Sustainable Remediation Forum (SURF)
SURF 27: November 11-12, 2014

SURF 27 was held at the University of Michigan in Ann Arbor, Michigan on November 11 – 12, 2014 and focused on "Sustainable Remediation in Action." Individuals that participated in the meeting, along with contact information, are listed in Attachment 1. The meeting marked the 27th time that various stakeholders in remediation—industry, government agencies, environmental groups, consultants, and academia—came together to discuss the use of sustainability concepts throughout the remediation life cycle. Meeting minutes are posted for members at www.sustainableremediation.org. Members should log in and access the minutes by clicking "SURF Meeting Minutes" under "Member Resources."

Day 1

The meeting began with Mike Rominger (meeting facilitator) discussing meeting logistics, ground rules, nonconfidentiality assumptions, export control laws, and antitrust issues. He thanked current SURF sponsors for supporting the organization. (Members interested in sponsorship opportunities should contact the SURF Treasurer at treasurer@sustainableremediation.org.) Presentation slides for Day 1 are provided in Attachments 2 through 12.

Introduction to SURF

Amanda McNally (SURF Secretary) welcomed SURF members to SURF 27 and reviewed the organization's mission (see Attachment 2). SURF has a presence on Twitter (@SR_Forum) and LinkedIn (Sustainable Remediation Forum). Amanda showed participants SURF's revised 2013 definition of sustainable remediation:

> "Sustainable remediation is site assessment and remediation that protects human health and the environment while maximizing the environmental, social, and economic benefits throughout the project life cycle."

She emphasized that this definition focuses on the entire life cycle of the project. In addition, Amanda reviewed the value proposition of SURF, which includes access to cutting-edge case studies and opportunities to collaborate and network.

Lastly, Amanda encouraged participants to nominate themselves or another SURFer for vacant positions on the 2015 Board of Trustees. All nominees must be SURF members in good standing. To nominate, members should log in and access the nomination form by clicking "Nominations: 2015 Board of Trustees" under "Member Resources." Presentation slides are provided in Attachment 2.

Panel Discussion: Sustainable Strategies for Managing Contaminated Properties

Kevin Lund [Michigan Department of Environmental Quality (MDEQ)], Grant Trigger (RACER Trust), Daniel Vrendenburg (University of Michigan undergraduate student), and Gina Cortese

(University of Michigan graduate student) discussed the sustainable engineering systems applied at the Willow Run Facilities, including the decisions to select end-of-pipe treatment using a subsurface wetland and leach field and adaptive reuse of the concrete slab. Panelists (1) provided background about the facility and summarized the sustainable remediation elements, (2) described the integration of University of Michigan student work through the university's Multidisciplinary Design Program, and (3) emphasized the importance of creating sustainable remediation solutions from the opportunities presented on-site. Presentation slides are provided in Attachment 3.

Kevin began by discussing the various definitions of sustainable remediation. He presented the SuRF-UK definition and said that he likes it because it includes the idea of balance:

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

Although sustainable remediation necessitates balancing a number of overlapping and interrelated factors (i.e., technical, legal, regulatory, societal, business), Kevin believes that collaboration is the most important. He discussed the phrase "remediation for redevelopment," which is being used more frequently in Michigan. The "remediation for redevelopment" concept involves the belief that business development and environmental stewardship can and should co-exist to promote sustainable engineered systems that safeguard public health and quality of life and also are compatible with sustaining natural (i.e., environmental) systems.

- Facility Background and Sustainable Remediation Elements (Kevin)
  The Willow Run site is located approximately 12 miles east of the meeting venue in Ypsilanti Township, Michigan. The 350-acre site was occupied by a manufacturing plant that was originally built in the 1940s as an airplane assembly plant and has over 80 acres of concrete slab. About 40 acres of light nonaqueous phase liquid (LNAPL) was found underneath the concrete plant floor, a system of storm sewers installed at or below the groundwater table provides groundwater control at the site, and a gravel sand unit over clay is the predominant geological profile. An existing wastewater treatment plant (WWTP) separates LNAPL, providing limited treatment of approximately 200 gallons per minute of combined storm and groundwater. Discharge is to the local utility. On-site storm water and groundwater management cost approximately $1 million/year.

  Sustainable remediation efforts include using the former concrete floor of the plant (which is about ½-mile long) to mitigate infiltration and direct contact exposure to the contamination, using the existing storm water system to collect oil and groundwater, and creating a subsurface wetland and leach field to provide end-of-pipe treatment.

- Student Work (Gina and Daniel)
  The University of Michigan's Multidisciplinary Design Program focuses on giving

students the opportunity to solve real-world problems and create breakthroughs in design by working in teams with experts in a variety of fields. For this project, nine students performed a literature review of wetland case studies and developed the design working hand in hand with the MDEQ. Students performed bench-scale tests to determine the most appropriate and beneficial vegetation and to define the best-case treatment scenario. Models were constructed to test theoretical contaminant removal and plant uptake from four media types. Results allowed plans to be optimized and costs for typical consulting services to be offset.

Bench-scale tests were followed by pilot-scale testing. Over two semesters, five students constructed scalable models to test contaminant reduction via a free-surface flow wetland, subsurface flow wetland, and leach field. Results indicated that all three systems could function to lower contaminant levels to the appropriate discharge requirement.

- Site-Specific Opportunities (Grant)
  Grant emphasized the importance of creating sustainable remediation solutions from the opportunities presented on-site. Although land is an asset at this site (like so many other remediation sites), demolition and disposal of the 80 acres of concrete on-site was cost prohibitive. Instead, the team evaluated the specific conditions and features at the site to identify assets.

  - The plant floor was concrete and was designed and built with a natural grade so that the planes could roll downhill during assembly. By designing small berms and taking advantage of the existing slope design, the team developed a plan to redirect storm water off the slab to a new storm water retention system. This concept converts the slab into a storm water management asset. In addition, by diverting storm water out of the sewer system, the existing storm water system will be converted into a new asset – a groundwater control and capture system. By stepping back and reconsidering the site features as potential assets, the team converted an obsolete structure and former storm sewer system into an environmental solution for the site and designed the remedial system with an overall improved landscape architecture goal in mind.

  - Long-term, lower operations and maintenance costs can be achieved by incorporating a natural system (i.e., wetland) into the treatment train. With the proposed infiltration system as a final step in the process, the goal is to operate with zero discharge for at least six months or longer if system performance can sustain that objective. It is expected that this system will operate at a substantially lower annual cost with only nominal operator requirements.

Participants asked panelists questions about community involvement at the site. Kevin meets with the Township Supervisor about twice/month and meets with members of the adjacent

community (2,500 homes) as well. He will be obtaining community input on the next step, which is redevelopment of the site as a connected vehicle research and test facility. (The alternative is to reuse the site as an industrial park.) Kevin emphasized the importance of local community involvement in this project and believes it is the remediation professional's job to respect, preserve, and integrate the end use of the site as an important part of the community.

For example, the Yankee Air Museum sought support to acquire a portion of the former Willow Run plant to relocate the local air and technology museum to a renovated portion of the plant. The MDEQ worked closely with Ypsilanti Township, RACER Trust, and local community leaders to address issues associated with the Yankee Air Museum proposal. In October, Yankee Air Museum closed on the purchase of about 155,000 square feet of the former plant and has begun the work necessary to rehabilitate the structure for a new museum. The effort was only possible with strong local and state support.

One participant asked when sustainable practices were incorporated into the project life cycle. Kevin said that the first action taken on the project was to renovate an existing on-site building for RACER Trust offices. Based on discussions with the community, community members placed value on the preservation of the historical aspects of the site and the protection of human health and the environment. Kevin commented that the local township has an environmental commission, which makes it easier to discuss green and sustainable remediation because the community is already embracing it.

Enhancing Sustainability in Brownfield Redevelopment

James Harless (Soils and Materials Engineers) presented case studies in which environmental risk management techniques were used to enhance brownfield redevelopment sustainability. He also examined the roles of the environmental regulatory environment and the availability of financial incentives for these sustainability approaches. Presentation slides are provided in Attachment 4.

- Ventower Industries
  Ventower Industries constructed a 110,000 square foot facility to manufacture steel towers for wind turbines on 38 acres of an industrial waste landfill located in a coastal ecosystem near Lake Erie. Significant challenges associated with the project included (1) addressing the high levels of on-site contamination and exposure pathways of direct contact and vapor intrusion, (2) designing a foundation to support a large plant on unconsolidated wastes while preventing the spread of groundwater contamination, and (3) securing over $7 million in brownfields financing to pay for the extra costs. A commitment to sustainability throughout the work resulted in approaches that eliminated soil and groundwater generation during construction (e.g., no water was used during soil stabilization) and contractor requirements for minimal commuting, minimal on-site engine idling, and the use of biodiesel.

- Mason Run
  This project involved the transformation of a 50-acre abandoned paper mill site into a 500-home community. Over 140,000 cubic yards of coal ash was present at the site and its removal was deemed necessary to facilitate residential redevelopment. One of the challenges to managing the cinder/ash fill was a requirement to maintain the existing site grade, which would result in the 2 feet of cinder/ash fill being replaced with clean fill after removal. The project team designed and negotiated with the MDEQ the technical and regulatory specifications for an alternate, sustainable, on-site solution whereby clean soil was excavated from beneath the roads and parks in the development and the cinder/ash fill was removed from the residential lots and encapsulated as inert fill beneath pavement or clean fill in these areas. The native soil removed from the roads and parks was used to replace the impacted coal ash fill removed from residential lots. The on-site encapsulation and reuse of 140,000 cubic yards of cinder ash material saved over $2.5 million in response costs, making the project economically viable.

- Abercrombie Center
  The Abercrombie Center is a 7,000 square foot building in Southgate, Michigan and former home to a dry cleaning operation. As a result of these operations, the soil underneath the building was contaminated with tetrachloroethene, which posed an indoor inhalation risk for future building occupants. The remediation strategy focused on preserving as much of the building as possible and converting it to usable space once again. The interior of the building was demolished and the concrete floor removed both to enable access to source materials for removal and disposal and to allow the installation of a passive vapor intrusion mitigation system. The response action design minimized the removal and disposal of contaminated soil, while providing a safe solution. The vacant property was redeveloped as a multi-tenant retail and commercial center.

Discussions after the presentation focused on the importance of brownfield funds and cleanup levels for soil left in place. In the case of Ventower Industries, James said that brownfield funds were used as incentive money to support construction of the facility. In response to a different question, James said that active remediation is not always required for brownfield development in some states. None of the three example sites was required to be remediated, just safely reused, which means the application of risk-based approaches.

The Greening of Chevy in the Hole: Phytotechnology on an Urban Brownfield

Joel Parker (Environmental Consulting & Technology) presented a case study of the ongoing sustainable remediation being conducted at the site of the original Chevrolet manufacturing plant in Flint, Michigan. A summary of the site background, master planning, social catalysts, and current metrics and status is provided below. Presentation slides are provided in Attachment 5.

- Background
  This 130-acre property was a key center of manufacturing for General Motors and is known as Chevy in the Hole because it is located in a depression along the Flint River. The Flint River flows through downtown Flint and the site. After several floods, the U.S. Army Corps of Engineers installed a concrete, one-mile channel in 1963. In the mid-1990s, General Motors began to close plants at site, and the last building was demolished in 2004. After the buildings were demolished, the site was paved with asphalt to eliminate direct contact with site contaminants, including solvents, oils, and metals. In addition, a barbwire fence was installed at the property perimeter to restrict access.

- Issue-Driven Master Planning
  Unlike conventional brownfield redevelopment, reuse discussions at this site were driven by site-specific issues and conditions. With no interested developer, the goal was to leverage site issues and conditions into an asset or resource and let this thinking drive reuse. Two positive items were identified about the site: time and space. Because reuse was not being driven by a developer, there were no demands to constrain the timelines of treatment technologies. In addition, the space (or location) of the site demonstrated its potential as a community connector. Surrounded by two elementary schools, two universities, a stadium, residential communities, and a children's museum (to name a few), the site could serve as an important center of the community.

- Trees as Social Catalyst for Change
  In 2011, the site was awarded a Great Lakes Restoration Initiative grant for the reduction of toxic substances on a brownfield site via the U.S. Forest Service. The grant focused on the need for trees at key locations along the river to serve as a riparian buffer and as nutrient runoff filter strips to protect the river from compost piles. The compost piles had evolved from the use of a portion of the site for municipal yard waste collection, which offered considerable savings to the City under financial duress.

  Different disciplines were brought together, and phytohydraulics was identified as the primary mechanism for contaminant treatment. Trees were planted and irrigated using solar power with pumped water from the river. Within one growing season, trees grew to an average of 8 to 10 feet, with the compost pile filter strip trees growing to as much as 13 feet. With the tangible evidence of trees, the community began to view the site as something that could be positive. The trees changed their view of the site and helped initiate a sense of ownership in the community. With community interest sparked, the public came forward with ideas for reuse.

- Current Metrics and Status
  At this time, the social benefits of remediation far outweigh the technical benefits. Approximately 1,600 new trees have been planted and over 200 pioneer trees have

been irrigated and their growth stimulated. After two growing seasons, small whips and 10-inch cuttings watered using solar power have grown as high as 25 feet with a 95% survival rate. In addition, the concept of filter strips for runoff collection was demonstrated successfully. Site contamination is being leveraged as an asset, with technologies being featured for local high school students through STEM programs. Community college students have received classroom and on-site field training and related certificates in environmental techniques (e.g., low-flow groundwater sampling) to better equip them in environmental industry careers. Community interest has prompted an annual city art festival to be held on the site for the last two years, and the First Annual Flint River Flotilla was held in 2014 so that residents could float through Chevy in the Hole on their kayaks and inner tubes.

- Future Plans
  Future site activities will include a third phytoremediation planting effort to focus on the potential for vegetation to uptake contamination from soil and be harvested as biofuel or other related uses. In the future and with additional green infrastructure, the site could be used as a local storm water utility authority.

Discussions after the presentation focused on communication with the community. Joel said that the project is a human communication exercise and emphasized the importance of not only talking to the community, but listening as well. He said that, at this site, the social aspects of the triple bottom line were weighed more heavily than the technical aspects.

DuPont and Remediation Partners Making Remediation LCA Easier and More Accessible

Paul Favara (CH2M HILL) presented a case study in which DuPont and its remediation partners Geosyntec Consultants, URS, CH2M HILL, and Parsons worked to develop Life Cycle Assessment (LCA) modules to make the application of LCA to sustainable remediation easier and more accessible to those who want to use LCA but don't have remediation-specific data sets. Using the best approaches of existing tools (i.e., SiteWise, SRT, and SEFA) and through a peer-review process, the team developed a sustainable remediation approach that leverages the benefits of other industry tools that are pre-populated with remediation-related materials, processes, and equipment. The approach uses SimaPro LCA software and achieves the following:

- Builds up remediation technology input (i.e., inventories that contribute to each remediation technology)
- Vets the input datasets to ensure they are appropriate for specific application and makes modifications as necessary
- Documents basis for specific datasets to provide transparency
- Builds up technology-specific modules to support overall remediation-specific applications

The approach will allow faster ramp up of LCA utilization in the remediation industry and provide environmental remediation practitioners with better and faster means to evaluate the trade-offs of alternatives and identify optimization opportunities. Presentation slides are provided in Attachment 6.

Participants asked questions about the availability of the tool and cost. Paul said that DuPont is working on internal approval processes to release the results of the work and plans to make the tool available for free. The tool assumes that the user has a license fee from SimaPro. Paul believes that this newly developed hybrid tool cuts the learning curve of SimaPro in half. He acknowledged the added expense of SimaPro compared to other tools, but emphasized the added value as well (e.g., other tools do not allow the user to know when burden shifting has occurred).

Sustainable Remediation Initiative: The Year of Implementation

Melissa Harclerode (CDM Smith) provided an overview of the Sustainable Remediation Initiative (SRI) and its accomplishments in 2014. She explained that SRI is a collaboration of members of SURF, the American Petroleum Institute (API), and the Interstate Technology Regulatory Council (ITRC). Presentation slides are provided in Attachment 7.

- *Green and Sustainable Remediation (GSR) Roundtable*
  On June 3, 2014, SRI convened the *GSR Roundtable* in Washington, D.C. Roundtable participants included SRI members, regulatory and federal agency representatives, and industry leaders. The following challenges were identified during the Roundtable: (1) a lack of uniform GSR implementation and tracking, (2) different definitions for GSR being used, (3) enforcement and jurisdictional limitations, and (4) a lack of resources. Opportunities for better implementation were discussed and included case studies and rewards and/or incentives. To overcome obstacles, Roundtable participants discussed the idea of a "Comprehensive Package" for GSR that would help cross-programmatic implementation and address the challenges associated with multiple definitions of terms.

- Federal Remediation Technologies Roundtable (FRTR)
  On November 6, 2014, the SURF members of SRI made a GSR presentation to the FRTR from the perspective of a member of the private sector. Case studies and the importance of time of implementation were discussed in the presentation.

Breakout Session 1:
Social Aspects of Sustainable Remediation and Case Study Initiative (CSI)

The first breakout session focused on two of SURF's technical initiatives: the Social Aspects of Sustainable Remediation (Melissa Harclerode, Initiative Co-Chair) and CSI (John Simon, Initiative Chair). Attendees participated in their preferred groups and Melissa and John provided a brief recap of discussions and action items to the larger group upon reconvening.

Applying Three Elements of Sustainability Groundwater Pump-and-Treat Optimization

Jennifer Borski [Wisconsin Department of Natural Resources (WDNR)] presented a case study of an optimization evaluation of an existing groundwater collection and ex-situ treatment system at a former chrome plating facility in Kaukauna, Wisconsin. The evaluation involved not only identifying ways to optimize the existing remedy, but also identifying alternative remedial options that considered environmental, economic, and social issues applicable to the site. The goals are to reduce and immobilize the contaminant mass, phase out the groundwater collection and treatment system, and return the site to private control so that the current business tenant will remain rooted in Wisconsin. Evaluation results revealed that the existing groundwater collection system was not fully capturing the plume and identified several optimization options and alternative remedies. Based on these results, a separate in-situ remedy was designed and implemented in Summer 2014 and modifications were made that reduced hazardous waste generation, chemical consumption, and labor for maintenance of the groundwater collection and treatment system. Presentation slides are provided in Attachment 8.

In response to questions, Jennifer emphasized the WDNR's focus on redevelopment and approach of pulling all available resources to maintain current business tenants. In fact, WDNR request for proposals are catered to contractors located in Wisconsin with priority given to geographically local field staff. Jennifer also mentioned that the WDNR has a goal to significantly reduce or even eliminate landfill disposal.

SURF Student Chapters Update

Mike Miller (Co-Chair, Academic Outreach Initiative) provided the background and purpose of SURF's Academic Outreach Initiative and introduced Rachael McSpadden, Director of Communications for SURF's Colorado State University (CSU) student chapter. Presentation slides are provided in Attachments 9 and 10.

- Academic Outreach Initiative
  This SURF initiative began its work in 2010 with the main goal of establishing relationships with students, professors, and researchers so that sustainable remediation would be established in universities, students would be involved in technical initiatives, SURF would collaborate with key researchers, and the future of SURF would be sustainable through new members and colleagues. A faculty advisor and SURF mentor/liaison are the two components of a student chapter. Experience has shown that an active faculty advisory is the key to the success of a SURF student chapter. Current vibrant SURF student chapters include CSU, Clarkson University, and University of Illinois at Chicago (UIC). At the end of his presentation, Mike asked participants to consider volunteering as a SURF mentor or sharing the job with a fellow SURF member. The responsibilities of the position are as follows:
  - Check in with Student Chapter President (30 minutes per month).

- Participate in conference call with Student Chapter Faculty Advisor and student chapter members (30 minutes every two months).
- Coordinate with SURF committee leaders to identify needs and opportunities so that students can become engaged in committee work.
- Contact SURF members to identify resources (e.g., speakers for student chapter meetings, research topics).

- CSU Student Chapter
  The mission statement of the CSU student chapter of SURF is to "expose students to the science and application of sustainable remediation through field trips, lectures, and group activities." The chapter currently consists of 12 graduate students and eight undergraduate students. Rachael reviewed the chapter's objectives for the upcoming academic year, which includes increasing involvement and interaction with the Parent Organization (i.e., SURF). Having a SURF Mentor/Liaison would help bridge this gap.

After both presentations, participants discussed the importance of student chapters. One participant said, "We owe it to them [the students]" and encouraged participants to "take action." Other participants provided the following suggestions to students as ways of contributing to SURF's mission:

- Mine case studies in literature and complete SURF case study template (available on website homepage)
- Read *Groundwater Conservation and Reuse at Remediation Sites* and consider working on one of the future research needs identified.
- Contact Melissa Harclerode (Co-Chair, Social Aspects Technical Initiative) if interested in teaming with Masters and Ph.D. students regarding social impact tools.

SURF Process Improvements

Bruce Wilkinson (Haley & Aldrich) provided background about a process improvement exercise that was designed for SURF leadership to understand SURF's current status and what might be holding SURF back from achieving its complete mission. At this meeting, Bruce used the technique as a way to explore the goal to "be the leader in sustainable remediation, but aligned with other partners working toward a common goal, sharing best practices, outreach, etc." An interactive exercise was designed to capture thoughts on contributing and/or restraining forces that will help and/or hurt SURF in achieving the following: "Become a leader in sustainable remediation in order to fulfill SURF's mission statement." Participants wrote thoughts on post-it notes, which were then placed on a Force Field Diagram (see Attachment 11). Presentation slides are provided in Attachment 12.

Day 2

At the beginning of the second day of the meeting, participants shared what they learned during the first meeting day and general reflections (see Attachment 13). Presentation slides for Day 2 are provided in Attachments 14 through 20.

EPA Region 1 RCRA Sustainable Remediation Summary and BMP Evaluation

John Simon (Gnarus Advisors) provided an overview of two ASTM standard guides associated with sustainable remediation [*Standard Guide for Integrating Sustainable Objectives into Cleanups* (ISOC), ASTM E2876] and greener cleanups (*Standard Guide for Greener Cleanups*, ASTM E2893) and emphasized the consensus-based process used to develop these documents. At the core of each standard are the selection of best management practices (BMPs) and a flexible evaluation process. In practice, standards are applied on a phase-by-phase basis. John highlighted some of the environmental BMPs included in the Greener Cleanups Standard, as well as the social and economic BMPs in the ISOC Standard.

Next, John presented a case study that demonstrates how these standards were applied together in a hybrid approach. The case study involves a site with over 200,000 pounds of dense, nonaqueous phase liquid (DNAPL) in which the selected remedy included affected material consolidation, capping, source removal using in situ thermal treatment, groundwater containment using a combination of barrier walls and pump and treat technology, and a wetland ecological feature. During open discussions with the community about potential end uses at the site, community members expressed a desire to blend ecological and commercial uses. A total of 75 environmental BMPs from the Greener Cleanups Standard were used, with 15 BMPs for in situ thermal treatment (e.g., insulating piping, recovering electrodes) alone. The community provided input into final remedy selection, which helped to integrate social and economic BMPs. A project website and Community Advisory Panel were developed, and a stakeholder-driven reuse planning process (including a market analysis) was implemented. Nature trails were provided and ecological diversity was maintained. Presentation slides are provided in Attachment 14.

After the presentation, one participant emphasized the importance of quantifying BMPs when possible to provide a stronger basis for the importance of the BMP.

Muddy Boots Meet Tech: Sustainable Tools for Environmental Data Management

Josh Ryan (Ornicept) presented information about an end-to-end fieldwork collaboration tool that has been developed to reduce the burdens of project managers and fieldwork staff while reducing material and energy usage, improving project turnaround, and reducing overall project costs. Josh described the historical and current practices associated with the manual nature of data management in the field. Although recent improvements in batteries and rugged tablet technology have opened the door to mobile computing in the field, a lack of tools that could handle fieldwork challenges has slowed adoption. In addition, the benefits of digital forms have not justified the investment to change the status quo. The developed fieldwork

collaboration tool gets past this hurdle and allows project managers (and even regulators and clients if desired) to review the collected data as soon as fieldwork is complete. Josh compared the return on investment for three approaches to data management: the status quo, digital forms, and collaboration tool. Presentation slides are provided in Attachment 15.

At the end of Josh's presentation, one participant said that he believes data management is a process challenge rather than a software or hardware challenge because remediation professionals continue to implement projects without thinking about how data will be managed or how data management will be staffed.

Sustainable Remediation: Looking Ahead Through to 2014

Sharron Reackhof (PG&E) provided an update about her company's overall sustainability program, as well as 2013-2014 goals. As highlighted in other SURF meetings, PG&E developed programmatic sustainable remediation guidance in 2011 to establish a consistent approach to evaluate, incorporate, and track the benefits of sustainable BMPs across its environmental remediation site portfolio. To date, the guidance has been applied to over 80 sites. In 2013, PG&E challenged its project teams to further reduce greenhouse gas emissions during field activities and document sustainable practices in technical reports. Sharron emphasized the importance of simple tools to document and track metrics and said that the key to the program's success thus far has been collaboration. The team, which includes consultants from multiple companies, works and listens to each other to implement and track program progress consistently. As a result, project team members view their remediation sites more holistically, leading to substantial and tangible environmental, social, and economic benefits. In March 2014, a draft green vendor list of over 150 companies was developed. Presentation slides are provided in Attachment 16.

Long-Term Benefits of a Systematic and Collaborative Sustainability Approach

Kristin Mancini (ARCADIS) presented a case study demonstrating the implementation of the PG&E Sustainable Remediation Guidance during site investigation and remedial activities at a site impacted with hexavalent chromium in Hinkley, California. A wide range of sustainability activities were implemented at the site including, but not limited to, construction debris recycling and reuse, equipment emission controls, beneficial use of impacted groundwater, local economy boost, a program to develop a more skilled and competitive workforce, and preservation of historic and cultural resources. Key lessons learned include the importance of a common sustainability language, a systematic approach to track and quantify sustainability benefits, and – above all – a collaborative team approach. Details about the approach, metrics, and revisiting and refocusing efforts are provided below. Presentation slides are provided in Attachment 17.

