorse, etc.?
- Do we want to sponsor or prepare training materials?
- Is lack of direct funding limiting us?
- Should there be participation requirements?
  - Meeting attendance
  - Active in committees, initiatives, etc.



AECOM ENVIRONMENT

## What are we now?

- Adhocracy
  - Loosely affiliated group with common interests
  - Not officially any kind of organization

## What do we need/want to be?

- Objectives should drive our organizational structure
  - Loosely affiliated group with common interests
  - Not officially any kind of organization
  - Generally agree that we need to become a more formal organization?
- Organize as independent or as a subsidiary of existing group



AECOM ENVIRONMENT

## Non-Profit Organization (NPO)

- **non-profit organization** (abbreviated "NPO", also "not-for-profit") is a legally constituted organization whose objective is to support or engage in activities of public or private interest without any commercial or monetary profit. Not always a charitable organization.

AECOM ENVIRONMENT

## Cooperative Research and Development Agreements (CRADA)

- A CRADA is a written agreement between a federal research organization and one or more federal or non-federal parties (collaborators) to work together as partners on a research project of mutual interest.
- No government funding
- offers a novel means of performing both basic and applied research in an economical manner, while capitalizing on human resources and encouraging the transfer and application of emerging technology.



AECOM ENVIRONMENT

## Cooperative Agreement

- typically used for competitive acquisition of cost-shared research services
- As defined in the Federal Grant and Cooperative Agreement Act (31 U.S.C. 6304 and 6305), a grant or a cooperative agreement is a legal instrument used by a Federal agency to enter into a relationship whose principal purpose is assistance (that is, the transfer of something of value to the recipient to carry out a public purpose of support or stimulation authorized by U.S. law).
- complement procurement contracts and other instruments used for acquiring goods and services for the direct benefit or use of the U.S. Government
- cooperative agreements used when substantial government involvement is contemplated.



AECOM ENVIRONMENT

## Professional Society?

- usually non-profit, that exists to further a particular profession, to protect both the public interest and the interests of professionals. The roles of these bodies have been variously defined to include: "a group of people in a learned occupation who are entrusted with maintaining control or oversight of the legitimate practice of the occupation;" also a body acting "to safeguard the public interest;" organizations which "represent the interest of the professional practitioners," and so "act to maintain their own privileged and powerful position as a controlling body."
- Though professional bodies often act to protect the public by maintaining and enforcing standards of training and ethics in their profession, they often also act like a cartel or a labor union (trade union) for the members of the profession, though this description is commonly rejected by the body concerned.



AECOM ENVIRONMENT

## Research Institute

- an establishment endowed for doing research. Research institutes may specialize in basic research or may be oriented to applied research.
- National Brownfields Association
- World Business Council for Sustainable Development
  - WBCSD is a CEO-led, global association of some 200 companies dealing exclusively with business and sustainable development.
  - The Council provides a platform for companies to explore sustainable development, share knowledge, experiences and best practices, and to advocate business positions on these issues in a variety of forums, working with governments, non-governmental and intergovernmental organizations.



AECOM ENVIRONMENT

## Acknowledgements


- Dave Ellis - DuPont
- Paul Hadley – CA DTSC
- Deb Goldblum – US EPA
- Dave Major - Geosyntec
- Paul Favara – CH2MHILL
- Stephanie Fiorenza – BP Oil
- Curt Stanley – Shell Oil

**Attachment 17**
**SURF Web Site**

SUSTAINABLE REMEDIATION FORUM USA

# Sustainable Remediation Forum (SuRF) USA goes live!

## Preparing for prime time…

## SuRF_Website_Introduction



- Website address is www.sustainableremediation.org
- Currently contains
  - Description of the forum
  - Mission statement
  - Location for report downloads
  - Contact info for making suggestions



SUSTAINABLE REMEDIATION FORUM USA

## SuRF_Website_Introduction

3

- What do you think we should have available that would be useful and appropriate?
- What should we not include?
- Who should manage content (the Leadership Team?)
- Links to other organizations? Firms? Affiliates?



SuRF USA
SUSTAINABLE REMEDIATION FORUM USA

## SuRF_Website_Introduction

4

- Advertising (to pay for maintenance and sponsor meetings)?
- Cost of website
  - G.E.O. Inc. donated domain and initial website design
  - Cost for future web site maintenance labor

  ~$75/month for 2 hours
- Should we publicize it? If so, how?



SuRF USA
SUSTAINABLE REMEDIATION FORUM USA