- Approach
  Kristin described the collaborative approach taken by the site PG&E team, consultants, and contractors and emphasized the importance of project leadership support of

sustainability initiatives. Having a formalized approach supported by both the PG&E project management and PG&E sustainable remediation team helped drive sustainability thinking on the project and encourage participation by all seven consultants involved. In addition, PG&E's guidance provided the team with a common sustainability language.

- Metrics
  Nine metrics or stressors were selected to track all site activities. Stressors were identified and selected by consultants and PG&E together and were defined as physical, chemical, or biological parameters with the potential to produce environmental, economic, and/or social impacts. Best management practices were identified and developed, and sustainability benefits were evaluated against qualitative and quantitative metrics (e.g., air emissions, material usage and waste generation, biological resource impacts, impacts to local economy, health and safety).

- Revisiting and Refocusing
  Quarterly tracking requirements and annual sustainability goals required the team to revisit and refocus sustainability activities continually. After the first year, the accuracy and reliability of data collection were reviewed and data collection and interpretation were refined. Individual consultants focused on one particular aspect of sustainability (e.g., on-site equipment emission controls). In addition, material that could be diverted from landfill disposal was refocused on the percentage of total waste diverted.

Participants asked questions about metrics and stakeholder and project team interest in sustainability. Kristin said that the PG&E guidance requires the use of a published recognized standard for metrics, which allows consultants some flexibility. In response to other questions, Kristin said that sustainability activities at the site are driven primarily by PG&E (vs. stakeholders). The PG&E project manager mandated adherence to the guidance and consideration of sustainability and consultants worked together as a team to determine the process.

U.S. EPA and Sustainability

Brad Bradley (USEPA Region 5) presented how EPA Headquarters and Region 5 are working sustainability into their programs. EPA Administrator McCarthy has identified seven themes for guiding the agency's work in the future, and supporting greener cleanups and sustainability is integral to at least three of these themes: (1) making a visible difference in communities across the country, (2) addressing climate change and improving air quality, and (3) working toward a sustainable future. Brad described EPA's goal of cleaning up and advancing sustainable reuse and said that the triple bottom line considerations of sustainability are woven into existing cleanup programs. For example, environmental and economic considerations are integrated into the Superfund Redevelopment Initiative, the Partnership for Sustainable Communities, and Re-Powering America's Land. Social considerations are integrated into EPA's Community

Engagement Initiative. Brad ended his presentation by discussing some of the tools (e.g., Spreadsheets for Environmental Footprint Analysis, environmental justice tools) used to quantify sustainability considerations. Presentation slides are provided in Attachment 18.

Discussions after the presentation focused on the importance of a consistent sustainability message from EPA and the need to track worker safety by remediation technologies.

Regulatory Panel Discussion

John Simon (Gnarus Advisors) moderated the regulatory panel discussion, which included Brad Bradley (USEPA Region 5), Jennifer Borski (WDNR), Kevin Lund (MDEQ), and Rebecca Bourdon [Minnesota Pollution Control Agency (MPCA)]. The questions and a summary of panelists' responses are provided in the table on the next page.

Questions	Panelists' Responses			
	Kevin Lund	**Jennifer Borski**	**Brad Bradley**	**Rebecca Bourdon**
Which drivers do your organization currently and anticipate use for enhancing the integration of sustainable remediation into cleanups? For example, do you think your organization will incorporate sustainable remediation into enforcement orders, grants, or Agency-lead cleanup?	Kevin will recommend that his organization use green contract language.	As of November 2013, rules were promulgated to require that a sustainability evaluation be performed as part of remedy selection. The WDNR has a website dedicated to sustainability that contains links to other resources and has published a Green and Sustainable Remediation manual. The WDNR is implementing greener cleanup practices at state-funded cleanup sites and working to apply these practices more consistently across all projects.	Green contract language will likely be included in all major contracts in the next three years. Green and sustainable remediation contacts located in EPA Region 5 states participate in a quarterly conference call to share knowledge.	Rebecca's organization does not mandate green contract language except in the requirements within their Master Services Contract within the Remediation Division.
How does your organization support the implementation of each of the three aspects of sustainable remediation? Specifically, do you have any drivers for social and economic aspects of sustainable remediation in addition to the environmental aspects? Do you have pre-established BMP lists or do you rely on industry-provided lists?	Unless laws change, the MDEQ cannot mandate sustainable remediation. However, the importance of communicating risks, decisions, and plans to appropriate stakeholders is paramount.	The WDNR does not have the authority to mandate sustainable remediation, but WDNR representatives try to engage consultants in conversation and change the culture so that the concepts of sustainable remediation become part of the fabric of the organization. The WDNR has a public participation requirement if remediation is funded through the state.	Without new legislation, the EPA Region 5 integrates the concept of green and sustainable remediation into its existing programs.	N/A

Questions	Panelists' Responses			
	Kevin Lund	**Jennifer Borski**	**Brad Bradley**	**Rebecca Bourdon**
Does your organization reference any industry standards, such as the ASTM standards or ITRC guidance documents?	The MDEQ references the ASTM standard in its guidance (e.g., for LNAPL). Keep writing good guidance!	The WDNR has developed its own site reference guides, which consist of a page of BMPs. The existence of the ASTM standards and the fact that industry supports them has helped integrate concepts into practical applications.	The USEPA Region 5 references only the ASTM *Standard Guide for Greener Cleanups* in its guidance.	The MPCA references both ASTM standards (*Standard Guide for Integrating Sustainable Objectives into Cleanup* and *Standard Guide for Greener Cleanups*) in its guidance.
Which sustainable remediation tools do your organizations' programs promote or support?	The MDEQ can only promote green and sustainable remediation tools on state-led projects.	Although the WDNR does not have authority to require responsible parties to use sustainable remediation tools, it encourages the use of these tools in state-funded cleanups. Sustainable remediation tools are required as part of contractors' scopes of work, but using the tools is not a contractual requirement.	The USEPA Region 5 tools focus more on greener vs. sustainable remediation.	The MPCA uses the Corrective Action UST beta calculator, SRT, and SiteWise™.
What types of training and resources are made available to your organization?	Kevin serves at the ITRC coordinator, so he provides some training to personnel. He stressed the need for free training due to tight, small budgets.	Jennifer participates in free ITRC webinars for the 100 WDNR project managers across the state. Eight WDNR staff obtained approval to attend an EPA-sponsored conference on the ASTM *Standard Guide for Greener Cleanups*.	All six states within USEPA Region 5 have been trained in terms of greener cleanups. Brad attends free ITRC trainings.	N/A

Sustainable Remediation Experiences

Mike Miller (CDM Smith) presented SURF member sustainable remediation experiences in the private sector, including an overview of the lessons learned from implementing sustainable remediation, a description of three case studies, and a discussion about the value of sustainable remediation. The presentation was also made previously to the Federal Remediation Technologies Roundtable (FRTR), which includes the U.S. Departments of Defense, Energy, and Interior; EPA; and National Aeronautics and Space Administration. Presentation slides are provided in Attachment 19.

- Overall Lessons Learned
  The following lessons learned apply to the general implementation of sustainable remediation rather than at a specific site:
  - Use sustainable remediation as the mechanism by which the following elements of project success are achieved: cost savings, efficient planning, value, and organizational decision making.
  - Integrate sustainable remediation elements earlier in the remedial process to ultimately implement new sustainable technologies and more effectively integrate social and economic considerations.
  - Decrease the sustainability burdens of a remedy by moving into a new solution space (see slide 6, Attachment 19).
  - Underpin technologies and alternatives with sustainable remediation objectives.
- Gilbert-Mosley Case Study
  At this 3,850-acre site in Wichita, Kansas, sustainable remediation objectives were applied before the remedial investigation and feasibility study phase. Through collaboration with regulators, a preemptive voluntary cleanup approach was developed to remediate a four-mile long plume of chlorinated solvents in groundwater in an aggressive timeframe. Tax-increment financing, liability waivers for property owners, property loans, and a cost sharing formula with a major responsible party were pursued. A risk-based approach reduced the volume of groundwater requiring treatment by 40% at a cost savings of $8 million. The groundwater treatment remedy includes an environmental education center in which treated groundwater is reused in the water fountains.
- Oakland Army Base Case Study
  This site is a former Army base that was decommissioned in 1999, resulting in the loss of about 7,000 jobs. Sustainable remediation objectives were applied in the predevelopment stage and the focus throughout the project was appropriately balancing triple bottom line considerations for the well-being of West Oakland residents. The community was involved from the earliest planning phases of the project

to remedy selection; over 150 meetings were held with stakeholders. Stakeholder concerns included immediately improving Oakland's fiscal and economic situation, expanding an undeveloped or underutilized portion of Oakland's economy, and improving the quality of existing residential areas by moving specific businesses out of the neighborhood. The alternative selected is a world-class intermodal gateway for transporting goods by seaport, railroad, and highway. During implementation of the remedies, air quality mitigation measures and ambient air monitoring were performed. Transparency and ongoing communication with stakeholders allowed for feedback and optimization during implementation. Details of these efforts are provided below.

  - Predevelopment planning involved 12 stakeholder interviews, market scans of 25 potential uses, the development of detailed opportunities and constraints report, and the establishment of an expert panel to develop and analyze four site alternatives.

  - Construction will create about 1,500 jobs, with an additional 1,800 permanent positions during operation. The project work-hour goals are as follows: 50% residents, 25% disadvantaged workers, and 20% apprentices. Employers are prohibited from screening for prior criminal convictions (with some exceptions).

  - Air quality mitigation measure plans are as follows: use grid electricity instead of diesel-powered generators and pumps; recycle, reuse, and/or salvage 69% of the demolition materials; crush and reuse 100% of the concrete and asphalt; and sell about 3,150 tons of salvaged materials for recycling.

- Sustainable Return on Investment (sROI) Case Study
  This case study involves quantifying the sROI of potential remedial alternatives for a landfill mining project. This approach provides a more comprehensive picture of investments by translating social and environmental impacts into economic terms, including an uncertainty analysis to demonstrate the likelihood of realizing costs and benefits, and generating results that are defensible and transparent.

  The site contains two landfills, one of which was used for the disposal of off-specification X-ray film. The two alternatives evaluated for the landfill were (1) excavation and off-site disposal and (2) recycling of the polyethylene terephthalate (PET) for product. A life-cycle analysis was performed using SimaPro to evaluate the social monetized damage of environmental externalities (e.g., carbon dioxide, sulfur oxide, particulate matter) associated with each alternative. The damage estimates for criteria air pollutants include damage to human health, materials, plants and animals, ecology, visibility, and aesthetics. The damage estimates for greenhouse gas emissions include net agricultural productivity, human health, property damages from increased flood risk, and ecosystem services. Data were synthesized and inputs for the model and

probability distribution function were identified. As a result, PET was shipped to China for cleanup and recycling and then sold.

Mike ended his presentation by reminding participants that sustainable remediation is best considered early and throughout a remediation project and emphasizing that social and economic benefits are reachable through environmental considerations.

Debrief: SustRem 2014 Conference

In September 2014, Amanda McNally, SURF Secretary, attended the 3rd International Conference on Sustainable Remediation (SustRem 2014) in Ferrara, Italy. Hosted by SURF Italy (a working group of RECONnet), SustRem 2014 was organized around five major themes of sustainable remediation, including conceptual framing; tools, metrics, and indicators; "greening" remediation; case studies; and stakeholder involvement. Amanda provided highlights of the conference, including updates from the international SURF network and a workshop on the Case Study Initiative (CSI), chaired by SURF's Barbara Maco. Through the conference, participants learned that environmental footprint tools are well established and widespread use of life-cycle analysis for remediation is occurring. The need for case studies of sustainable remediation persists and participants discussed the benefits of a case study sustainability rating system. Amanda also reported that a poster on SURF's Groundwater Reuse Technical Initiative was on display at the conference and was awarded Best Poster at the conference. Kudos to the GW Reuse TI Team for this effort! Presentation slides are provided in Attachment 20.

Attachment 1
SURF 27 Participant Contact Information

SURF 27 Participant Contact Information

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Attachment 2
Introduction to SURF

Sustainable Remediation Forum (SURF) Organization Overview

SURF 27 "Sustainability in Action"
University of Michigan, Ann Arbor, MI
November 11, 2014

Amanda D. McNally, P.E.
Secretary – 2014 Board of Trustees

Mission Statement

The mission of SURF is to maximize the overall environmental, societal, and economic benefits from the site cleanup process by:

- Advancing the science and application of sustainable remediation
- Developing best practices
- Exchanging professional knowledge
- Providing education and outreach

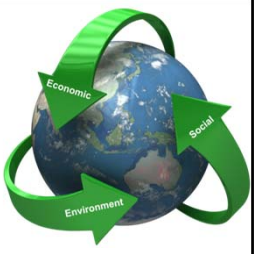
www.sustainableremediation.org

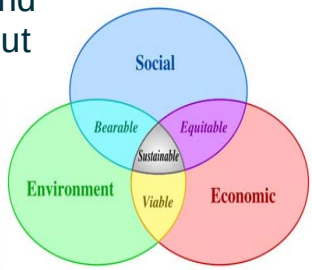
@SR_Forum

LinkedIn Group: Sustainable Remediation Forum

Sustainable Remediation

- **Sustainable Remediation** is defined as site assessment and remediation that protects human health and the environment while maximizing the environmental, social, and economic benefits throughout the project life cycle (SURF, 2013).





History

2006	• Founded as an adhocracy with 20 members
2009	• Published groundbreaking White Paper in the Remediation Journal
2010	• Incorporated as a non-profit organization
2011	• Published framework and guidance on metrics and life cycle assessment in the Remediation Journal
2013	• Engage with the International SuRF Network and Partners • Published Guidance on Groundwater Conservation and Reuse and Integration of Remediation and Reuse
2014	• Federal GSR Roundtable, SURF 25 – 27, 3rd International Conference on Sustainable Remediation (Ferrara, Italy)

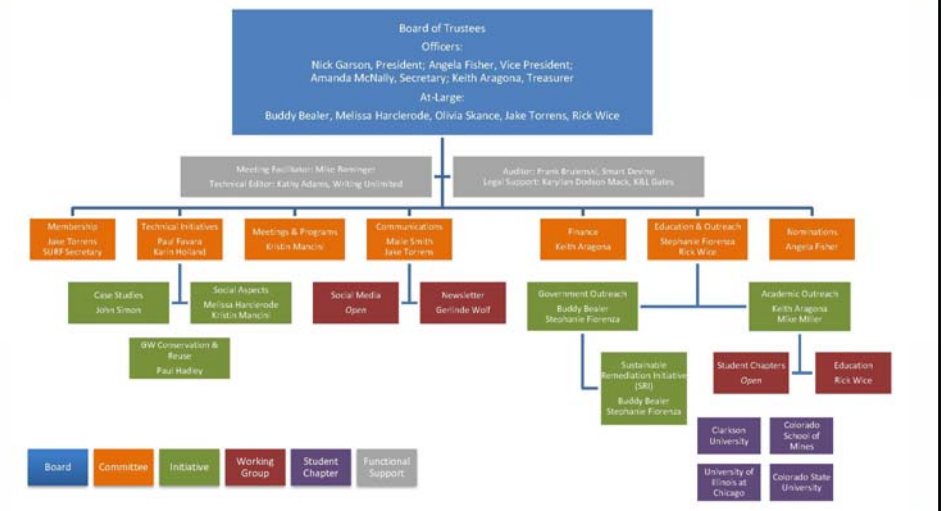
Who is SURF?

- Members
  - Industry
  - Regulators
  - Government
  - Vendors
  - Academics
  - Students
  - Consultants
- Sponsors
  - GOLD : Boeing, CH2M Hill, DuPont, Shell
  - SILVER : AMEC, BP, CDM Smith, Haley & Aldrich, Langan Engineering, Terra Systems, URS
  - BRONZE : AECOM, GE Research, Tetra Tech

Value Proposition

- Alignment with corporate sustainability goals
  - Reduced remediation costs and long term liabilities
  - Environmental footprint reduction
  - Social responsibility & public outreach
- Innovative thinking, research & real world application
- Peer Benchmarking (domestic & int'l)
- Access to leading edge case studies
- Opportunities to collaborate on publications
- Networking & access to subject matter experts
- Academic outreach & mentoring

SURF Organization



How We Work

- General membership meetings
  - 2 in-person meetings and 1 webinar per year
- Technical Initiatives & Working Groups
  - Teleconferences
  - Breakout Sessions
- Professional conferences
- Participation in international SR conferences, webinars, affiliate work-products
- Technical journal articles

Guidance and Publications

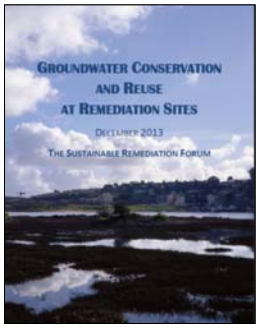
- Sustainable Remediation White Paper—Integrating Sustainable Principles, Practices, and Metrics Into Remediation Projects (2009)
- Framework for Integrating Sustainability into Remediation Projects (2011)
- Guidance for Performing Footprint Analysis and LCA for the Remediation Industry (2011)
- Metrics for Integrating Sustainability Evaluations into Remediation Projects (2011)

http://www.sustainableremediation.org/library

SURF

Guidance and Publications

- Sustainable Remediation Panel (Remediation Journal, quarterly Q&A)
- Integrating Remediation and Reuse to Achieve Whole-System Sustainability into Remediation Projects (2013)
- Groundwater Conservation and Reuse at Remediation Sites (2013)
- Integrating Groundwater Conservation and Reuse into Remediation Projects (2014)



Subscribe to our Quarterly Newsletter & RSS Feed!

SURF

Technical Initiatives

- Sustainable Remediation Initiative (SRI)
- Social Aspects of Sustainable Remediatic
- Case Study Initiative (CSI)
- Academic Outreach Initiative (AOI)

Learn more on the SURF website:
www.sustainableremediation.org
→ Member Login
→ Committee/Initiative Folders

SRI

INTERSTATE COUNCIL ITRC TECHNOLOGY REGULATORY

energy API

SURF

Vision for the Future

- Continue mission of education and outreach
- Develop strategic partnerships to collaborate on initiatives and achieve common goals
- Continue and expand international collaboration (e.g., social initiative)
- Expand membership and visibility
- Advance the science of SR and lead technical initiatives
- Applying the above to“ Transition” to the Implementation of the SR triple bottom lines (environmental, social and economic) as a Standard Remediation Practice in Federal and State Programs and Internationally (international seeks for US as guidance)

SURF

2015 Board Nominations

- Nominations open until December 30, 2014
- Nominator and nominee must be members in good standing
- Open Positions
  - President (1-year term)
  - Vice President (1-year term)
  - Secretary (1-year term)
  - 3 At-Large Positions (2-year terms)
- Elections to be held in January 2015

Next Meeting

- SURF 28
  - February 24-26, 2015
  - Hosted by Boeing
  - Arlington, Virginia

Image Source: http://www.loopnet.com/Listing/18415182/1200-Wilson-Blvd-Arlington-VA/

Questions?

Sustainable Remediation Initiative

Collaborative effort involving SURF, the Interstate Technology and Regulatory Council (ITRC) and the American Petroleum Institute (API) to promote acceptance and implementation of SR.

- Goal is to inform, educate, and promote the acceptance of SR frameworks, techniques, tools, metrics, and processes
- Seeks to play a significant role in developing strategies and plans on how to accomplish education and outreach to stakeholders.
- Promote and implement sustainable remediation at federal and state level
- USEPA Executive Forum: USEPA and SRI leadership, state stakeholders, June 2014

Contact - Buddy.bealer@sustainableremediation.org

Social Aspects Initiative

Developing a journal article to set the foundation for evaluating the social and socio-economic aspects of a remediation project's life cycle.

- In the remediation sector social impacts can be divided into two major categories.
  - Community- local level, property value, congestion, point emissions, land re-use, employment
  - Regional and Global – human health and the environment, and financial investments to alleviate global issue (climate change)
- Provide overview of current tools and guidance focused on environmental footprint
- Set foundation for the development of methods and guidance for evaluating social and economic aspects of SR

Contact - melissa.harclerode@sustainableremediation.org

SURF

Case Study Initiative

Compiling a case study inventory showing examples of successful sustainable remediation implementation.

- The Case Study Initiative (CSI) will create a searchable database of peer-reviewed case studies following a consistent format.
- Actively soliciting submissions from SURF members, including international professionals
- The case studies will be available as a resource for sharing best practices

Contact - csi@sustainableremediation.org

SURF

Academic Outreach Initiative

Engages with members of the academic community, including faculty and students, and encourages inclusion of sustainable remediation in curricula and research.

- Supports student chapter member's travel to SURF events
- Current Student Chapters:
  - Colorado School of Mines
  - Colorado State University
  - Clarkson University
  - University of Illinois - Chicago
- Plans to develop student competition and is exploring funding for graduate student research projects

Contact - rick.wice@sustainableremediation.org

SURF

Attachment 3
Panel Discussion: Sustainable Strategies for Managing Contaminated Properties

Sustainable Strategies for Managing Contaminated Properties

Kevin Lund, PE MDEQ
Grant Trigger, PE RACER Trust
Daniel Vredenburg U of M Student
Gina Cortese U of M Student

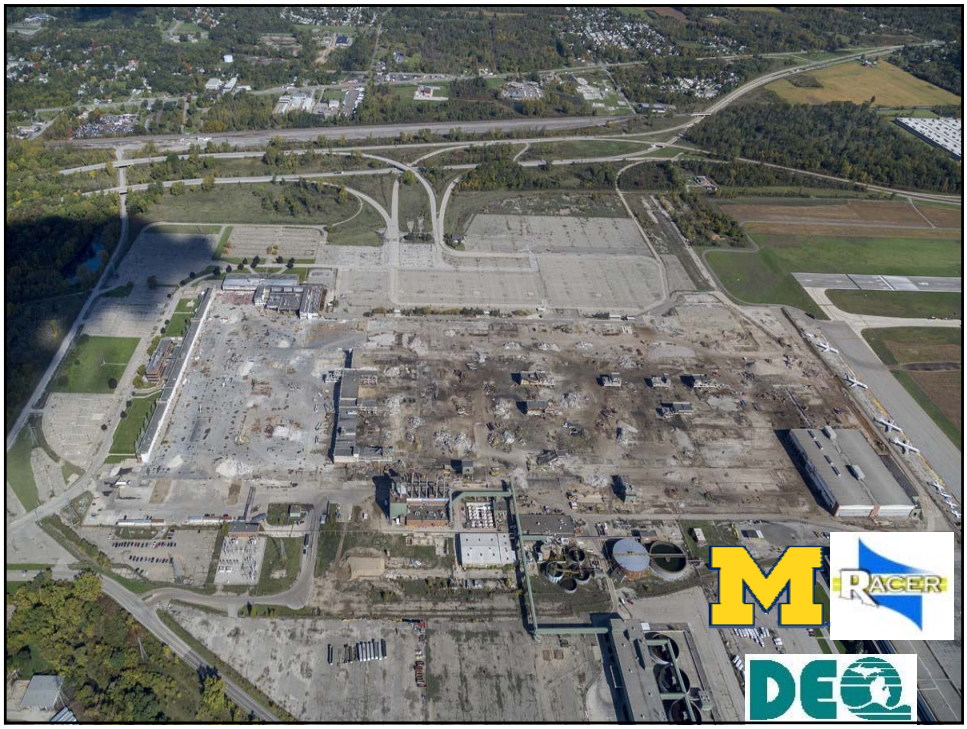
SURF27 "*Sustainability In Action*"
Panel Discussion

9:00 to 9:30
November 11, 2014
Michigan League, University of Michigan, Ann Arbor, MI

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


Business (economic) Issues
Legal
Regulatory
Collaboration
Societal
Technical


Willow Run Site
SITE LOCATION
Wisconsin
Michigan
Ontario
Illinois
Indiana
Ohio
SITE LOCATION
Denton
Ridgewood Hospital
WILLOW RUN AIRPORT
Rest Area
Ford Lake
YPSILANTI
Edgewater Heights
SCALE IN MILES



Sustainable Remediation Willow Run Area

- Use the former Concrete Floor to mitigate infiltration and direct contact
- Assist Developers with adaptive reuse of the concrete slab
- Utilize the Existing Storm Water System to collect oil and groundwater
- End of pipe treatment using a subsurface wetland and leach field
- Deed/Land Use Restrictions

Setting Goals for the Student Work

Student Involvement

Bench Scale Testing

- Constructed models to test theoretical contaminant removal
- Tested four separate methods
  - four media types
  - plant uptake

Bench Scale Testing

Student Involvement

Pilot Scale Testing

- Constructed scalable models to test contaminant reduction
- Tested three separate methods
  - Free Surface Flow Wetland
  - Subsurface Flow Wetland
  - Leach Field

Student Involvement

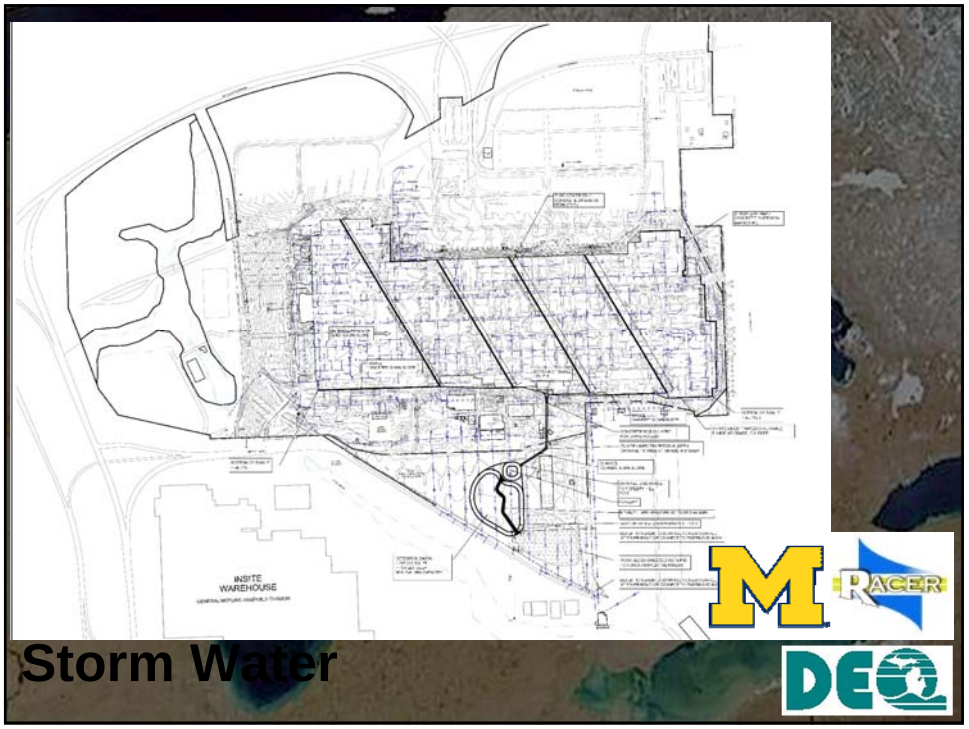
Pilot Scale Testing

- Free Surface Flow Wetland
- Subsurface Flow Wetland
- Leach Field

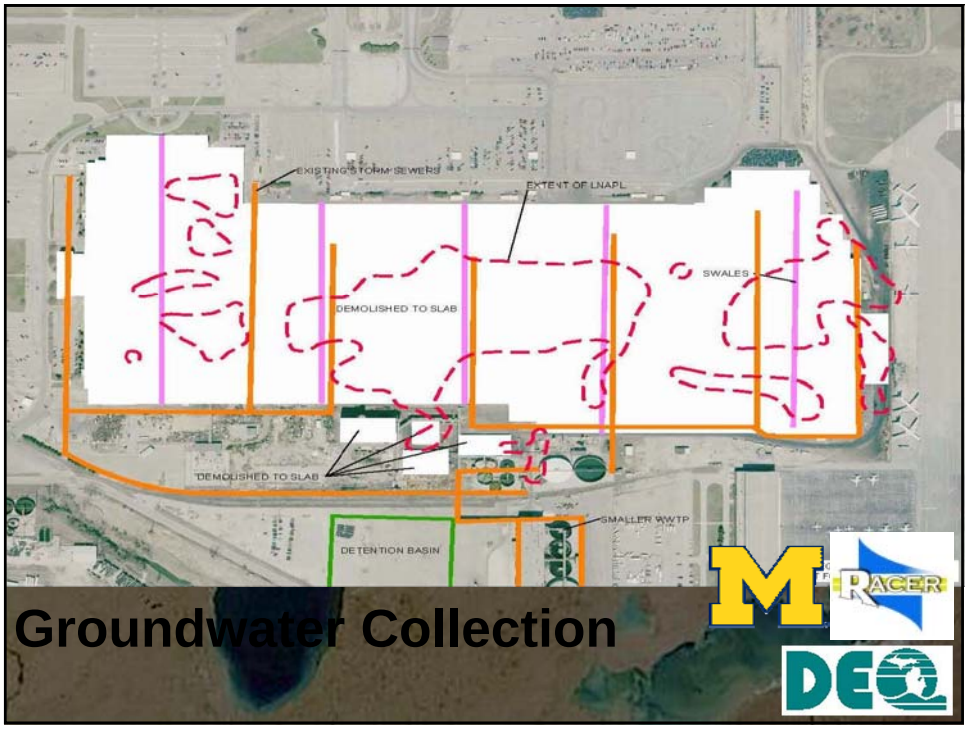
Leach Field


Pilot Test Area

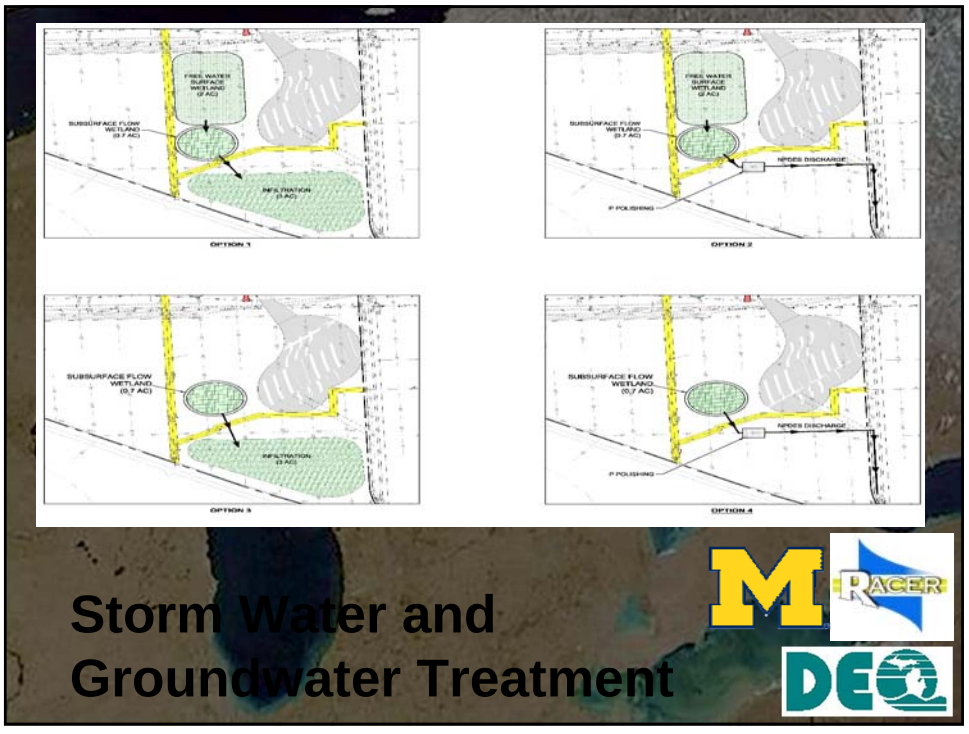

Storm Water


INSITE
WAREHOUSE
Storm Water


Groundwater

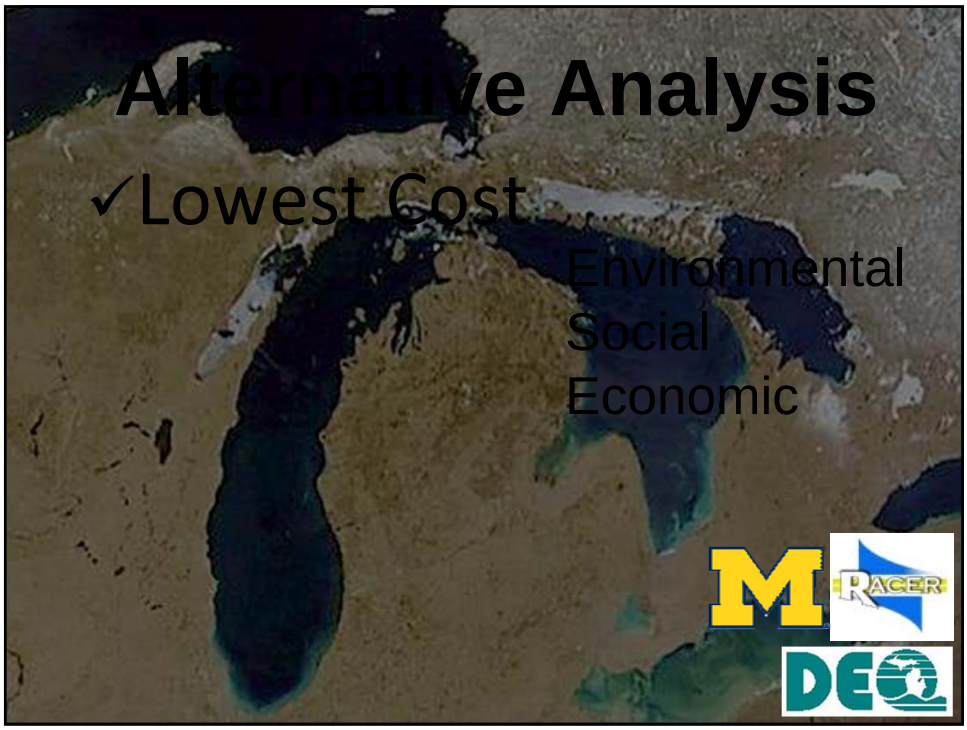


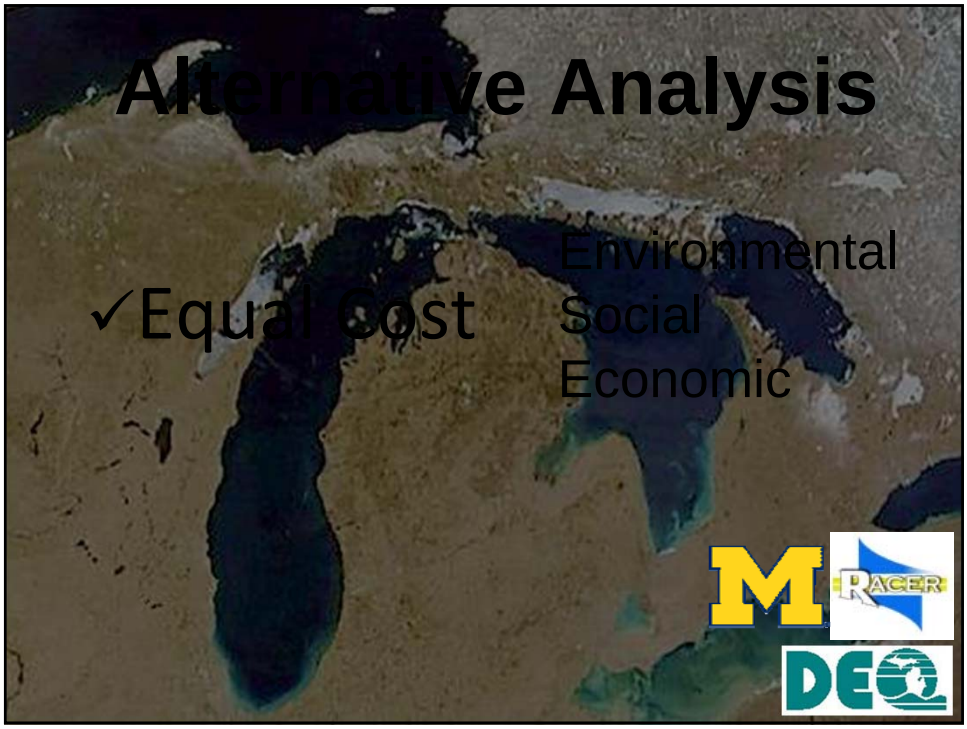
Groundwater Collection

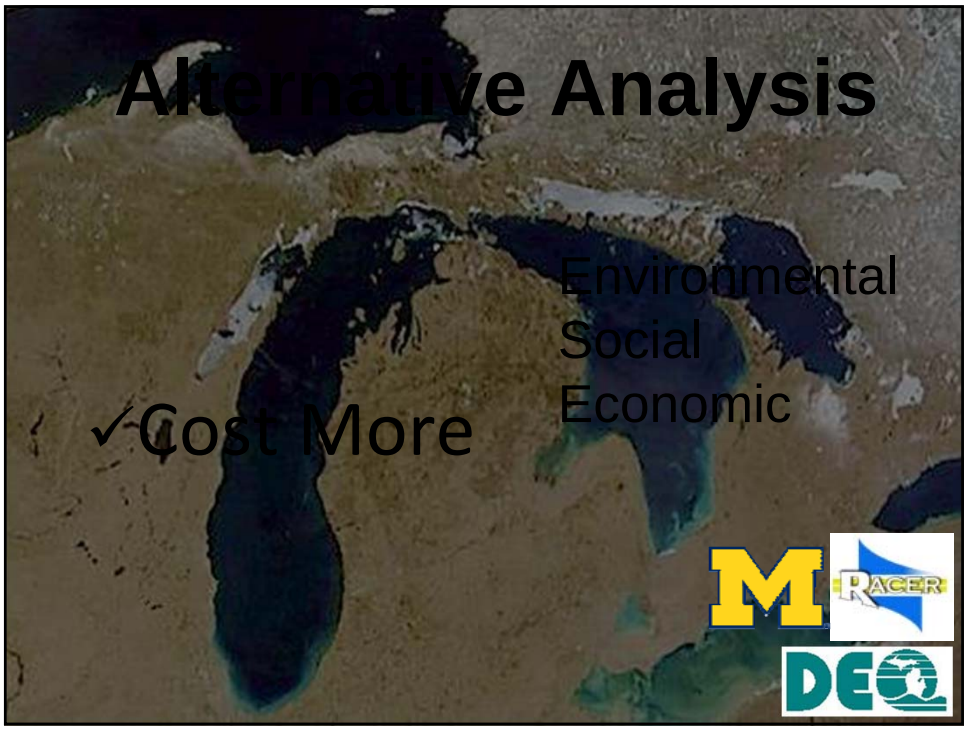


Storm Water and Groundwater Treatment


Foundations


Alternative Analysis
✓Lowest Cost
Environmental
Social
Economic


Alternative Analysis
✓Equal Cost
Environmental
Social
Economic


Alternative Analysis
✓Cost More
Environmental
Social
Economic


Alternative Analysis
✓Cheaper
✓Equal Cost
✓Cost More
Collaboration


Questions?
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Attachment 4
Enhancing Sustainability in Brownfield Redevelopment

www.sme-usa.com

ENHANCING SUSTAINABILITY IN BROWNFIELD REDEVELOPMENT

James Harless, PhD, CHMM
Vice President / Principal

Passionate people revitalizing our world

SUSTAINABLE BROWNFIELD REDEVELOPMENT

BROWNFIELD SITE

The term "brownfield site" means real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant.

Small Business Liability Relief and Brownfields Redevelopment Act (2002)

BROWNFIELDS IN THE U.S.

425,000 – 650,000 sites

> 5,000,000 acres (Σ 60 largest cities)

BROWNFIELD REDEVELOPMENT

The Epitome of Sustainability:

Reuse previously developed land

Reduce sprawl and greenspace absorption

Reuse existing infrastructure

Revitalize urban core areas

Control environmental hazards

REDEVELOPMENT IMPACTS

- **32% - 57% reduction in vehicle miles travelled vs. greenfield development (location efficiency)**
- **47% - 62% reduction in storm water runoff**
- **5% - 13% increase in values of nearby residential properties**
- **$0.5 - $1.5 million cumulative property value increase within one-mile radius**

ENVIRONMENTAL RESPONSES

Active remediation

- Source removal
- Contaminant reduction

Migration control

Exposure mitigation

Exacerbation prevention

The greenest remediation is often no remediation.

ENHANCING SUSTAINABILITY

Manage resource consumption

- Exposure mitigation/containment vs. active remediation; minimize O&M
- On-site management of contaminated media vs. disposal
- Consider impact on resource use in redevelopment

ENHANCING SUSTAINABILITY

Manage energy use (electricity and fuel)

- Conserve through response design
- Minimize staff, equipment and materials travel / transport / idling
- Use alternative sources

Manage water and wastewater

- Minimize use and production
- Reuse/recycle

ENHANCING SUSTAINABILITY

- **Reduce GHGs**
  - Minimize staff, equipment and materials travel/transport/idling
  - Manage energy use

EXAMPLES

VENTOWER INDUSTRIES

48-acre site

Former industrial waste landfill

Wind tower manufacturing

110,000 sq. ft. facility

CHALLENGES

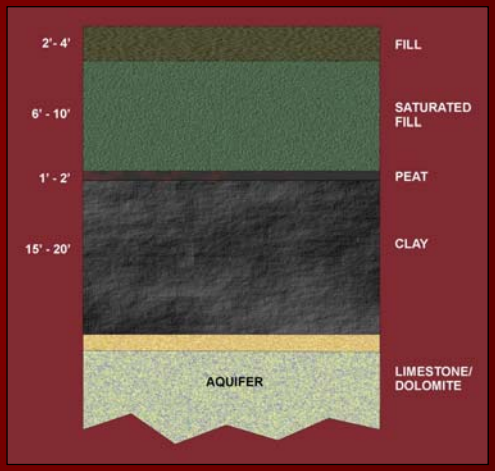
Unconsolidated wastes

- Contaminated leachate/GW

Human contact

- Vapor intrusion

Coastal ecosystem



SOLUTIONS

Soil stabilization (CMCs)

Contact barriers

Vapor barriers

No soil or groundwater generated

ENHANCING SUSTAINABILITY

- Wind power for the plant (Phase II)
- Excess fill retained on site
- Soil stabilization and environmental responses with no spoils or effluents
- Minimal remediation – resources directed to site development
- Minimal commuting
- Minimal on-site engine idling
- Use of biodiesel

MASON RUN

42-Acre site

Former paper mill

New Urbanism, single-family neighborhood

CHALLENGES

35 acres of cinder/ash fill – ~1.5' thick (150,000 cy)

50,000 sf filled basements

Buried infrastructure

Coal residuals

Contaminated soil

Bedrock 9' bg

Residential reuse

SOLUTIONS

- **Staged response/redevelopment program**
- **Swap coal/ash for clean soil under roads and parks**
- **Excavate utilities and concrete basements**
  - **Dispose fill**
  - **Recycle concrete and metal**
- **Remediate contaminated soil**
  - **Metals**
  - **Solvents**
  - **PCBs**

MASON RUN

ABERCROMBIE CENTER

0.44 acres

7,000 sq. ft., multi-tenant bldg.

CHALLENGES

- Former dry cleaner tenant
- Chlorinated solvent contamination
  - To depths > 15’ under
  - > 12,000,000 µg/kg soil
  - > 80,000,000 µg/m^3 soil gas
- Clay soil
- Limited redevelopment potential

SOLUTIONS

- Keep building intact, but demolish interior
- Remove entire floor
- Remove/dispose ~ 1’ contaminated soil
- Install passive vapor intrusion mitigation system
- Restore floor

ENHANCING SUSTAINABILITY

- Preservation of structure and external utilities
- Minimal soil excavation, waste transportation and disposal
- Minimal commuting
  - Local contractors
  - On-site equipment staging
- Minimal on-site engine idling

GREEN REMEDIATION TAKE-AWAYS

- Developers resist (abhor) extra costs
- Green remediation for brownfield redevelopment means:
  - Minimal active remediation
  - Maximum use of exposure barriers
  - Incorporation into development components
  - Application of low-cost operational approaches

    Minimal commuting Minimal idling

    Biodiesel use Solar charging


www.sme-usa.com
ENHANCING SUSTAINABILITY IN BROWNFIELD REDEVELOPMENT
BE CREATIVE
Passionate people revitalizing our world
James Harless, PhD, CHMM
Vice President / Principal

Attachment 5
The Greening of Chevy in the Hole:
Phytotechnology on an Urban Brownfield

THE GREENING OF CHEVY IN THE HOLE:
Phytotechnology on an Urban Brownfield
November 11, 2014

Joel Parker, M.S., Project Designer
Environmental Consulting & Technology

1

The CITH Project: *A Team Effort*

- USDA/Forest Service
- City of Flint
- Center for Community Progress
- ECT
- Sand Creek Consultants
- AKT Peerless
- Wade Trim

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Chevy in the Hole

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CITH Today

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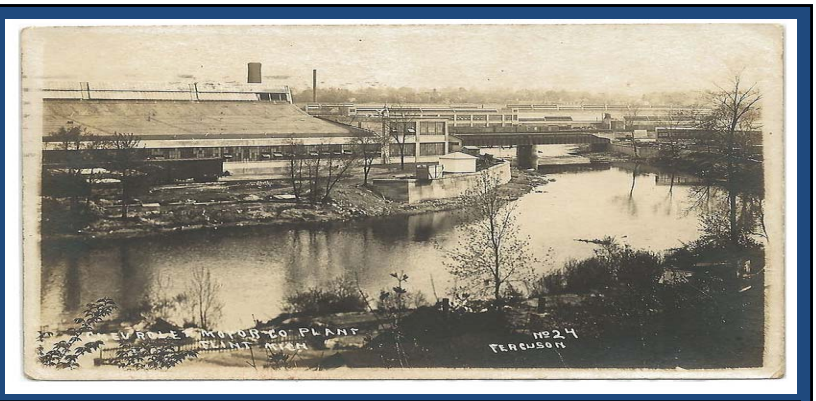
At the River



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CITH as a Connector

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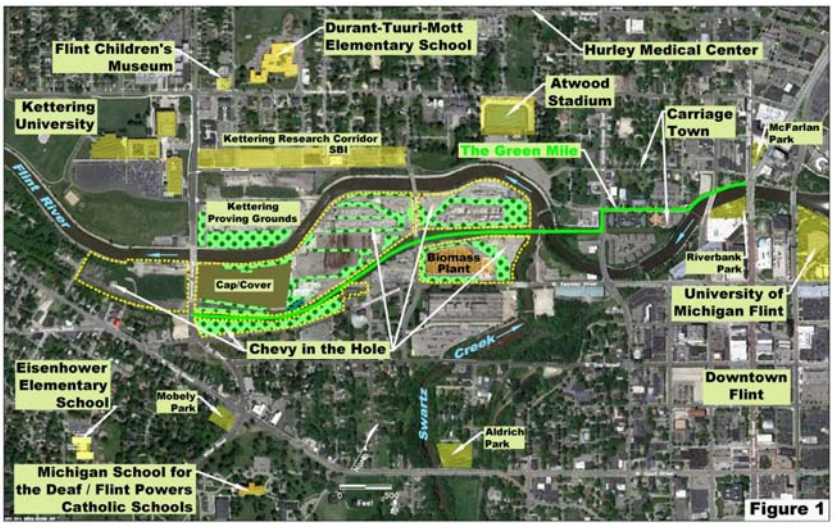
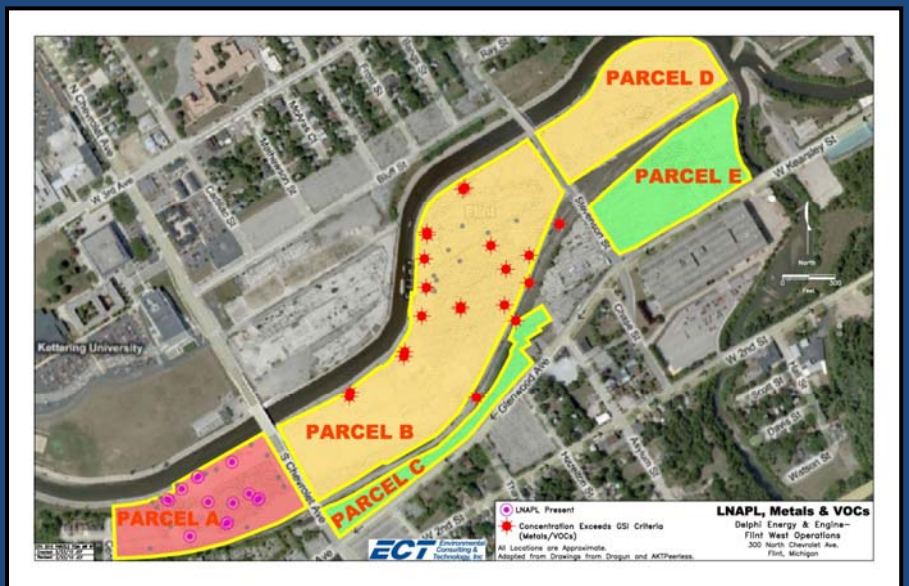
CITH as a Connector (cont'd)



The Legacy (cont'd)



The Situation

- 100+ acres
- No development interest
- Multiple contaminants
- Complex environmental system
  - Hydrogeology
  - Contaminant fate & transport
- "What do we have going for us here?"

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Our glass is half full

- Time
- Space
  - We have no immediate redevelopment pressure or demands to constrain the technologies we use
  - Conventional thinking: we need lots of $$$ (*i.e. Developer*) to deal with all the negatives
  - Altered thinking: leverage everything into an asset or resource and let this thinking drive the reuse of this space
  - *But how & where do we start?*

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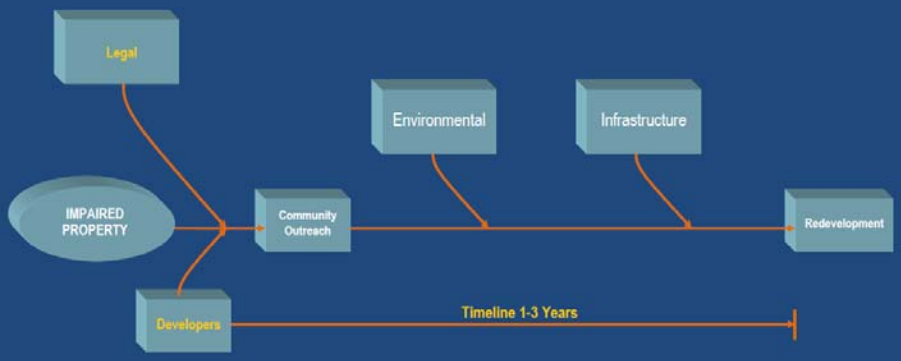
Traditional Brownfield Master Planning: "Developer Driven"



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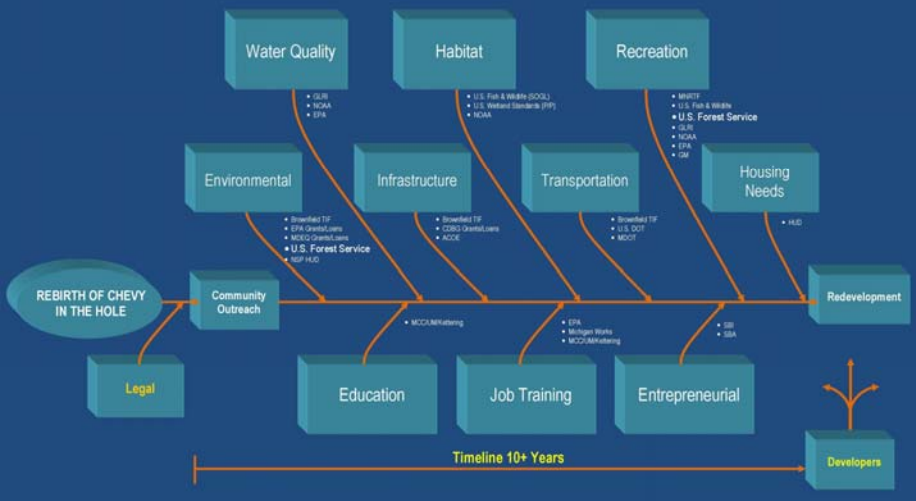
CITH Project Master Planning: "Issue Driven"



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GLRI Grant: Phytotechnologies at CITH

- Mechanisms:
  - Phytohydraulics is primary mechanism
  - Phytodegradation, phytovolatilization, and rhizodegradation
- Other Roles of Phyto:
  - Natural riparian buffer (wind, noise, visual, air quality)
  - Sediment erosion control, runoff management, nutrients
  - Beneficial player in redox manipulations and micro-climatizing
  - Funding mechanism for better CSM
  - Social "catalyst" for site

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2012 Arbor Day Planting: Compost Pile Filter Strip

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September 26, 2012 – Same Filter Strip

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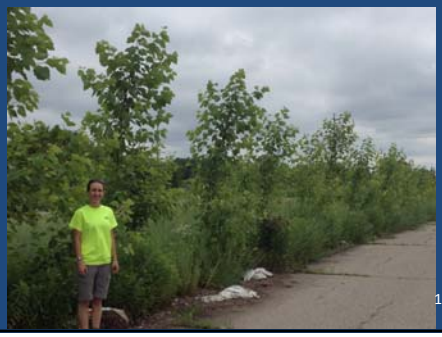
Biomass Runoff Example



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Parcel E – At the Confluence

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Parcel A – On the Bluff

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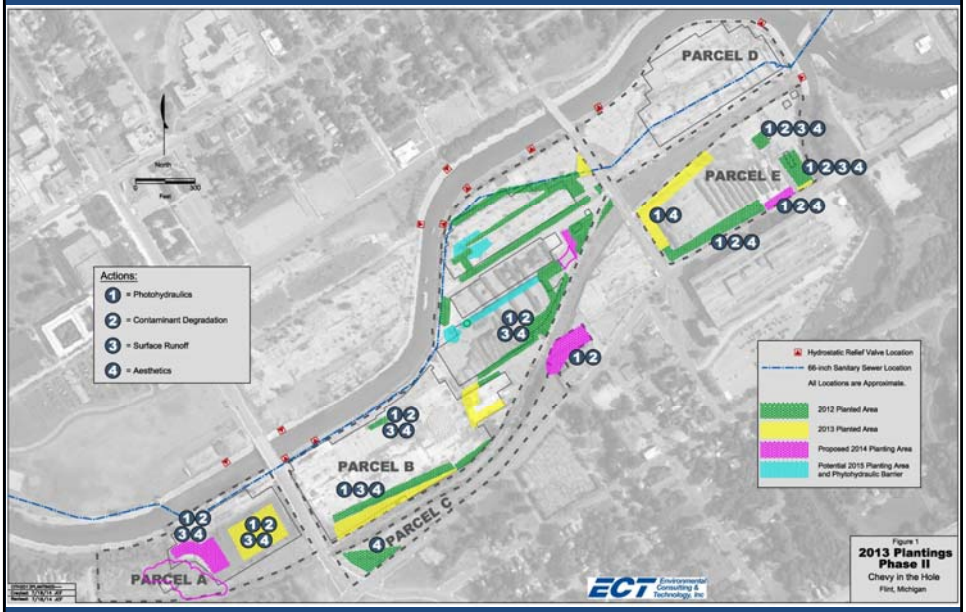
Phyto Assets on the Ground in 2012-2013

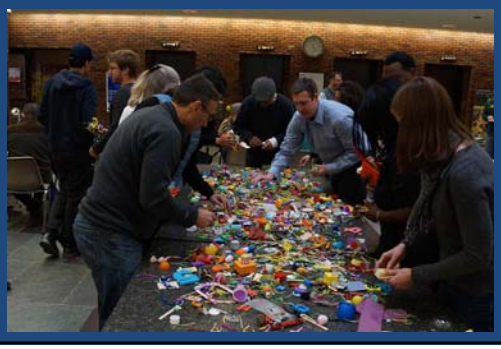


Metrics thus far

- Built 10 acres of Green Infrastructure
- Planted approximately 1,600 new trees
- Irrigated and fertilized an additional 200+ pioneer trees (**solar** powered)
- 10” cuttings grew to as high as 15-16’ !!!
- 98% survival rate
- Proved concept of filter strips for runoff collection

Phyto is the “spark” catalyzing Chevy in the Hole

- Technical, Social, Recreational aspects
- First inertial mass to the project
- Holistic Role of Phyto in Urban Brownfields
- Funding to enhance CSM
- The Chevy project gives back to phyto/tech transfer as ecological field lab



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Mott Workforce Training

- Use of site as a training ground
- Environmental certification program

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Free City Art Festival – 2013 & 2014

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Flint River Flotilla - 2014

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Future Activities…2014 and Beyond

Kettering University Biological Research

STEM Mentoring with Flint Students

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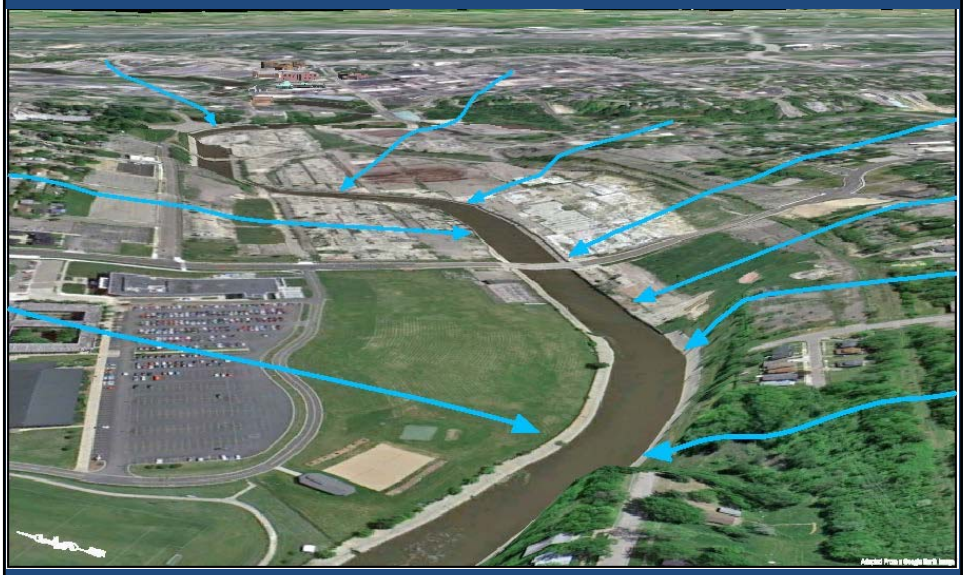
Site as Regional Stormwater Utility via Phyto



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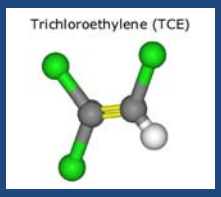
Other Fortuitous Processes



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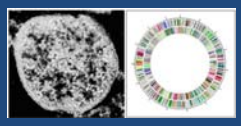

= Grant $$$ for Green Technology Incubation

Site Demonstration as a Metals Speciation Reactor:

- Mercury
- Chromium
- Tiered wetlands as reactors

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Closing Remarks

- Leveraging time and space to incubate green technologies
- Phytotechnology grants, i.e., “trees” were the spark
- Site’s proximity fosters community ownership, riparian buffer, placemaking, and teaching moments

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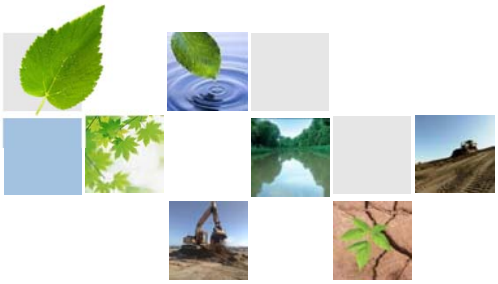
Attachment 6
DuPont and Remediation Partners Making Remediation LCA Easier and More Accessible

DuPont and Remediation Partners Making Remediation LCA Easier and More Accessible

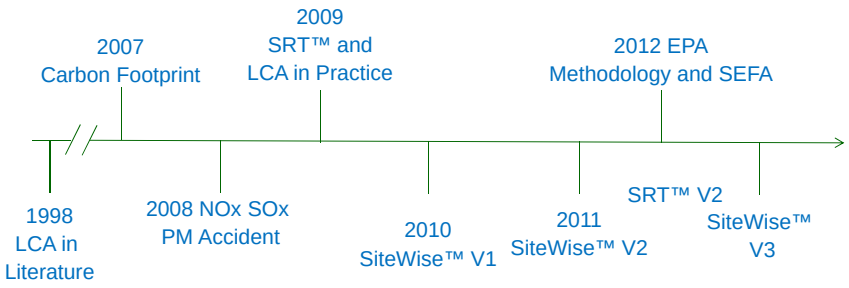


Collaboration between: DuPont, Geosyntec, URS, CH2M HILL, and Parsons

Paul Favara

CH2MHILL.

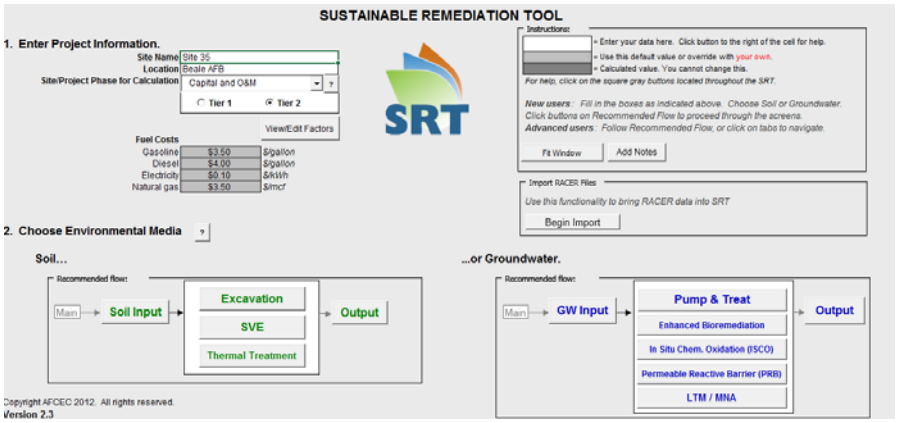
A Brief History of the *Brief* History of Quantitation of Remediation Footprints/Impacts



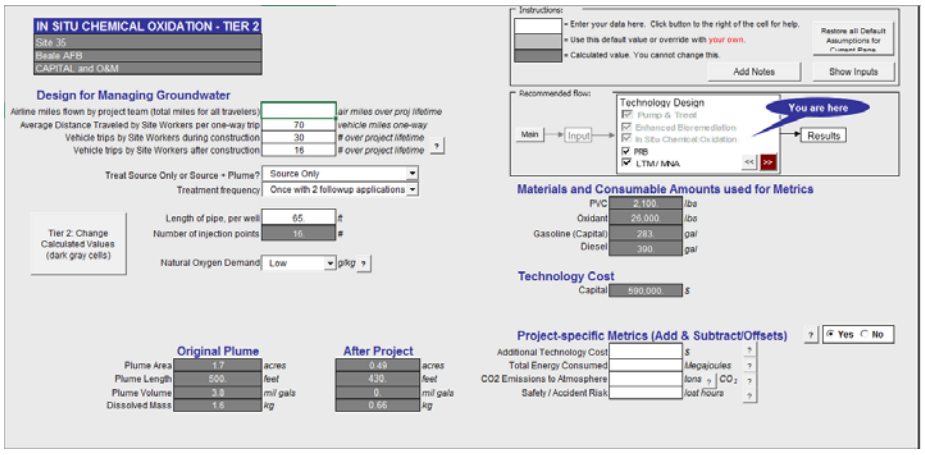
Four Main Tools Used in Remediation Industry Today:

- SiteWise
- SRT
- SEFA
- LCA (predominantly SimaPro)

SRT Technologies



SRT Technology Input Example



SiteWise Menu Approach (Bottom-Up) (Small portion of input)

COMPONENT 1 DURATION AND COST	Entire Site
Input duration of the component (unit time)	1
Input component cost per unit time ($)	

MATERIAL PRODUCTION

WELL MATERIALS	Well Type 1	Well Type 2
Input number of wells		
Input depth of wells (ft)		
Choose specific casing material schedule from drop down menu	Sch 40 PVC	Sch 40 PVC
Choose well diameter (in) from drop down menu	1/8	1/8
Input total quantity of Sand (kg)		
Input total quantity of Gravel (kg)		
Input total quantity of Bentonite (kg)		
Input total quantity of Typical Cement (kg)		
Input total quantity of General Concrete (kg)		
Input total quantity of Steel (kg)		

TREATMENT CHEMICALS & MATERIALS	Treatment 1	Treatment 2
Input number of injection points		
Choose material type from drop down menu	Hydrogen Peroxide	Hydrogen Peroxide
Input amount of material injected at each point (pounds dry mass)		
Input number of injections per injection point		

TREATMENT MEDIA	Treatment 1	Treatment 2
Input weight of media used (lbs)		
Choose media type from drop down menu	Virgin GAC	Virgin GAC

CONSTRUCTION MATERIALS	Material 1	Material 2
Choose material type from drop down menu	HDPE Liner	HDPE Liner
Input area of material (ft2)		
Input depth of material (ft)		

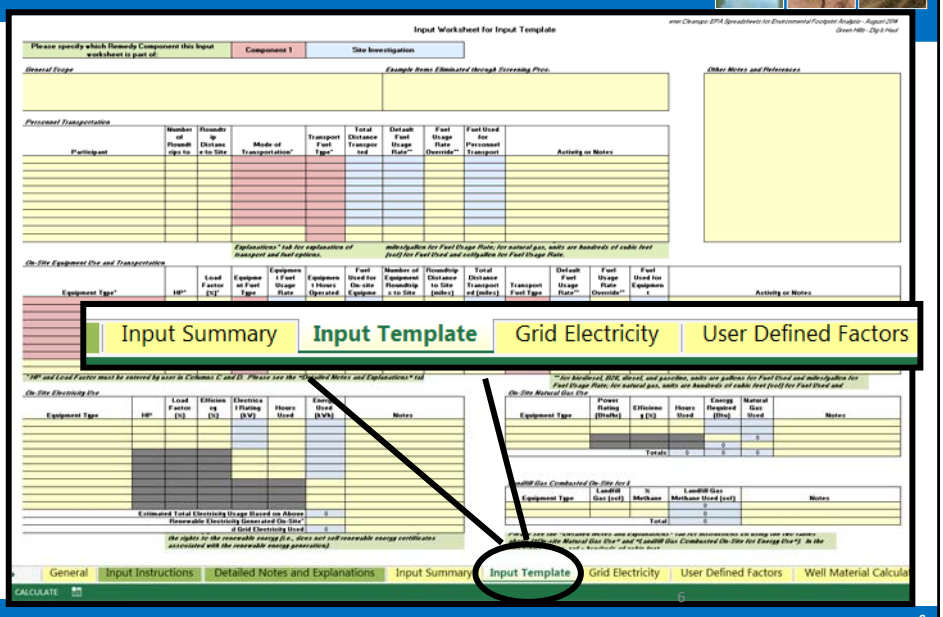
WELL DECOMMISSIONING	Well Type 1	Well Type 2
Input number of wells		
Input depth of wells (ft)		
Input well diameter (in)		
Choose material from drop down menu	Soil	Soil

BULK MATERIAL QUANTITIES	Material 1	Material 2
Choose material from drop down menu	Acetic Acid	Acetic Acid
Choose units of material quantity from drop down menu	pounds	pounds
Input material quantity		

5

INPUT WORKBOOK

User sets up the structure for data entry



6

How is LCA input Different/Similar?

- Similar to SEFA and SiteWise in that it is a Bottom-Up build up
- Conversely, SRT has constructed treatment modules that includes all the inventory elements for a specific technology
  - You only need to adjust the quantities
- The challenge comes from HUGE library of information to select input parameters from
  - SEFA/SiteWise already includes inventory of remediation input
  - SRT goes further with all components consolidated in technology
- DuPont and their remediation partners worked to develop modules to make application of LCA easier
  - Hybrid of “best of” the approaches used by other tools

7

LCA Modular Approach Key Elements

- Build up remediation technology input (inventories that contribute to each remediation technology)
- Vet the input datasets to make sure they are the appropriate ones to use for specific application
- Document basis for specific datasets (e.g., bentonite) to provide transparency on why specific dataset most appropriate for inclusion in technology build-up
- Build-up technology specific modules

8

Project Tasks Developed

- Capping
- Cut-off Wall
- Excavation
- Groundwater extraction, treatment, and reinjection
- Insitu bioremediation
- Insitu soil mixing
- Well drilling processes

- Also selected and included specific inventories for energy and transportation

9

Material Components

- Asphalt
- Bentonite
- Carbon- GAC, with regeneration or disposal
- Clay
- Emulsified Vegetable Oil
- Gravel
- HDPE Pipe
- HDPE Sheet
- PVC Pipe
- Sand
- ZVI
- Steel (different varieties)
- Cement
- Concrete

10

Example – InSitu Soil Mixing - Processes

TASK, Mobilization - In Situ Bioremediation TEMPLATE - 2014-07-16	p
TASK, Monitoring/Sampling - In Situ Bioremediation TEMPLATE - 2014-07-16	p
TASK, System O&M or EVO Injection Event - In Situ Bioremediation TEMPLATE - 2014-(	p
TASK, Utility Clearance-Geo Srvy - In Situ Bioremediation TEMPLATE - 2014-07-16	p
TASK, Well & System Installation - In Situ Bioremediation TEMPLATE - 2014-07-16	p

Drill Down – Delivery and O&M

Known inputs from nature (resources)

Name	Sub-compartment	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
Water, unspecified natural origin, low water stress		WaterExtracte	m3					Extracted longer av depletion
(Insert line here)								

Known inputs from technosphere (materials/fuels)

Name	Amount	Unit	Distribution	SD^2 or 2*SD	Min	Max	Comment
(Insert line here)							

Known inputs from technosphere (electricity/heat)

Name	Amount	Unit	Dis	SD^	M	Comment
Electricity, medium voltage, at National Grid, US, 2008/RNA U, CRG 2013	ElecExtracPumps = 800	kWh				Electricity for extraction pumps
Electricity, medium voltage, at National Grid, US, 2008/RNA U, CRG 2013	ElecTreatmentPumps = 800	kWh				Electricity for treatement component pumps etc., (i.e. airstripper)
Electricity, medium voltage, at National Grid, US, 2008/RNA U, CRG 2013	ElecTransReinjPumps = 800	kWh				Electricity for transfer & reinjection pumps
Carbon, GAC from Coal briquettes Sent for Reactivation after use - (US LCI Butiminous /US)	GACReac = 50	kg				GAC used - sent for reactivation
Carbon, GAC from Coal Briquettes - One-time use (Bituminous US LCI)/ US | CRG 2013 - 201	GACOneTime = 50	kg				GAC used - not sent for reactivation
Emulsified Vegetable Oil (SRS) - 2014-07-16	EVOMass = 500	kg				Mass of EVO injected
Yeast paste, from whey, at fermentation/US* US-EI U	KB1Mass = 10	kg				Mass of KB1 (bacteria) injected. Yeast paste as proxy
Well Decomissioning - 2014-07-16	WellDecom = 50	ft				Feet of wells decommissioned

Drill Down Substrate (SRS)

Name	Amount	Unit	Distribution	SM	Comment
Refined Soy Oil, at plant/USB ECON Alloc Schmidt Refining - 2014-07-16	0.569	kg	Undefined		From CRG model
Emulsifier for SRS - 2014-07-16	0.07	kg	Undefined		Parsons model; mass based on CO2 equivalent to match Terra Systems carbon footprint document amount.
Tap water, at user/US- US-EI U	0.3025	kg	Undefined		Ingredient and mass from Terra Systems report
Yeast paste, from whey, at fermentation/US* US-EI U	0.003	kg	Undefined		Ingredient and mass from Terra Systems report
Diammonium phosphate, as P2O5, at regional storehouse/US- US-EI U	0.0005	kg	Undefined		Ingredient and mass from Terra Systems report
Refined Soy Distillate soybean oil co-product/USB ECON Alloc Schmidt Refining - 2014-07-16	0.003524	kg	Undefined		Sodium Lactate placeholder; mass based on CO2 equivalent to match Terra Systems Report
High density polyethylene resin, at plant/RNA	0.0056	kg	Undefined		Assumes drums are recycled 10 times before disposal
(Insert line here)					

Known inputs from technosphere (electricity/heat)

Name	Amount	Unit	Distribution	SM	Comment
Transport, combination truck, diesel powered/US	0.72	tkm	Undefined		Transport of materials and drums to production facility (681 km from material production facility; source: Terra Systems) and to remediation site (100km from production facility)
Plaster mixing/US* US-EI U	0.14	kg	Undefined		Material mixing process weighted to match Terra Systems CO2 eq report

Value of project

LCA Perception	Opportunity Created by Project
Reviewers don't have access to datasets - concern with "gaming the results"	Documentation of datasets provides transparency on datasets
LCA data libraries are large and there is uncertainty on which datasets to use	Project team members vetted datasets and selected the most relevant for technology
Each LCA requires a bottom-up construction of technology	Technology build-ups provided for most common remediation technologies
LCA is expensive	LCA is still an expensive tool but provides more information for decision making
LCA required a lot more training as compared to other tools	Project datasets will provide easier remediation technology buildup *but you still need to know how to use SimaPro utilize*
Figure out which datasets to select can be time consuming	Modularized data technologies speed up process; can be modified based on site conditions
LCA takes more time	LCA is even faster than footprint tools, provided experienced practitioner is engaged

Next Steps

- DuPont is working on internal approval processes to release results of work
- Plans to make available
  - Need to work through licensing since user needs to have current Ecoinvent and US-EI databases
- Will allow faster ramp up of LCA for remediation industry
- Provide us with better, and faster means, to evaluate trade-offs of alternatives or identify optimization opportunities

15

Team Members

- DuPont - Todd Krieger and Mariella Juhasz
- Geosyntec - Matt Vanderkooy
- CH2M HILL – Paul Favara
- URS – Brandt Butler and Maureen McBride
- Parsons – Shannon O'Connell

16

Attachment 7
Sustainable Remediation Initiative:
The Year of Implementation

Sustainable Remediation Initiative

SRI

SURF

INTERSTATE COUNCIL ITRC TECHNOLOGY REGULATORY

energy API

1

The Year of Implementation

- Green & Sustainable Remediation Roundtable
- Federal Remediation Technologies Roundtable
- Future Endeavors

2014

2

GSR Roundtable:

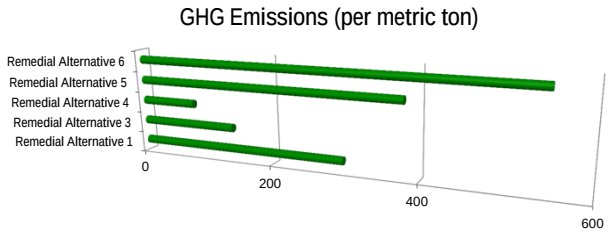
Washington D.C., June 3rd, 2014

3

GSR Roundtable:

Moderated Discussion

- **Part 1 – How is GSR being incorporated into our programs and activities?**
  - Enforceable vs. Voluntary
  - Established Policies
  - Established Evaluation Tools



  - Lack of Uniformed Implementation & Tracking

4

GSR Roundtable:
Moderated Discussion

- **Part 2 – What are some challenges/ opportunities for better implementation?**
  - **Challenges**
    1. What is GSR?
    2. Enforcement & Jurisdictional Limitations
    3. How to Move Forward?
    4. Lack of Resources

5

GSR Roundtable:
Moderated Discussion

- **Part 2 – What are some challenges/ opportunities for better implementation?**
  - Challenges
  - **Opportunities**
    1. Case Studies
    2. Celebrating Successes
    3. Education and Communication
    4. Rewards and Incentives
    5. Adopting Sustainability Programs and Goals

6

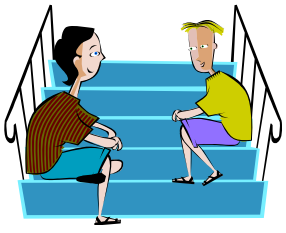
GSR Roundtable:
Moderated Discussion

- **Part 3 – What actions both public and private can be taken to overcome obstacles and further the understanding of GSR practices?**
  - "Comprehensive Package"
    - Cross-Programmatic Implementation
  - Continued Support from USEPA
  - Recognition Programs
  - Simplify the Language
  - Education & Share Success Stories

7

GSR Roundtable:
Moderated Discussion

- **Part 4 – What ideas are there for possible next steps?**



1. Case Studies
2. Awards Program
3. Pilot Projects
4. Identify Champions
5. EPA Endorsement
6. Survey the Industry to Understand Current State of the Practice & Obstacles

8

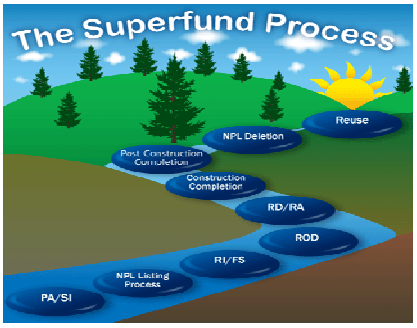
Federal Remediation Technologies Roundtable:

Washington, D.C., November 6th, 2014

9

Federal Remediation Technologies Roundtable:

- Progress!!!
  - Action Item from June 2014 GSR Roundtable
- Presentation
  - Case Studies
  - Discussed the Importance of Time of Implementation



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Future Endeavors

- 2015 National Brownfields Conference Panel
- Identify and Collaborate with SR Champions
  - SURF 28 Meeting in D.C.
- Work on Next Steps Identified by the GSR Roundtable

11

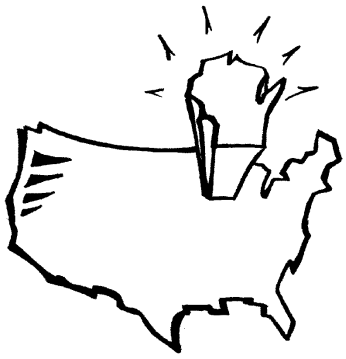
Attachment 8
Applying Three Elements of Sustainability:
Groundwater Pump-and-Treat Optimization

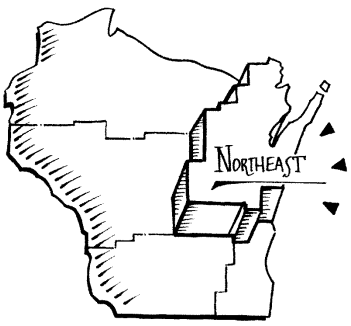
Applying Three Elements of Sustainability to Optimization of a Groundwater Pump & Treat Remedy in Kaukauna, Wisconsin

Sustainable Remediation Forum (SURF) 27
November 11-12, 2014 – Ann Arbor, MI

Jennifer Borski, WDNR

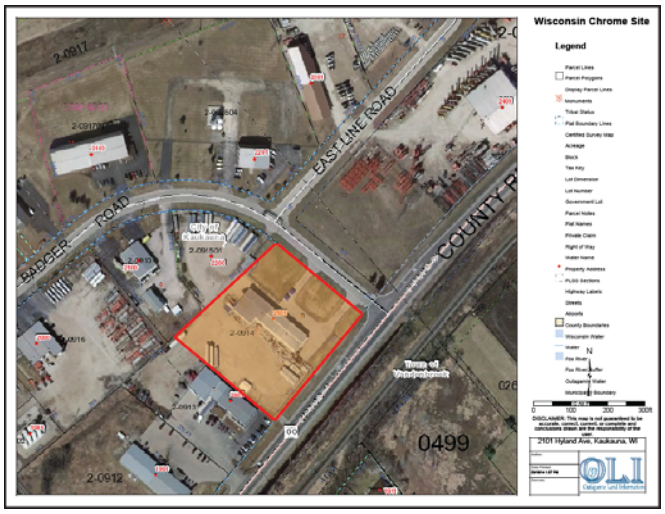
Where is Kaukauna, WI?





Wisconsin Chrome, Kaukauna

2010
Aerial



Wisconsin Chrome, Nov 1980

Wisconsin Chrome, Jan 1987

Contaminants of Concern (mg/L)

- Hexavalent chromium (Cr^{+6})
  - Highest chromium in groundwater at 350 mg/L (ES = 0.1)
- Volatile organic compounds (VOCs):
  - 1,1,1-TCA 56 mg/L (ES = 0.2)
  - 1,1-DCA 18 mg/L (ES = 0.85)
  - 1,1-DCE 7.1 mg/L (ES = 0.007)
  - TCE 0.041 mg/L (ES = 0.005)

ES = WI groundwater enforcement standard

Geology

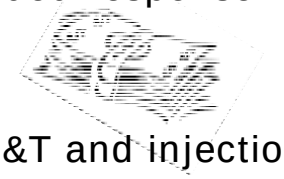
- 60’ of silty clay with 4-10’ deep silty sand seam in upper 20’
- Water table: highly variable - between 1-10’ below ground surface

Brief Chronology

- Plating operations 1976 – 1986
- Initial State inspection - Nov 1980
- Superfund Site Inspection (SSI) - Jun 1989
- Litigation – Settlement 1996:
  - Deed property to County
  - $270,000 in escrow account

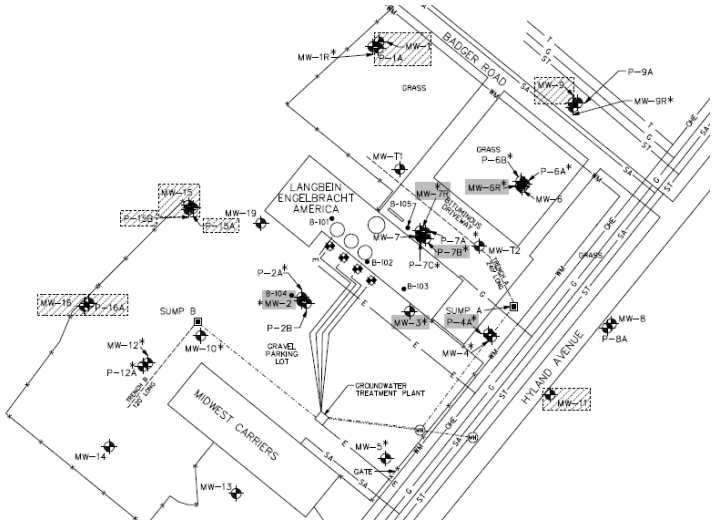
Brief Chronology Continued

- 1997 – Site Investigation & Remedial Action Options Report
- 1999 – Settlement escrow funds exhausted → state-funded response

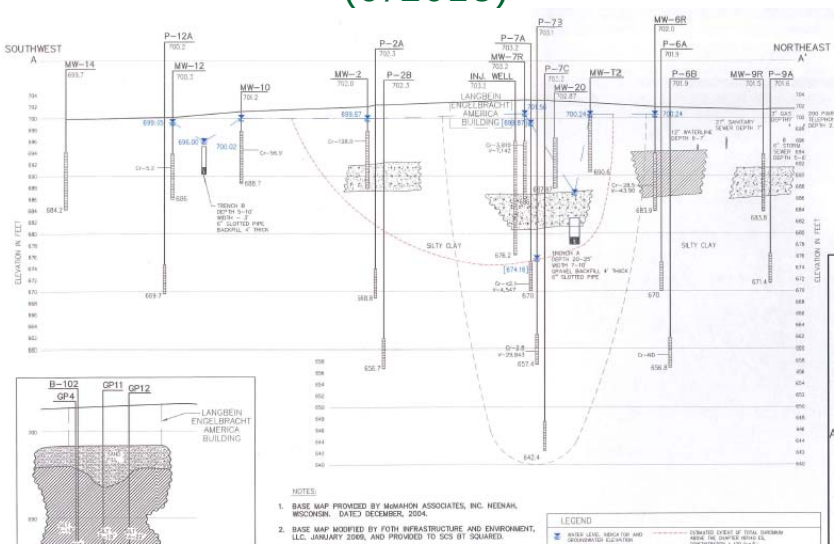


- 2000 – Design report
- 2001 – Groundwater P&T and injection
- 2005 – System evaluation

Site Detail Map



Contaminant Cross Section
(9/2013)



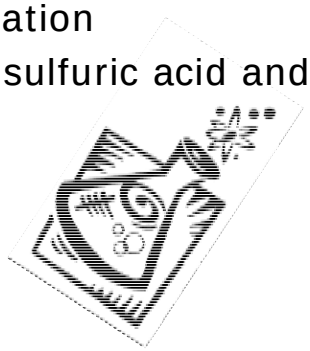
Green & Sustainable Remediation

- Environmental (energy, water, waste, air & land)
- Economic (life cycle cost)
- Social (community impact - considers end land use)

GSR – Environmental

2001 – 2014:

- Energy – 190,000 kwH
- Water – 5,108,000 gallons pumped
- Waste – haz waste generation
- Consumable chemicals – sulfuric acid and sodium hydroxide



GSR - Economic

Contractual Expenditures (excl. staff time)

- FY99 – FY03: total not available
  - System installation approx. $120,000
- FY04 – FY12: $916,802
- FY13: $25,664

Total estimate FY99 – FY13: $1.2M

GSR - Social

- Property owned by County
- 1996 agreement between County and WDNR
- Tenant taxed at contaminated property rate
- Tenant unable to invest in property

Optimization Efforts – Environmental / Economic

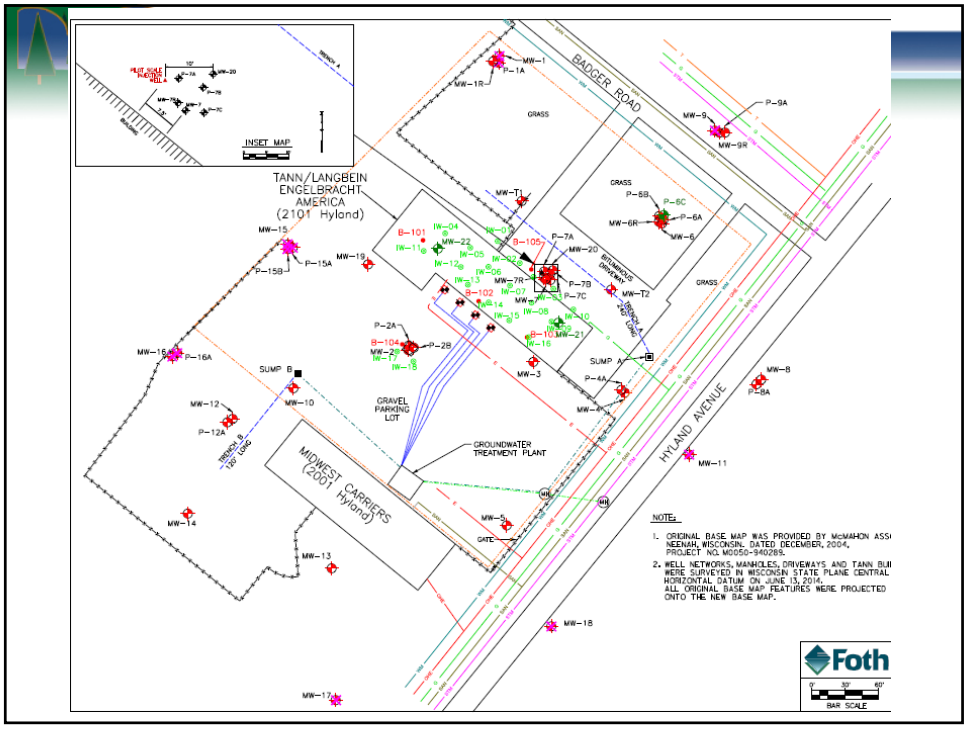
- Evaluated existing injection wells – no longer an option
- Chose not to enhance or expand collection trenches
- Implemented electrical & chemical enhancements for ex-situ treatment
- Evaluated geochemistry of subsurface

Optimization Efforts - Environmental / Economic

- Performed bench scale treatability test
- 2009 - performed pilot injection of sodium dithionite - ferrous sulfate solution
- 2014 – performed full scale injection
- Currently collecting post-injection data & developing RAOR for VOCs

Optimization Efforts - Social

- Holding stakeholder meetings annually (County and tenants)
- Working with County and tenant on business expansion options
- Working with County and tenant on exit strategy for state-funded response (e.g. tenant request closure, transfer of title)



Thank You

Jennifer Borski, Hydrogeologist
(920) 424-7887
Jennifer.borski@wisconsin.gov

Attachment 9
Academic Outreach Initiative

SURF Student Chapters Update

SURF 27, Ann Arbor, MI
November 12, 2014

Team:
Mike Miller, CDM Smith
Stephanie Fiorenza, BP
Rick Wice, Tetra Tech
Keith Aragona, Haley & Aldrich
Colorado State University
University of Chicago
Clarkson University

BACKGROUND

- Academic Outreach Initiative (AOI) began ~2010
- Establish relationships: students, professors, researchers
  - Establish SR in in universities
  - Get students involved in technical initiatives
  - Collaborate with principal researchers
  - Gain future SURF members and colleagues
- Two main components: student chapters and faculty outreach
- Student chapter (SC) components
  - Faculty advisor
  - SURF mentor/liason
  - Student officers
  - Student members

What are the chapters doing?

- Several vibrant chapters:
  - Colorado State University
  - University of Chicago
  - Clarkson University
- Report from Colorado State University

AOI UPDATE

In 2014, we set out to:

- Reset/re-establish our mission - **DONE**
- Determine what makes a vibrant chapter - **DONE**
- Apply learnings to other chapters
- Expand relationships with faculty
- Become intentional about engaging SURF with the SCs

REQUEST FOR SURF MENTORS

Mentor Guidance – Easy and rewarding!

Can be a shared job. DUTIES:

- Check in with SC President (1/2 hr. per mo.)
- Call with SC faculty advisor and students (1/2 hr. every 2 mos.)
- Coordinate with SURF committee leads
  - Identify needs and opportunities
  - Engage students in committee work
- Reach out to SURF members to identify resources
  - Speakers
  - Research ideas
  - Etc.

Attachment 10
Colorado State University Student Chapter

SURF

Sustainable Remediation Forum

Colorado State University Student Chapter

1

SURF
Sustainable Remediation Forum
Colorado State University Student Chapter

Mission Statement:

To expose students to the science and application of sustainable remediation through field trips, lectures, and group activities.

2

SURF
Sustainable Remediation Forum
Colorado State University Student Chapter

Officer Positions:

Current:

- Missy Tracy (President)
- Emily Stockwell (Vice President)
- Gabi Davis (Treasurer)
- Rachael McSpadden (Communications)

CSU Faculty Support:

- Mitch Olson (Advisor)
- Tom Sale (Co-Advisor)

3

SURF
Sustainable Remediation Forum
Colorado State University Student Chapter

Active Members:

- 12 Graduate Students
- 8 Undergrads
  - Civil and Environmental Engineering

Communications:

- Emails
- Meeting advertisements
  - Fliers, Listservs
- Facebook

4

SURF
Sustainable Remediation Forum
Colorado State University Student Chapter

Student Chapter Objectives for 2014-2015 academic year

- Generate interest in environmental problems/principles
- Understand principles of sustainability, the triple bottom line, and how they can be incorporated into environmental problems
- Create social connections with students and faculty with similar environmental interests
- Introduction to environmental contaminant fate and transport
- Introduction to common remediation approaches
- Explore related environmental issues
- Increase involvement and interaction with Parent Organization

5

SURF
Sustainable Remediation Forum
Colorado State University Student Chapter

2013-2014 Events:

Guest Lecture Topics:

- Ecological recovery following High Park Fire
- Phytoremediation
- Acid mine drainage/reclamation
- Use of Isotope Analysis to Evaluate Biodegredation (Steve Blake Lecture Series ft. John Wilson)

6

SURF
Sustainable Remediation Forum
Colorado State University Student Chapter

Past Events:

Field Trips:

- New Belgium Wastewater treatment tour

7

SURF
Sustainable Remediation Forum
Colorado State University Student Chapter

Past Events:

Field Trips:

- New Belgium Wastewater treatment tour

8

SURF
Sustainable Remediation Forum
Colorado State University Student Chapter

Past Events:

Field Trips:

- Active in-situ thermal remediation site (TPS Tech)

9

SURF
Sustainable Remediation Forum
Colorado State University Student Chapter

Past Events:

Field Trips:

- Union Pacific Railroad Tie Treating Plant (CH2MHill)

10

SURF
Sustainable Remediation Forum
Colorado State University Student Chapter

Past Events:

Field Trips:

- Union Pacific Railroad Tie Treating Plant (CH2MHill)

11

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Sustainable Remediation Forum
Colorado State University Student Chapter

Past Events:

Field Trips:

- New Belgium Wastewater treatment tour
- Active in-situ thermal remediation site (TPS Tech)
- Union Pacific Railroad Tie Plant (CH2MHill)
- ***Stormwater BMP's tour (City of Fort Collins)***
- ***Poudre River coal tar remediation (AECOM)***

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SURF
Sustainable Remediation Forum
Colorado State University Student Chapter

Special Events:

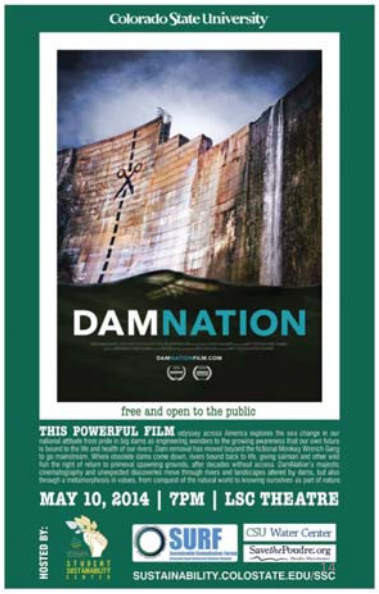
- Host Steve Blake Lecture Series
- Attend National SURF Conference in Ann Arbor, MI
- Host Movie Series
- Volunteer w/ CSU Serves (Nov. and/or Dec.)
- Social!
  - New Belgium Brewery Tour

13

SURF
Sustainable Remediation Forum
Colorado State University Student Chapter

Special Events:

- Co-Host Movie Series



SURF
Sustainable Remediation Forum
Colorado State University Student Chapter

Special Events:

- Co-Host Movie Series

15

SURF
Sustainable Remediation Forum
Colorado State University Student Chapter

Potential Events for 2014-2015:

Guest Lecture Topics:

- Hydraulic fracturing – soil and groundwater contamination
- Stormwater Management, BMP's, LID
- Greywater Reuse
- Environmental contaminant fate and transport
- In-depth discussion on specific remediation techniques

Field Trips:

- Rocky Mountain Arsenal (groundwater contamination)
- Rocky Flats Plant (radioactive groundwater contamination)
- National Renewable Energies Lab (Boulder)
- Engines and Energy Lab (Fort Collins)

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Attachment 11
Force Field Diagram

Force Field Diagram
SURF 27

Contributing Forces

growing recognition
mature and growing recognition
ability to reach other disciplines
societal tools
small but passionate workforce
sustainable remediation can result in saving $
student chapter engagement
sustainable remediation builds on success of brownfields
focused and have a niche
interdisciplinary cross-over to other fields
corporate sustainability
collaborative effort with agencies and groups - antitrust
not-for-profit allows to collaborate
integrating SR for development is easier - more accepted among other sectors
many different groups working on common goal
we are the experts! we have the experience and knowlege
sharing of knowledge
members embracing new approaches to SR
putting SR at the forefront for academia and industry

Become the leader in Sustainable Remediation in order to fulfill SURF's mission statement

Restraining Forces

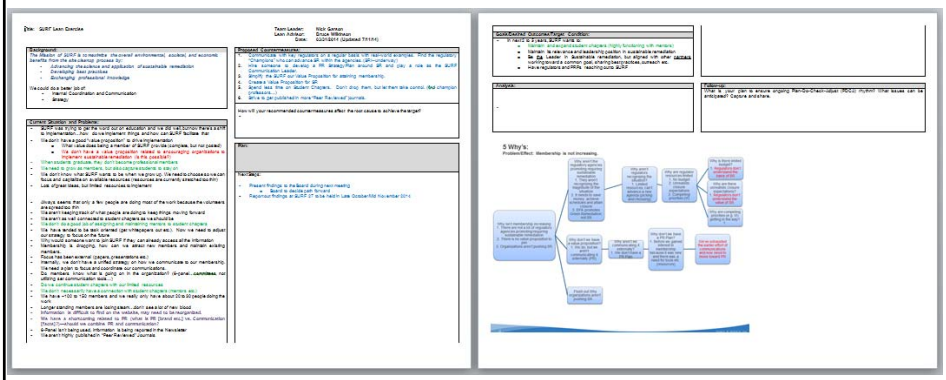
"sustainable remediation is fluff"
SR is excuse for cheaper cleanups
hard to maintain - used to be new
false perception regarding sustainable remediation
now mature
greenwashing leads to false impression
"punish the pollutor" mindset
limited resources (time, money, people)
limited to remediation (end of pipeline; too specific)
competing voices (ASTM, EPA, ITRC)
green remediation
responsible party with limited resources
no legislation that allow regulators to mandate sustainability
disconnect between Executive Orders and actual practice
inadequate demonstration of value
communication between regulatory agencies and legislators (lack of)
consultants lack convincing story for responsible parties
not marketing cost savings/value
lack of effective communications regarding SR
remediation community fixed in its ways
RPs are looking to reduce liability (dig and haul) over GSR
SURFers not informing their companies
not identifying receptive responsible parties
need sustainable remediation in academia
clients not given SR option and traditional option

Attachment 12
SURF Process Improvements

SURF Process Improvements

- Background:
  - The Mission of SURF is to maximize the overall environmental, societal, and economic benefits from the site cleanup process by:
    - Advancing the science and application of sustainable remediation
    - Developing best practices
    - Exchanging professional knowledge
    - Providing education and outreach
- So…why are we looking at process improvements?
  - SURF leadership wanted to understand the current situation and what might be holding SURF back from achieving the full mission

Problem Solving A3 (Lean Tool)



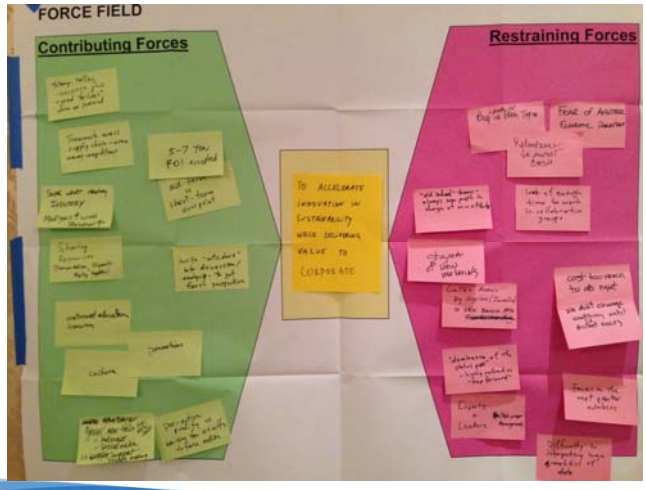
SURF Process Improvements

- Interactive Exercise:
  - Explore the goal to ***"Be <u>the</u> Leader in Sustainable remediation, but aligned with other <u>partners</u> working toward a common goal, sharing best practices, outreach etc."***
  - In order to boil this down to a single problem statement we can work on in the next 30 minutes, we modified this a bit to read

    "Become a leader in sustainable remediation in order to fulfill SURF's mission statement"

SURF Process Improvements

- Force Field Exercise



SURF Mission Statement

The Mission of SURF is to maximize the overall environmental, societal, and economic benefits from the site cleanup process by:

- Advancing the science and application of sustainable remediation
- Developing best practices
- Exchanging professional knowledge
- Providing education and outreach

Attachment 13
Participant Reflections

Day 1 Participant Reflections

Participants responded to the question "What did you learn yesterday" as follows:

- We face the same challenges that we faced at the beginning of SURF.
- SURF is a great group. Impressed with the openness.
- Impressed with presentation by Joel Parker. Reestablishing trees was an entry into sustainable remediation in an economically depressed area where it wouldn't have happened any other way.
- Case studies presented had a strong social focus or driver even though social issues were not a focus of our meeting. Pleasantly surprising and inspirational.
- SURFers have passion. Sustainable remediation isn't just a buzz word, which is great.
- We are several orders of magnitude up on the learning curve than years ago.
- Enlightening meeting with good collaboration. The group works together and listens together while respecting each other's opinion. Refreshing open forum and inviting to new participants.
- As environmental practitioners, we deal with all different scales of sites. Day 1 presentations focused on big sites, but we need to remember small properties. It would be good for SURFers to provide guidance on the different site conditions about what sustainable remediation means to you.
- Fostering/mentoring students is wise investment and crucial for lifeblood of the organization.

Participants responded to the question "What didn't you hear yesterday? What was missing?" as follows:

- How do you normalize CO_2 value so that it has meaning across all three elements of sustainability? This would be a good tool to gauge good/bad decisions. On social side, we need more tools.
- Day 1 presentations were missing hard data and metrics which allow us to judge how a similar approach might help our programs.
- "Sustainability" was missing.

Attachment 14
EPA Region 1 RCRA Sustainable Remediation Summary and BMP Evaluation

EPA Region 1 RCRA Sustainable Remediation Summary and BMP Evaluation

John Simon, ASTM Task Group Lead
Gnarus Advisors LLC

GNARUS ADVISORS LLC

Expertise Matters.

GNARUS ADVISORS LLC

Overview of ASTM Standard Guides

1. *Standard Guide for Integrating Sustainable Objectives into Cleanups (ISOC) ASTM E2876*
2. *Standard Guide for Greener Cleanups ASTM E2893*

- Fundamental core is selecting BMPs
- Flexible evaluation process
- Qualitative evaluation (BMP selection)
- Quantitative evaluation (numerical)
- Standards are applied on a phase-by-phase basis

2

Expertise Matters.

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ASTM Greener Cleanups Standard

Sections

1. Scope
2. Referenced Documents
3. Terminology
4. Significance and Use
5. Planning and Scoping
6. BMP Process
7. Quantitative Evaluation
8. Documentation and Reporting

3

Expertise Matters.

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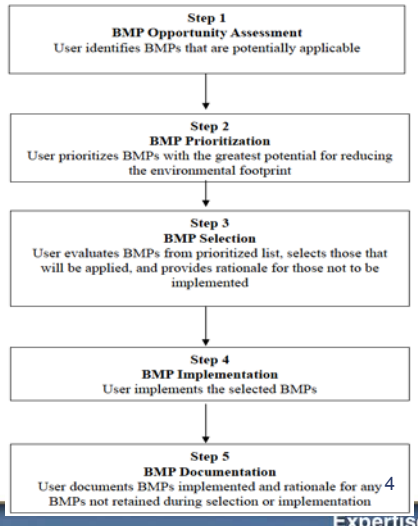
Overview – Greener Cleanup Standard and ISOC

- Began the process in 2009
- Followed ASTM's consensus-based process
- **Revelation** is that this is about a Process, not just Technologies
- BMP Selection is the Backbone of the Standards



4

Expertise Matters.

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Environmental Best Management Practices

- Standard Management Practice (not included because routine)
- Environmental Best Management Practices
  - An environmental or “green” BMP is an approach that reduces the environmental footprint of an activity
  - ASTM’s GCS Task Group developed a comprehensive list of green BMPs
  - Green BMPs drive environmental footprint reduction
  - Green BMPs can be sorted by activity, remediation technology or core elements
  - Green BMPs organized around EPA’s five core elements in GCS these and social and econonmic core elements in ISOC

5

Expertise Matters.

GNARUS ADVISORS LLC

Social and Economic Best Management Practices

- BMPs listed in Appendix X1 of ASTM 2876-13 *Standard Guide for Integrating Sustainable Objectives into Cleanup*
- Additional core elements in the standard
  - Community involvement
  - Enhancement of individual human environments
  - Local community vitality

6

Expertise Matters.

GNARUS ADVISORS LLC

BMP Process
"Five Steps to Greening Cleanu

ASTM INTERNATIONAL

1. Opportunity assessment
   - Review master list of BMPs and retain those that warrant further consideration
   - Consider BMPs not on the master list
   - Should be a pretty straightforward exercise
2. BMP prioritization
   - Prioritize BMPs from Step 1
3. BMP selection and implementation
   - Unless a compelling reason to do otherwise, select each BMP from Step 2 for implementation
   - What is a "compelling reason to do otherwise"?
   - Substantive issues associated with applicability, implementation, impracticability and cost
4. BMP Implementation
   - Implement selected BMPs, unless not practicable in application
5. BMP Reporting
   - Document BMPs implemented
   - Explain why BMPs from Step 3 were not implemented (if any)

7

Expertise Matters.

GNARUS ADVISORS LLC

Project Overview

8

Expertise Matters.

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Project Scope of Work

- Preliminary discussion with Client's project management team to review the project history and cleanup activities
- Review of critical corrective action documents, including: the EPA's Statement of Basis, EPA's Final Decision and Response to Comments, and the Corrective Measures Design
- Screening of potentially applicable BMPs and developing a list of green, economic, and social BMPs incorporated into the project design.
- Discussions with the Client's project management team regarding which green and sustainable BMPs in Gnarus' list were implemented
- Implementation of ASTM review process, including adding social and economic BMPs to the Appendix X3 BMP table prioritization of the applied or planned BMPs
- Preparing this summary report following ASTM format

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Applying BMP Table to the Site

		Core Element Addressed (at Site Level)					
gory		Energy	Air	Water	Materials and Waste	Land and Ecosystems	In-situ Thermal Treatment
rials	Maximize the reuse of existing wells for sampling, injections or extractions, where appropriate, and/or design wells for future resuse	X	X		X	X	X
rials	For in-situ thermal treatment using ERH, recover and recycle or re-use steel electrodes at project completion				X		X
nd Fuel	Insulate all applicable pipes and equipment to improve energy efficiency	X					X
Team Management	Use local staff (including subcontractors) when possible to minimize resource consumption	X	X		X		X

Environmental BMPs Implemented

Notable Environmental BMPs

- Total of 75 environmental BMPs
- Remedy consolidated majority of contaminated materials under engineered caps
- Creating on-site wetlands
- Utilizing blast furnace slag for hydraulic barrier wall construction
- Utilizing re-usable geotextile bags for dewatering contaminated sediments

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Expertise Matters.

Environmental BMPs Implemented (cont.)

Notable Environmental BMPs

- Operating P&T in pulsed mode and adjusting pumping to match river's tidal elevation changes
- Selecting re-vegetation requiring minimal mowing
- Managing drilling wastes on-site under caps
- Used field screening DNAPL dyes to control investigation progress real-time

12

Expertise Matters.

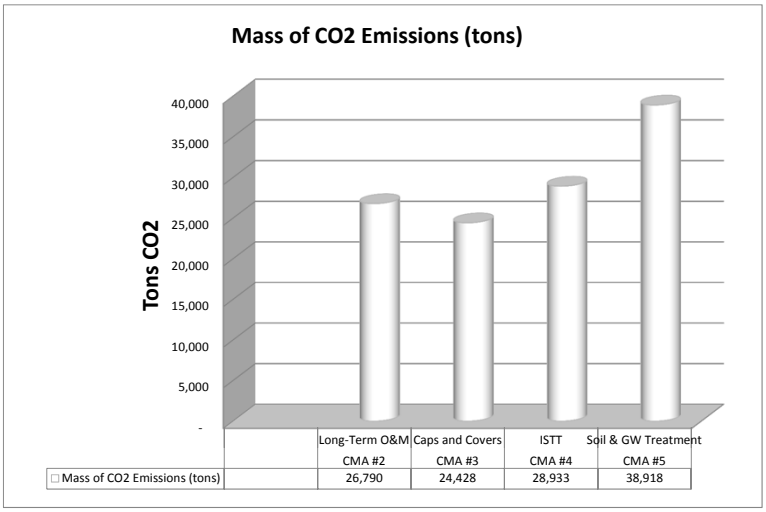
Environmental BMPs Implemented (cont.)

Environmental BMPs Identified for ISTR

- 15 BMPs for thermal treatment alone
- Examples include:
  - Insulating piping
  - Recovering electrodes
  - Using local labor and labs, when possible
  - Employing variable frequency drives
  - Segregating drilling waste and placing under cap (if possible)

13

Expertise Matters.



14

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Social BMPs

- Developed project website
- Worked with town council to establish a Community Advisory Panel
- Involved community in remedy selection
- Recognized community members with awards
- Implemented community relations plan
- Stakeholder-driven re-use planning process
- Provide nature trails
- Maintained eco-diversity (yes, this is a social BMP because popular with community)

15

Expertise Matters.

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Economic BMPs

- Local buying commitment, including web-based form on website
- Created local jobs
- Re-use planning included a market analysis
- Providing redevelopment opportunities
- Still a work in progress and re-development is in process

16

Expertise Matters.

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Examples of GSR Benefits

- Promoting economical, yet green BMPs
- Shifted media and public perception from negative to positive – improved corporate social responsibility
- Community now feels cleanup is a benefit
- Created local jobs
- Community can utilize ecological resources
- Enhanced regulatory acceptance of remedy
- Stakeholders can showcase success

17

Expertise Matters.

GNARUS ADVISORS LLC

Questions?

- John Simon, ASTM Task Group Lead, Gnarus Advisors LLC
  jsimon@gnarusllc.com

18

Expertise Matters.

Attachment 15
Muddy Boots Meet Tech: Sustainable Tools for Environmental Data Management

Muddy Boots Meet Tech

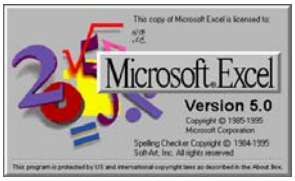
Sustainable Advances and Best Practices to Get Digital Field Data Implemented

POWERED BY ORNICEPT

1

FOUNDATION CHANGING TECH

Microsoft Excel



1978
VisiCalc Invented

1983
Lotus 1-2-3 Commercial Success

1993
Excel 5.0 with VBA

2011
Microsoft Office 2010, 100 million copies sold

2

TECH

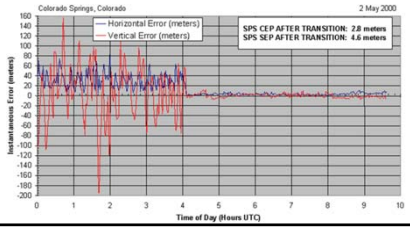
GPS

1957
Sputnik Inspiration

1960
US Navy launches TRANSIT

1995
GPS 24 Satellite System Complete

2000
End Selective Availability



2010
122.35 million GPS devices sold

3

SUSTAINABLE FIELDWORK

The Mission

"Today **EPA** aims to make sustainability the next level of environmental protection by drawing on advances in science and technology to protect human health and the environment, and promoting innovative green business practices."

"The mission of **SURF** is to maximize the overall environmental, societal, and economic benefits from the site cleanup process…"

4

HURDLES TO ADOPTION

Fieldwork is Relatively Manual

HISTORICALLY

- Hardware
  - Long days
  - Harsh, remote environments

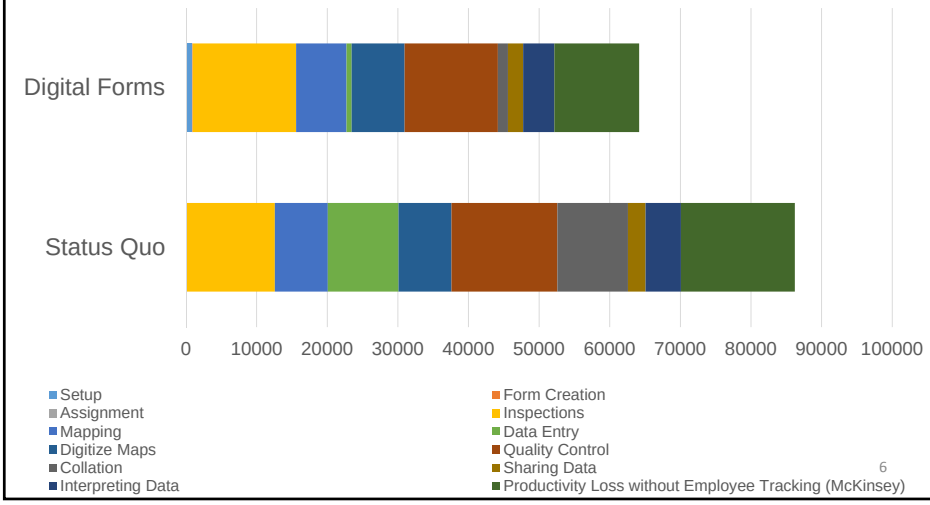
TODAY

- ROI
  - Benefits of digital forms haven't justified the investment to change the status quo

5

ROI

Time Comparison



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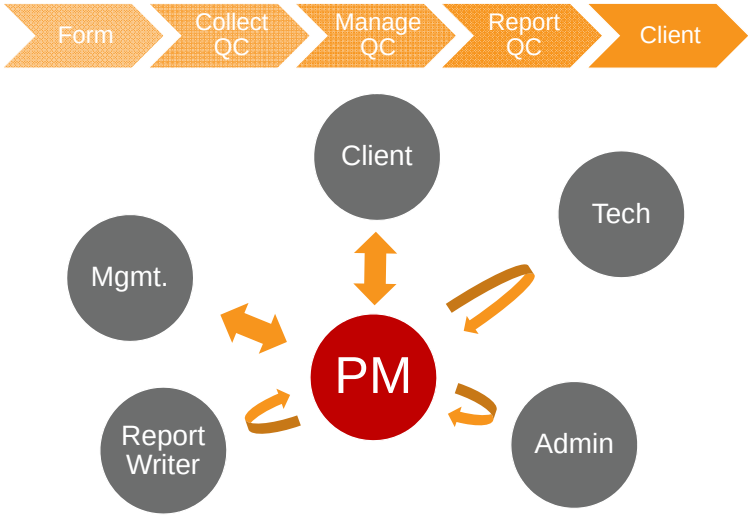
WORKFLOW



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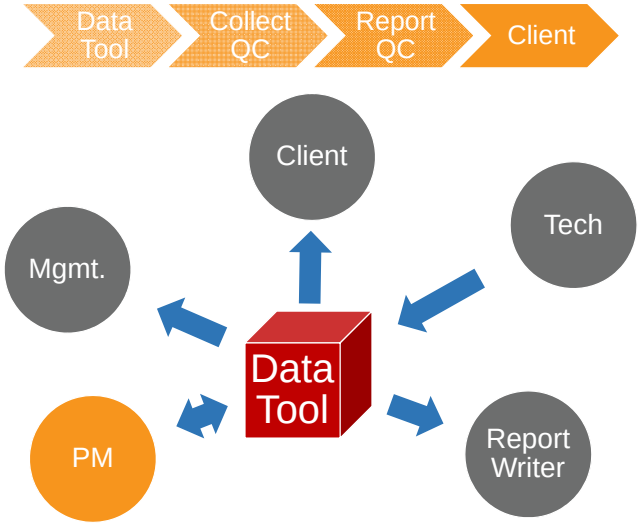
ROI

What does the Status Quo Cost?

TASK	TIME/FORM	HOURLY RATE	COST
Setup			
Collect Data			
Manage Data			
Report			
QC			
Delivery			

8

WORKFLOW 2.0



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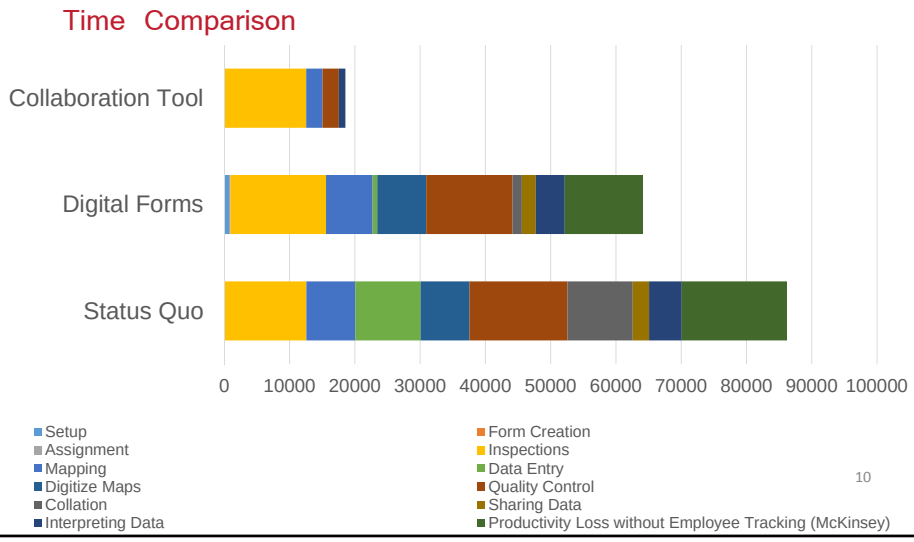
ROI



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QUESTIONS

Thank you

Josh Ryan, *Account Manager*
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734.945.2577

Ornicept, Inc.

11

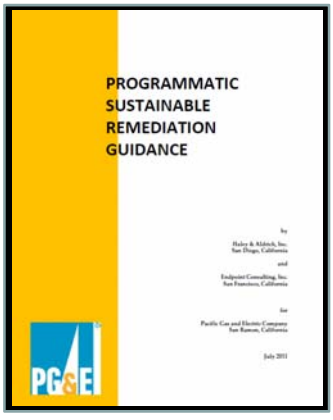
Attachment 16
Sustainable Remediation: Looking Ahead Through to 2014

Sustainable Remediation: Looking Ahead Through to 2014

Sharron Reackhof – PG&E
Karin Holland – Haley & Aldrich, Inc.
Mehrdad Javaherian – Endpoint Consulting, Inc.

Presentation Outline

- Who is PG&E?
- Background on PG&E's sustainable remediation program
- 2013-2014 goals
- Next steps
- Questions



Who is PG&E

- Provider of electricity and natural gas to approximately 40% of Californians.
- Focus on bringing more renewable energy to our customers

Taking Responsibility – our historical impacts

PG&E continues to operate a comprehensive program of environmental remediation at sites throughout our service area. The program's goal is to sustainably reduce our eliminate the remaining environmental impacts associated with our historical operations, or those of predecessor companies.

a) Historical Gas Plant Sites
b) Divested Power Plants
c) Various PG&E operating facilities

PG&E Sustainable Remediation Journey

Apr.: PG&E and DTSC start developing guidance

June: Guidance (1st version) complete

Aug.: Training for PG&E MGP* sites PMs and Contractors

Feb.: Program expanded to cover PG&E portfolio

Mar.: PG&E's Sustainable remediation goals for 2013-2014

2010 | 2011 | 2012 | 2013 | 2014

Dec.: DTSC's Interim Advisory Released

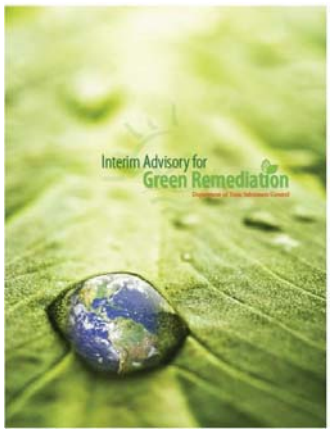
Oct.: Briefing to DTSC Executive Leadership Team

Mar.: Training to DTSC PMs

*** MGP = Manufactured Gas Plant**

Guidance Objectives

- **Standardized** approach
- **Ongoing, iterative** thought process
- Project **life cycle** coverage
- Aligned with **DTSC's Interim Advisory**



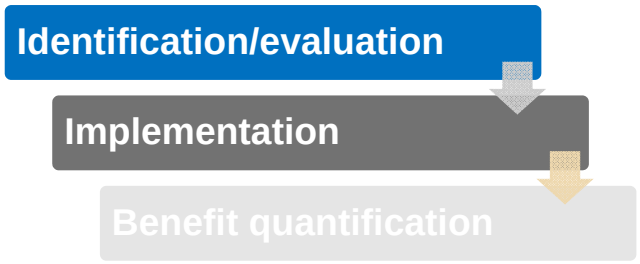
Attributes

- Dynamic, living
- Comprehensive
- User-friendly
- Flexible
- Minimal imposition
- Compliant

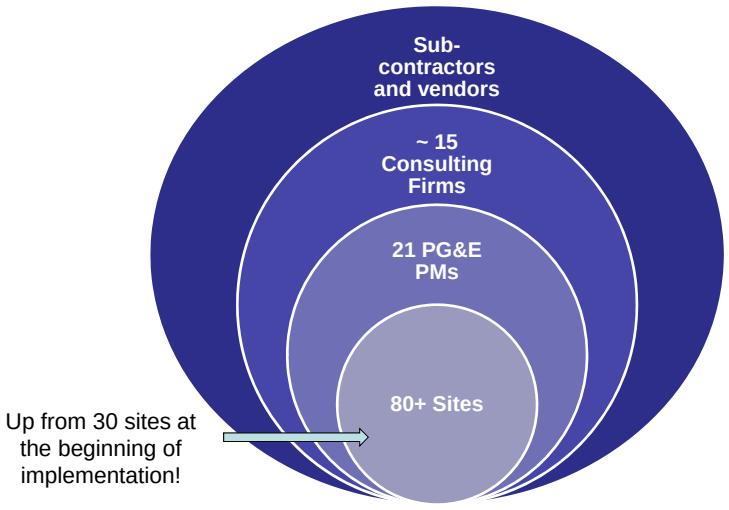
Sustainability Team Members

Framework

- Standard approach for **Best Management Practices (BMPs)**

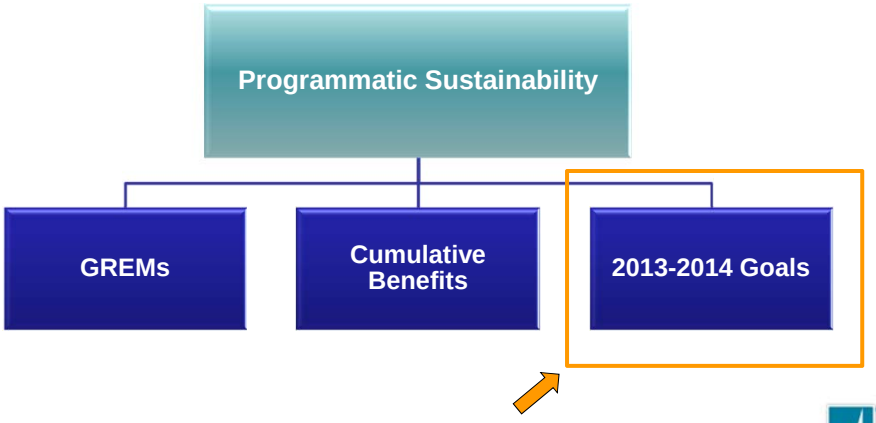


Portfolio Overview



Up from 30 sites at the beginning of implementation!

Sustainability Program



2013-2014 Goals

1. **Metric 1:** Implementation of GHG reducing BMPs during field activities
2. **Metric 2:** Documentation of sustainable practices in technical reports

Goals for 2013-2014
#1: Emissions Reduction Practices

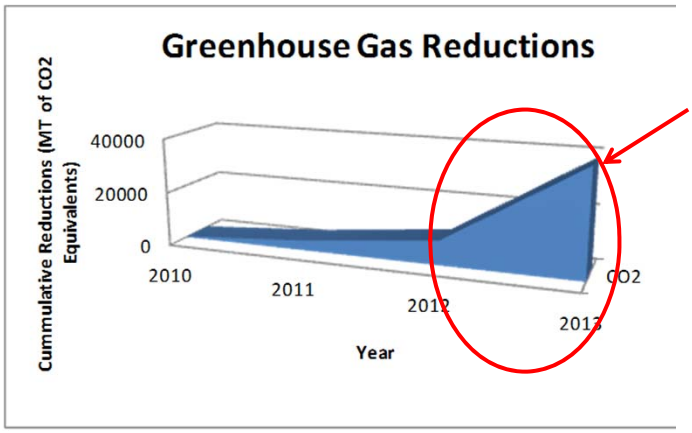
Where applicable, implement one or more emission-reducing practices at sites where investigation and remediation activities involving the use of heavy equipment are taking place

Emissions Fact Sheet

- Numerous BMPs:
  - Minimizing idling
  - Preventative maintenance
  - Equipment retrofits
  - Alternative fuels
  - Equipment replacement
- Importance of vendors


Emissions Reduction Fact Sheet

Greenhouse Gas Emission Reductions

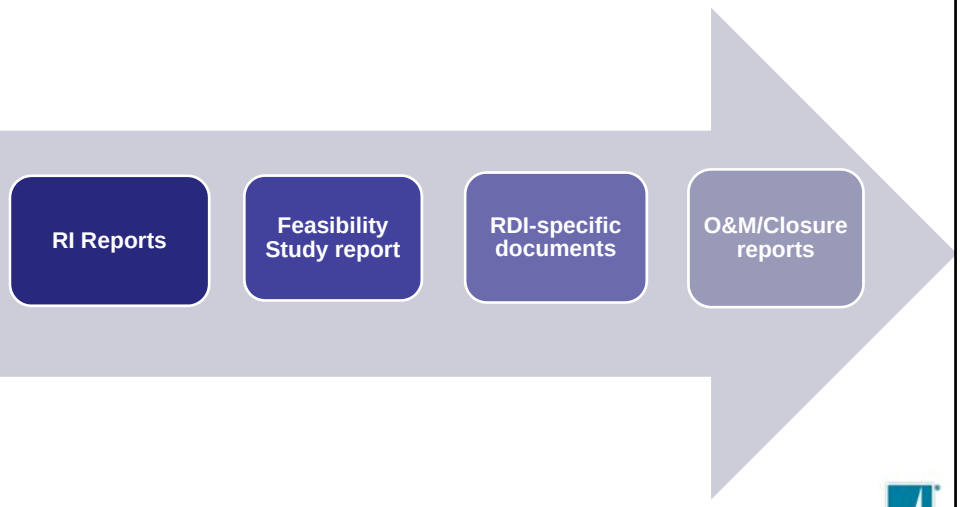


Exponential decrease in GHG emissions

Example BMPs

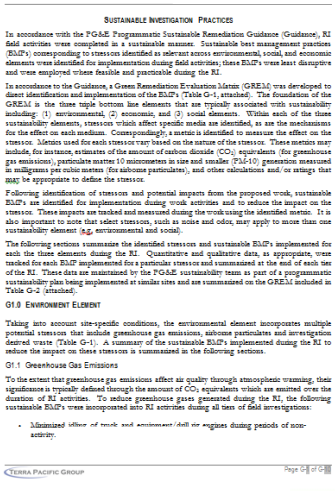
- Use of higher tier vehicles
- Automate mechanical and electrical equipment
- Use renewable energy, e.g. for lighting
- Fewer, longer days for O&M activities
- Optimize sampling schedules
- Installation of a high efficiency equipment
- Remote data collection

Goals for 2013-2014
#2: Document and Report Sustainable Practices



Approach

- Summary in text
  - Consistent with regulatory guidance
  - Built around GREM
- Reference to standalone section



SUSTAINABLE INVESTIGATION PRACTICES

In accordance with the PG&E Programmatic Sustainable Remediation Guidance (Guidance), RI field activities were completed in a sustainable manner. Sustainable best management practices (BMPs) corresponding to stressors identified as relevant across environmental, social, and economic elements were identified for implementation during field activities; these BMPs were least disruptive and were employed where feasible and practicable during the RI.

In accordance to the Guidance, a Green Remediation Evaluation Matrix (GREM) was developed to direct identification and implementation of the BMPs (Table G-1, attached). The foundation of the GREM is the three triple bottom line elements that are typically associated with sustainability including: (1) environmental, (2) economic, and (3) social elements. Within each of the three sustainability elements, stressors which affect specific media are identified, as are the mechanisms for the effect on each medium. Correspondingly, a metric is identified to measure the effect on the stressor. Metrics used for each stressor vary based on the nature of the stressor. These metrics may include, for instance, estimates of the amount of carbon dioxide (CO_2) equivalents (for greenhouse gas emissions), particulate matter 10 micrometers in size and smaller (PM-10) generation measured in milligrams per cubic meters (for airborne particulates), and other calculations and/or ratings that may be appropriate to define the stressor.

Following identification of stressors and potential impacts from the proposed work, sustainable BMPs are identified for implementation during work activities and to reduce the impact on the stressor. These impacts are tracked and measured during the work using the identified metric. It is also important to note that select stressors, such as noise and odor, may apply to more than one sustainability element (e.g., environmental and social).

The following sections summarize the identified stressors and sustainable BMPs implemented for each the three elements during the RI. Quantitative and qualitative data, as appropriate, were tracked for each BMP implemented for a particular stressor and summarized at the end of each tier of the RI. These data are maintained by the PG&E sustainability team as part of a programmatic sustainability plan being implemented at similar sites and are summarized on the GREM included in Table G-2 (attached).

G1.0 ENVIRONMENT ELEMENT

Taking into account site-specific conditions, the environmental element incorporates multiple potential stressors that include greenhouse gas emissions, airborne particulates and investigation derived waste (Table G-1). A summary of the sustainable BMPs implemented during the RI to reduce the impact on these stressors is summarized in the following sections.

G1.1 Greenhouse Gas Emissions

To the extent that greenhouse gas emissions affect air quality through atmospheric warming, their significance is typically defined through the amount of CO_2 equivalents which are emitted over the duration of RI activities. To reduce greenhouse gases generated during the RI, the following sustainable BMPs were incorporated into RI activities during all tiers of field investigations:

- Minimized idling of truck and equipment/drill rig engines during periods of non-activity.

TERRA PACIFIC GROUP

Internal Tracking of Metrics

- Simple table to complete
- 48 projects submittals within 6 weeks!
  - Covers > 60% of remediation portfolio

2013/2014 Metric Summary Worksheet

Project Name:

Period	Metric 1: Implementation of GHG Reducing BMPs During Field Activities		Metric 2: Documentation of Sustainable Practices in Technical Reports		Comments
	(1) Number of Field Activities Involving the Use of Heavy Construction Equipment?	(2) Number of Field Activities where GHG-Reducing BMPs were Applied to Heavy Construction Equipment?	(3) Number of Technical Reports Submitted to Regulatory Agencies?	(4) Number of Technical Reports Submitted Containing Sustainability Writeup?	
Q1 2013					
Q2 2013					
Q3 2013					
Q4 2013					
Q1 2014					

Technical Reports represent documents summarizing project activities and phases covered in the PG&E Programattic Sustainable Remediation Guidance
Please provide any additional details you see fit regarding documents submitted (e.g., name or type of report) in the Comments column
GHG-reducing BMPs recognized in column 4 should correspond to entries within the relevant GREM(s) and Cumulative Sustainability Benefits Rollup Table for each relevant quarter

Example Submittal

2013/2014 Metric Summary Worksheet

Project Name: Fresno MGP

Period	Metric 2: Implementation of GHG Reducing BMPs During Field Activities		Metric 1: Documentation of Sustainable Practices in Technical Reports		Comments
	(1) Number of Field Activities Involving the Use of Heavy Construction Equipment?	(2) Number of Field Activities where GHG-Reducing BMPs were Applied to Heavy Construction Equipment?	(3) Number of Technical Reports Submitted to Regulatory Agencies?	(4) Number of Technical Reports Submitted Containing Sustainability Writeup?	
Q1 2013	0	0	2	0	-IRM Report (1/13/13) -Revised Draft RAP and response to comments (2/5/13)
Q2 2013	0	0	4	1	-Draft UST Removal Action Report (4-23-13) - Tar Pit Contents Removal and Well Destruction Report (4-17-13) -Fate and Transport Modeling Report (6-27-13)
Q3 2013	0	0	3	0	- Revised Draft RAP and response to comments on second Draft RAP (8/20/13) - Revised Final Draft RAP (9/9/13) -IRM Inspection Report (9-12-13)
Q4 2013	0	0	2	0	-IRM Inspection Report (12-16-13) -Final Remedial Action Plan (12-6-13)
Q1 2014					

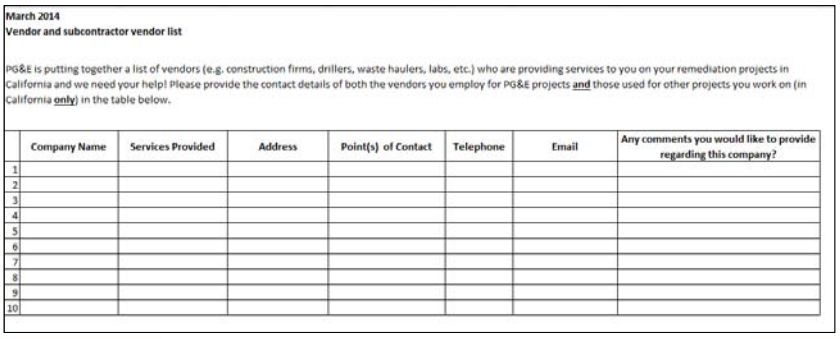
Technical Reports represent documents summarizing project activities and phases covered in the PG&E Programattic Sustainable Remediation Guidance
Please provide any additional details you see fit regarding documents submitted (e.g., name or type of report) in the Comments column
GHG-reducing BMPs recognized in column 4 should correspond to entries within the relevant GREM(s) and Cumulative Sustainability Benefits Rollup Table for each relevant quarter

Portfolio-Wide Cumulative Sustainability Benefits (through Q4 2013)

GHG emission reductions:	> 52,000 metric tons
Offsite waste reductions:	> 121,000 tons recycled
Reductions in liquid IDW:	> 13,500,000 gallons
Reductions in soil IDW:	> 117,900 tons
Local economy boost:	> $ 51.3M
Stakeholder satisfaction:	99.9%
Reduction in energy use:	~ 45,000 KWh

Next Steps: Green Vendor List

- Aligned with consultant needs
- Opportunity to green supply chain
- List extends beyond PG&E sites



March 2014
Vendor and subcontractor vendor list

PG&E is putting together a list of vendors (e.g. construction firms, drillers, waste haulers, labs, etc.) who are providing services to you on your remediation projects in California and we need your help! Please provide the contact details of both the vendors you employ for PG&E projects **and** those used for other projects you work on (in California **only**) in the table below.

	Company Name	Services Provided	Address	Point(s) of Contact	Telephone	Email	Any comments you would like to provide regarding this company?
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Green Vendor List

Since rolled out in March 2014:

- > 150 vendors on list
- Multiple categories of vendors
  - e.g. constructors, drillers, labs, waste handlers, specialty services…
- ~ 40% vendors employ green practices

April 2014
Vendor and subcontractor vendor list
Master List

Company Name	Services Provided	Address	Point(s) of Contact	Telephone	Email	Any comments you would like to provide regarding this company
APPL Labs	Laboratory services	908 N Temperance, Ave. Clovis CA		(559) 275-2175		WBE laboratory. PG&E project lab for 15+ years
Belshire Environmental Services	Transportation and Disposal of Waste	25871 Towne Centre Drive, Foothill ranch, CA 92610	Cindy Johnson	949-460-5200	cindy@belshire.com	Visit multiple Sites in a day to coordinate pickups for drums reducing miles for travel, hence minimizing CO2 Emissions
Blainetech Services	GW sampling, Well Development	4731 Pell Drive Unit #E, Sacramento, CA 95838	David Webb	916-925-2913	dwebb@blainetech.com	Visit multiple Sites in a day and reduces miles for travel hence minimizing CO2 emissions, implement carpooling
Cascade Drilling	Drilling, geoprobe, injections	120 S. 23rd Street, Richmond, CA 94804	Derrik Sandberg	415-377-5026	DSandberg@cascadedrilling.com	Very large drilling company, with nationwide resources. Cascade has implemented the following practices: • California Air Resource Board (CARB) compliant rigs, trucks, and support equipment in California. • Several limited access/indoor auger rigs that run on propane fuel vs diesel • EPA certified waste oil burner to both heat the shop and incinerate waste oil • Filter scrubber on the welding bay to eliminate metal particulates (Chrome, Zinc) generated & discharged into the atmosphere while performing welding & fabrication activities • No idling policy for drill rigs on-site with the exception of deck motors. • All solvents, oil, rags are picked up by a recycle vendor • oil / water separator in all wash bays • use of "green" cleaners when available.

Questions?

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Sharron.Reackhof@pge.com

Karin Holland:
443-845-7817
kholland@haleyaldrich.com

Mehrdad Javaherian:
415-706-8935
mehrdad@endpoint-inc.com

Attachment 17
Long-Term Benefits of a Systematic and Collaborative Sustainability Approach

Long-Term Benefits of a Systematic and Collaborative Sustainability Approach in Hinkley, California

Kristin Mancini (ARCADIS), Kevin Sullivan (PG&E), and Sharon Reackhof (PG&E)

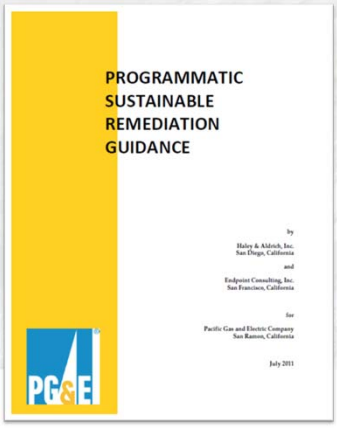
November , 2014

Imagine the result

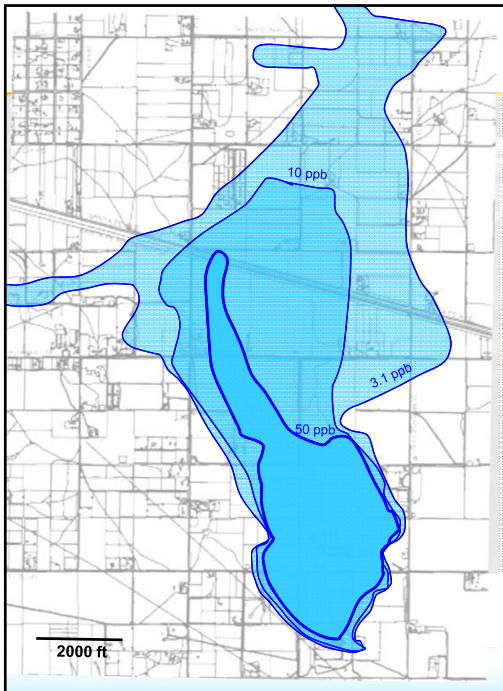
ARCADIS

Sustainable Remediation Approach

1. Identify project specific sustainability performance metrics material to ongoing activities
2. Identify and implement sustainable BMPs for site activities
3. Track site impacts (environmental, social and economic) and the benefits of sustainable BMPs.



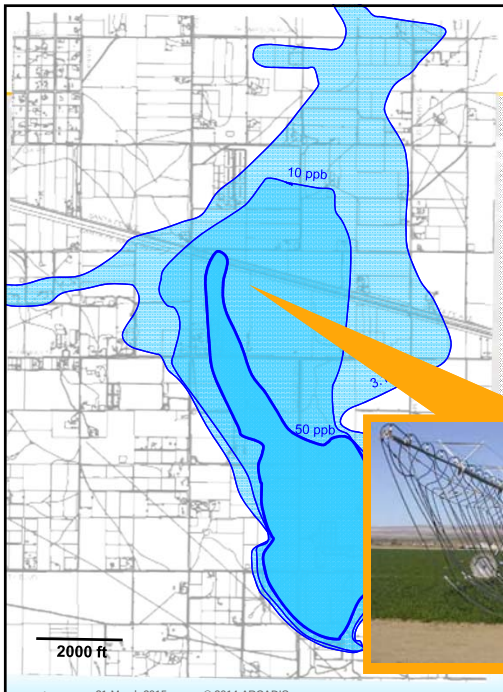
ARCADIS



Site Background

- Cr(VI) in groundwater due to historic release at the PG&E Hinkley compressor station
- High concentration plume core (up to ~9,000 ppb Cr(VI))
- Cr(VI) plume drawn to currently defined background levels(3.1/3.2 ug/L)
- EIR approved in June 2013 and remedy currently in design

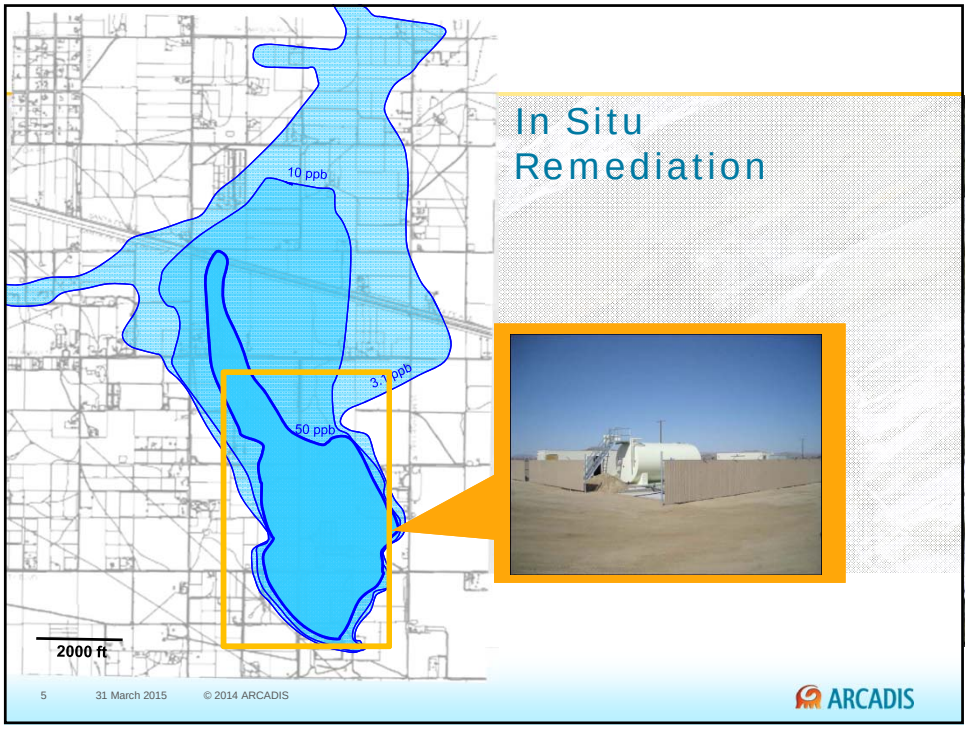
  ARCADIS



Plume Containment

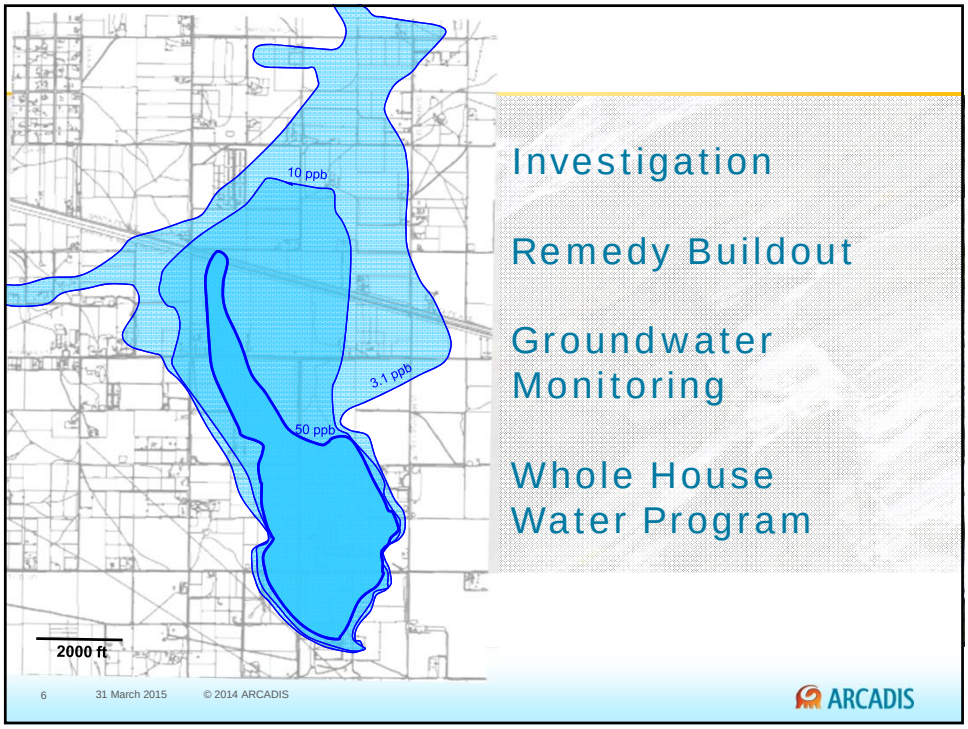
- Groundwater extraction and treatment via agricultural application
- Freshwater injection

  ARCADIS



In Situ Remediation

ARCADIS



Investigation

Remedy Buildout

Groundwater Monitoring

Whole House Water Program

ARCADIS

Selected Stressors




Substance Release and Production	Resource Depletion or Gain	Stakeholder Consideration	Health and Safety	Economics
Air emissions Liquid waste Soil waste	Material consumption and reuse Biological and cultural resources	Community investment	Occupational health and safety	Efficiency Local economy spend

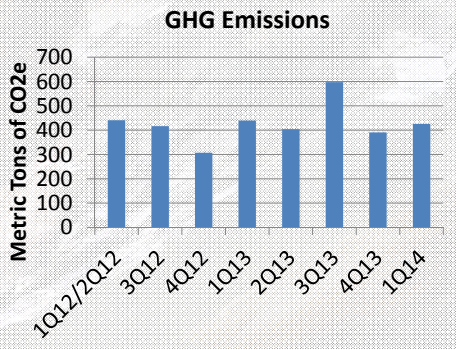
  ARCADIS

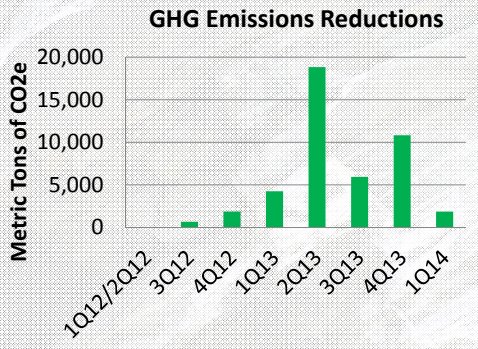
Systematic Tracking of Impacts and Benefits

STRESSOR	SUSTAINABLE BEST MANAGEMENT PRACTICE	METRIC	SUSTAINABILITY STANDARDIZATION	SUSTAINABILITY CALCULATION RESULT	RATING
Implementation GREM scope currently includes operation of DVD LTU, agricultural units, fresh water injection, Central Area IRZ, SCRIA, Source Area IRZ					
Greenhouse Gas Emissions	1) Regular optimization of extraction flow rates and locations to reduce overall pumping and carbon substrate requirements. 2) Maximize waste/material bulk shipments.	Metric tons of CO_2e/ total volume COCs in relevant media	LOW = ≤0.005 MODERATE = >0.005 and ≤0.01 HIGH = >0.01	**4.68E-07**	**LOW**

  ARCADIS

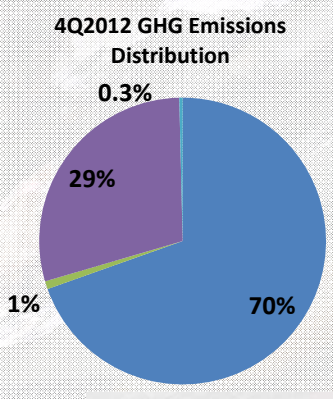
Tracking Impacts and Benefits

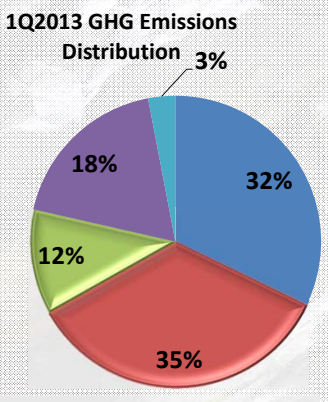




- Major GHG reductions achieved through the following: material recycling/salvaging, onsite treatment/reuse of development water, onsite land farming of drilling cuttings, and avoided Dairy farmer travel for alfalfa purchasing

Refining Data Collection and Reliability

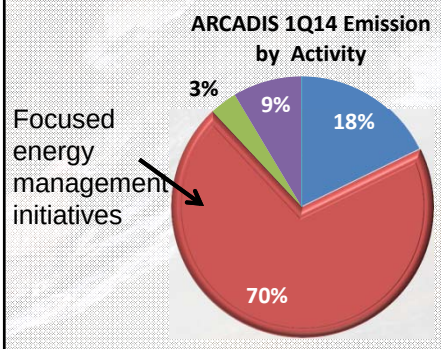




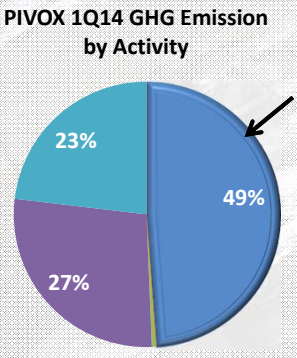
Improvements

- Added electricity usage and air travel data
- Developed GHG database established
- Added SOx and NOx to air emission

Focusing Sustainability Activities



Focused energy management initiatives



Focused onsite equipment emission controls

Onsite Equipment Operations
Equipment Electricity Usage
Air Travel
Auto Travel
Truck Shipments

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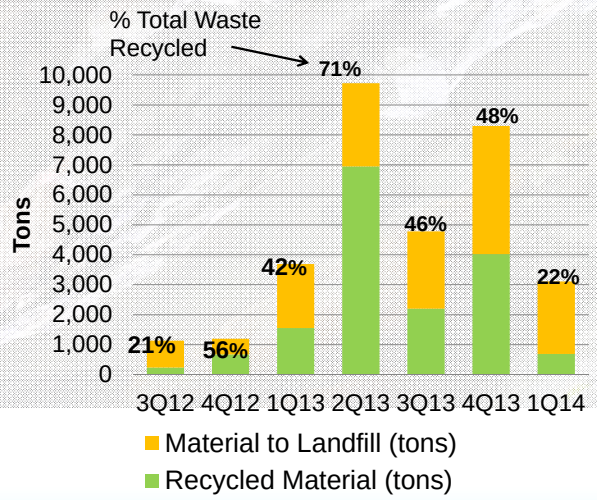
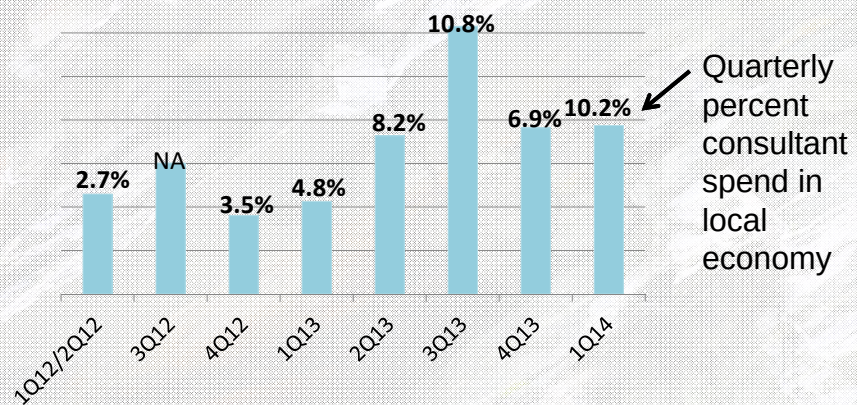
Landfill Waste Diversion



Landfill diversion activities account for 99% of total project GHG reductions

  ARCADIS

Quarterly Local Economy Boost



- 2012 Total Consultant Local Economy Spend – 4.9%
- 2013 Total Consultant Local Economy Spend – 6.6%

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Agriculture to Treat Groundwater

- Water conservation
- Improving water quality
- Material consumption reduction
- Air emission reductions
- Keeping it local

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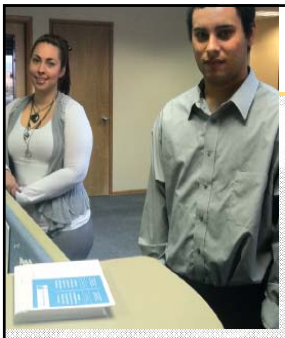

Recology

Investing in the Community

Partnering with local organizations with a focus on youth, wellness, education and workforce development

Community Advisory Committee

Communicating Sustainable Practices

Stakeholder communications

- Progress Reports

Continual team collaborations and education

- Annual planning and goal setting

Looking Ahead

- Adaptive data tracking and management approach
- Focus on 2014 sustainability goals implementation
- Continue to seek opportunities to invest in local community

  ARCADIS

Acknowledgements

PG&E
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Stantec
Holly Quasem

ARCADIS
Jenifer Beatty
Matt Carney
Jay Erikson
Drew Feucht
Dan Garcia
Hans Johannes

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31 March 2015
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Attachment 18
U.S. EPA and Sustainability

U.S. EPA and Sustainability

Brad Bradley, U.S. EPA Region 5
Superfund Greener Cleanup Coordinator

EPA Themes

Administrator McCarthy identified seven themes for guiding the Agency's work in the future. Supporting greener cleanups and sustainability is integral to at least three of these themes, including:

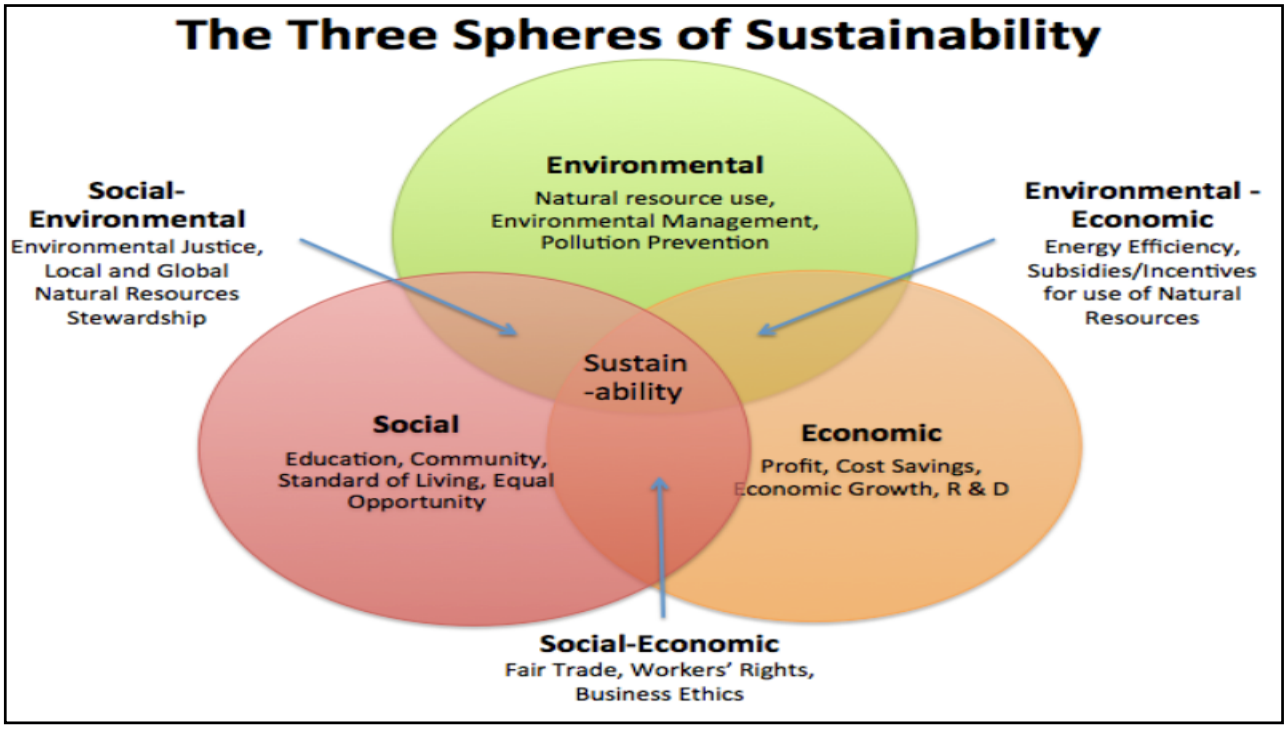
- **Making a Visible Difference in Communities across the Country**
- **Addressing Climate Change and Improving Air Quality**
- **Working Toward a Sustainable Future**

EPA and Sustainability

A goal of the U.S. Environmental Protection Agency (EPA) Office of Solid Waste and Emergency Response (OSWER) and its many partners is to preserve and restore land by promoting and using protective waste management practices and assessing and cleaning up contaminated sites. OSWER cleanup programs (including national and regional programs) address contaminated soil, groundwater, surface water, sediments, air, and other environmental media.

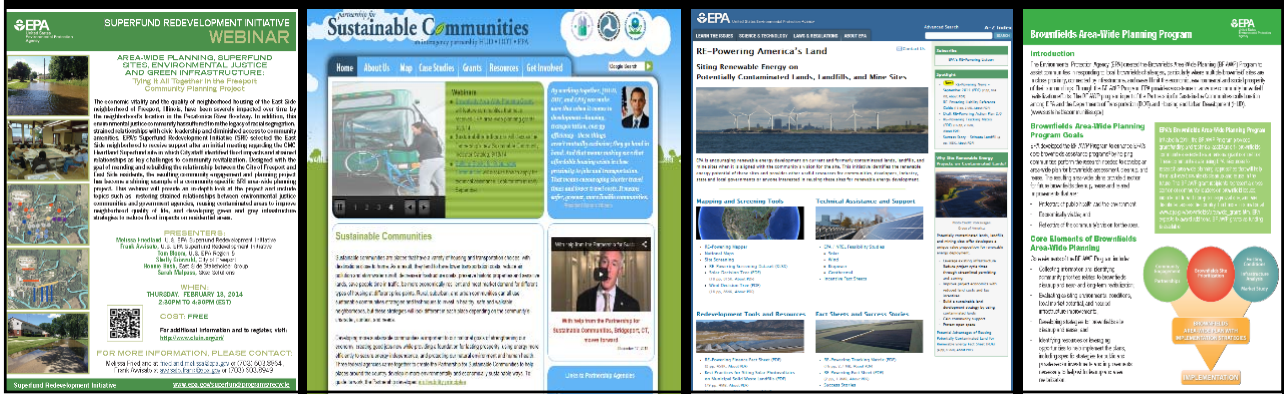
EPA has a clearly stated goal to clean up and advance sustainable reuse to make our communities safer and healthier. By maximizing the potential of our programs to spur environmental cleanups and by fostering stronger partnerships with stakeholders affected by our cleanups, we are moving toward our goal of building sustainable, healthy, economically vibrant communities.

Restoration of the riverfront in Oshkosh, WI – Before, During and After Brownfields Assessments and Cleanups completed.

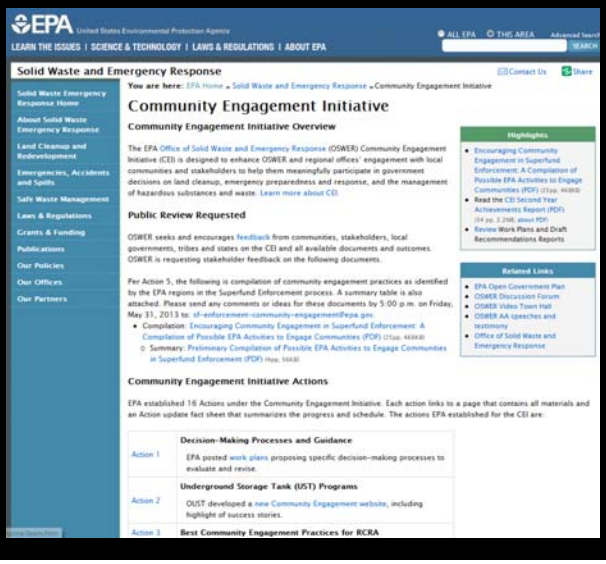


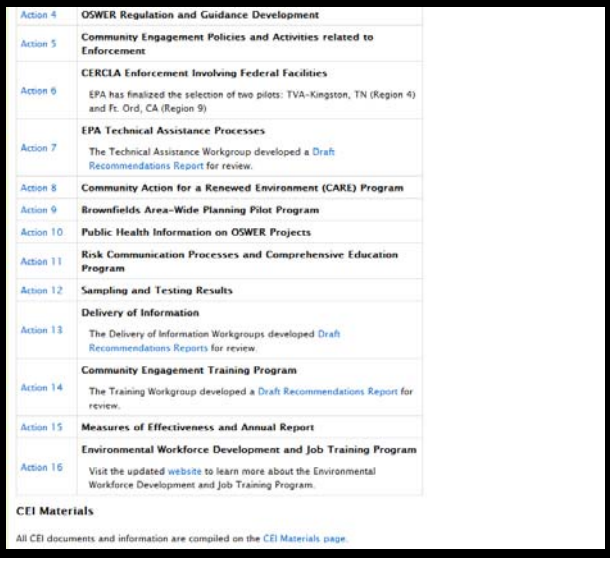
The triple bottom line of sustainability is woven into our existing cleanup programs.

To support the ***Environmental-Economic*** leg of sustainability we consider anticipated reuse to better prepare sites for economic redevelopment. We go a step further through multiple efforts to foster sustainable redevelopment, such as the Superfund Redevelopment Initiative (SRI), the EPA/HUD/DOT Partnership for Sustainable Communities, Re-Powering America's Land and Area-wide Planning Grants. We also implement job training programs in the communities where we oversee major cleanups. In this way we enhance the skills sets of local citizens and improve their options to secure a job either on the remediation project or in the redevelopment effort and the businesses that move in after cleanups.



The ***Social-Environmental*** leg of sustainability also plays an important role how we manage our cleanup programs, which is particularly important as local communities have the most at stake in how contaminated sites are remediated. Our Community Engagement Initiative, for example, is designed to enhance our engagement with local communities and stakeholders to help them meaningfully participate in government decisions on how we approach cleanups.

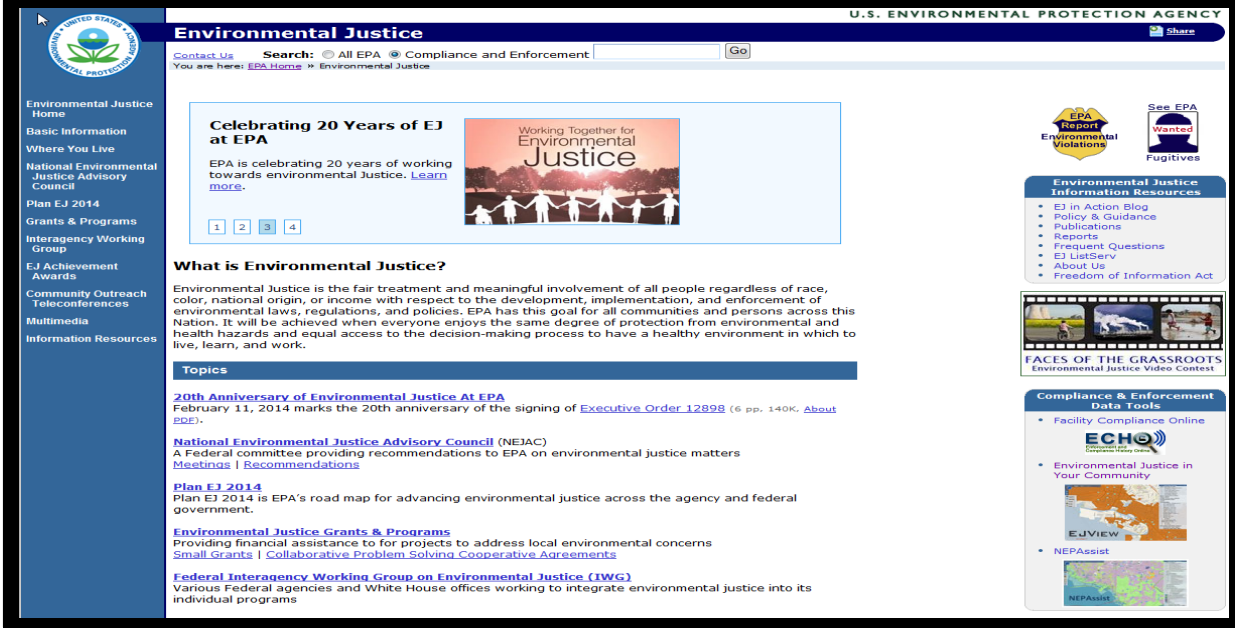




Having robust mechanisms in our cleanup programs to engage a community and consider its economic interests, allows us to focus on improving the *social-environmental* leg of sustainability at site cleanups. We also recognize that each cleanup creates its own environmental footprint and there are opportunities for us to do our jobs "greener" and smarter. The Principles for Greener Cleanup, released in 2009, recommended that we evaluate our actions more holistically using the core elements as a framework. Since that time, EPA has undertaken several efforts to achieve protectiveness with a lower environmental footprint. These efforts include:

- Developing technical documents highlighting greener cleanup best management practices;
- Creating footprint assessment tools such as the Spreadsheets for Environmental Footprint Analysis (SEFA);
- Collaborating with the broader cleanup community to develop ASTM's Standard Guide for Greener Cleanups.

The ***Social-Economic*** leg of sustainability has become integrated into our decision making as well as how we manage our cleanup programs by consideration of Environmental Justice issues at all of our sites.



ASTM Standard Guide for Greener Cleanups

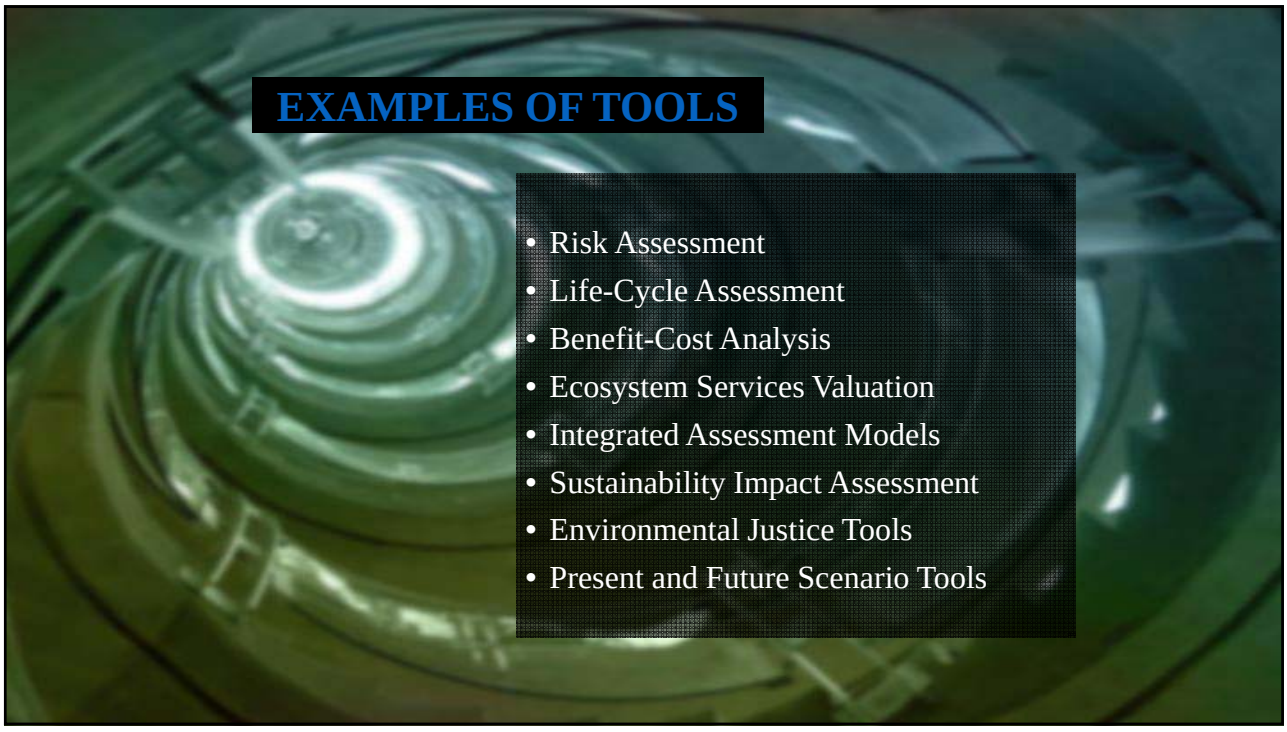
The ASTM Greener Cleanup Standard will help us to be mindful of our impacts, identify approaches that minimize the environmental footprint of our cleanups and advance OSWER's Greener Cleanup Principles.

Regarding green washing, protection of human health and the environment is our first priority. Greener cleanups are not intended to trade cleanup program objectives for other environmental objectives.

Successful greener cleanup practices will help achieve cleanup objectives by ensuring protectiveness while decreasing the environmental footprint of the cleanup itself.

ASTM Integrating Sustainable Objectives Into Cleanup

- Questions we have heard more than once since the release of the GC Standard Guide are: "Why is there a Greener Cleanups Standard and a Sustainability Standard?", and "What's the relationship between the two?"
- There is a perception that since EPA has not been more active in the development of the Sustainability Standard, the Agency only cares about the environmental considerations and less about the social and economic legs of sustainability.
- To be clear, we believe the triple bottom line sustainability concept is substantially woven into our cleanup programs. That said, we could do a better job communicating the holistic nature of sustainable practices in our cleanup programs.
- EPA recommends that we work together to ensure the communities where we conduct our cleanups understand how greener cleanups and sustainable use/reuse can be achieved, and how they can use existing channels to take part in the decision making process.



EPA Region 5 GC/Sustainability

- Land Revitalization Coordinator
- Greening Grants Workgroup
- Effort to make all contracts sustainable
- Financial Break-Even Point Calculator
- Continued involvement in ASTM Standard Guide for Greener Cleanups and Integrating Sustainable Objectives into Cleanups
- Trade-offs not well defined

QUESTIONS/SUGGESTIONS?

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Attachment 19
Sustainable Remediation Experiences

Sustainable Remediation Experiences

Sustainable Remediation Forum

Federal Remediation Technologies Roundtable
November 6, 2014

Michael E. Miller, CDM Smith, SURF
Brandt Butler, URS, SURF

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Order of Presentation

- Lessons Learned from SR Implementation
- Case Studies
  - Gilbert-Mosley
  - Oakland Army Base
  - Sustainable Return on Investment
- Conclusions: the Value of SR

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Lessons Learned from SR Implementation

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Successful Projects

- Cost **Savings** – New means to identify cost reductions
- SR underpins **planning** - Big projects with high visibility
- Site owner believes in SR **value** - Project to make a statement
- Sustainability in **organizational** decision making

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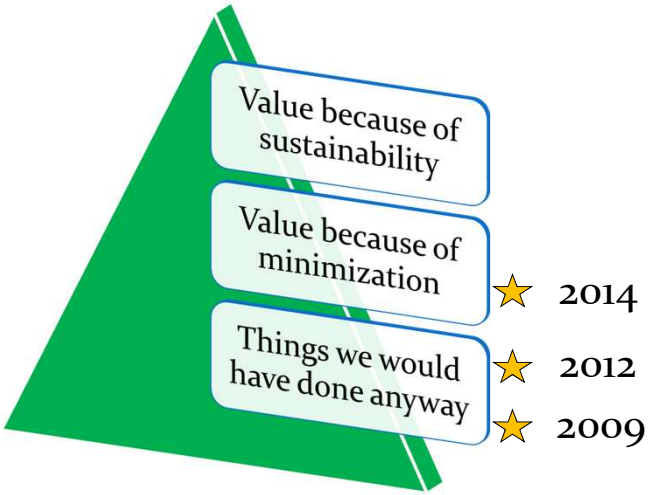
Early and Better SR Integration



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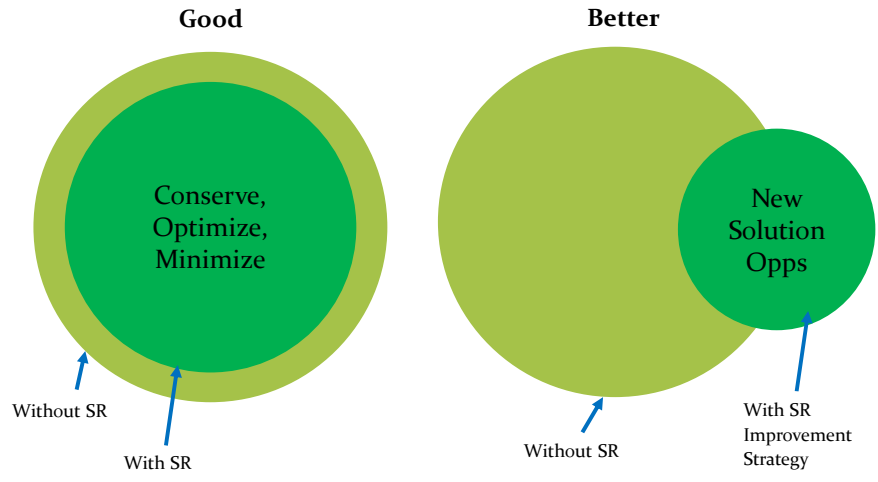
SR identifies new solution space



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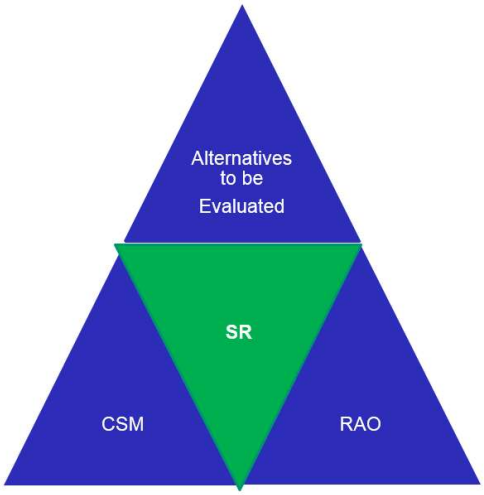
SR should underpin technologies and alternatives developed



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the corner of …

Gilbert & Mosley Streets

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Gilbert-Mosley

Project overview:

- 3,850-acre site in Wichita, Kansas
- Innovative approach to remediate contaminated groundwater
  - Chlorinated solvents
  - 4-mile long plume
- Protected public health, while promoting economic development

When SR considered:

- Before RI/FS

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Gilbert-Mosley

What was done:

- Collaborated with regulators to devise a preemptive voluntary cleanup approach
- Worked with the city to pursue:
  - Tax increment financing of remediation
  - Liability waivers for property owners
  - Property loans
  - Cost sharing formula with major PRP
- RI/FS
- Designed/constructed groundwater P&T
  - Treated water reuse

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Gilbert-Mosley

Estimated value derived:

- Risk-based approach → alternate cleanup levels
  - Reduced volume of groundwater requiring treatment by 40%
  - Saved ~$8 million
- Helped promote > $300 million in economic development through fast, aggressive cleanup

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Gilbert-Mosley

Estimated value derived (continued):

- Treatment building
  - Includes environmental education center
  - Reused treated groundwater for water features

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Oakland Army Base

OAB Redevelopment

Project Overview

- Former Oakland Army Base (OAB) decommissioned in 1999
  - ~7,000 jobs lost
- Public-Private partnership
- #1 priority from pre-development stage: social, economic, and environmental well-being of West Oakland residents
- Remediation initiated before and integrated with redevelopment

OAB Redevelopment

Pre-Planning

- Plans evaluated for:
  - Economic benefits to City/community, environmental impacts, and land use compatibility
  - All involved extensive trade-offs and public-private partnerships to fund infrastructure improvements
- Best land use → extension of Port services
- Local labor/employment rated as higher benefit than tax revenue

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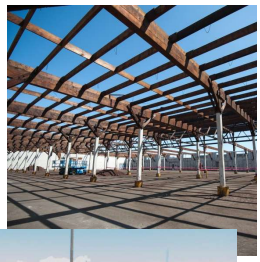
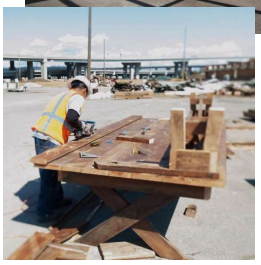
OAB Redevelopment

Sustainability + Redevelopment

- Long-term quality-of-life benefits
  - Recycling operations out of West Oakland
  - Divert truck operations to rail (↓ VMT/emissions, injury, cost)
  - Local labor, job training, "banned the box"
  - Conformance with City's ECAP
- RAP + RMP for construction/operations
- >600 compliance and mitigation measures
  - Major focus: **air quality**





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OAB Redevelopment

Transparency + Communication

- Air quality plans developed with broad stakeholder input (developer, City, Port, regulators, community)
- Web-based data portal for air monitoring results in near-real time
  - Interactive, easy-to-use maps and graphs
  - Basis for transparent and productive stakeholder discussions
- Quarterly meetings for reporting, feedback, and collaboration on future plans

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Sustainable Return on Investment

Landfill Mining Project

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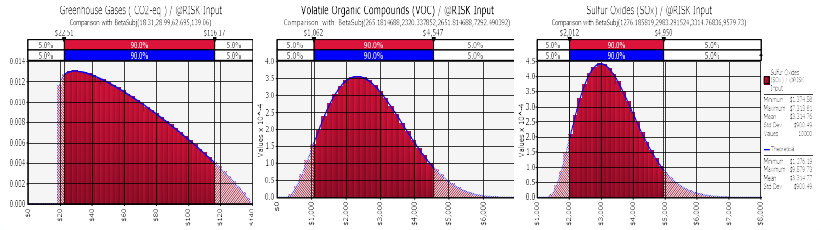
Social Damage Estimates

SOCIAL DAMAGE ESTIMATES - AIR EMISSIONS OF ENVIRONMENTAL EXTERNALITIES (2013$ per metric ton of air emissions)					
Pollutant	**Studies**	**Min**	**Median**	**Mean**	**Max**
Carbon Dioxide (CO2-eq)	5	$18	$29	$63	$139
Sulfur Oxide (SOx)	10	$1,276	$2,983	$3,315	$9,580
Particulate Matter (PM)	12	$1,575	$4,641	$7,127	$26,850
Volatile Organic Compounds (VOC)	5	$265	$2,320	$2,652	$7,292



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Sustainable Economics

Impact category	Incremental Impact (MT)	Value 2013$
Economic Benefit		$2,233,442
Climate change (CO2-eq)	14,426	$904,447
Particulate Matter Formation (PM)	(368)	($2,619,934)
Terrestrial acidification (SOx)	(10)	($32,830)
Photochemical oxidant formation (VOC)	(0.06)	($166)
	Net Benefit	**$484,959**
	FROI	**500%**
	sROI	**109%**

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sROI Summary

- Provides a more comprehensive picture of investments
- Translates social and environmental impacts into economic terms
- Includes an uncertainty analysis to demonstrate the likelihood of realizing costs and benefits
- Combines objective data and expert judgment
- Generates results that are defensible and transparent

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Conclusions

- Sustainable remediation best considered early and throughout project
- Social & economic benefits are reachable through environmental considerations
- Sustainable remediation provides broad and cost effective solutions
- sROI (environmental, economic, social) → single index

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Questions?

Additional Contributors:

- Paul Favara, CH2M Hill
- Maile Smith, Northgate Environmental Management
- Melissa Harclerode, CDM Smith
- Barbara Maco, Wactor & Wick
- Amanda McNally, AECOM

Practices demonstrated through case studies:

http://www.sustainableremediation.org/

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Attachment 20
Debrief: SustRem 2014 Conference

3rd International Conference on Sustainable Remediation – Ferrara, Italy

SURF 27 "Sustainability in Action"
University of Michigan, Ann Arbor, MI
November 12, 2014

Amanda D. McNally, P.E.
AECOM, Pittsburgh, PA
Secretary – 2014 Board of Trustees

Conference Background

- "The Sustainable Remediation Conference 2014 aims to stimulate international exchange by providing a venue for professionals and interested parties from multiple backgrounds to share experiences and perspectives on how contaminated sites can be remediated with a lower environmental footprint, and how their reuse can contribute to a more sustainable land development."
- Builds on the Green Remediation Conference (Copenhagen, November 2009), the 2nd International Conference on Sustainable Remediation (Vienna, November 2012)

Ferrara, Italy

- The intact historical center has been declared UNESCO World Heritage site as a remarkable example of Renaissance urban planning

Conference Themes

- Conceptual Framing
- Tools, metrics and Indicators
- "Greening" Remediation, eco-efficient Technologies and Opportunities from Synergy
- Case Studies
- Stakeholder Involvement and Participative Approaches

International SuRF Network & Partners

- Italy
- Canada
- Australia/ New Zealand
- Netherlands
- United Kingdom
- Brazil
- Taiwan
- United States

Workshops

- Implementing Remediies with a Lower Environmental Footprint: Recent Developments (Carlos Pachon, USEPA)
- The World of Café Nanoremediation: Hope or Fear from the Sustainability Perspective (Paul Bardos, R3 Environmental & Yevgeniya Tomkiv, NMBU)
- Sustainable Remediation and Redevelopment Case Studies State of the Art (Barbara Maco, Wactor & Wick, LLP)

USEPA Workshop

- Social leg is robust within USEPA programs – Guidance for Community Involvement in Superfund
- Expecting more work in Land & Ecosystems, including quantitative assessment of ecosystem services
- Options for implementation:
  - Best Management Practices (BMPs)
  - Footprint Methodology
  - ASTM Standard Guide for Greener Cleanups
- Footprint analyses are not meant for remedy comparison; rather to evaluate modifications to remedy (i.e., BMPs) to reduce footprint of most significant contributors
- May find inefficiencies you may not have otherwise identified through traditional analyses

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Case Study Workshop

- Suggested to carefully review case studies before to labeling as "sustainable"; do they consider the TBL?
- When citing social considerations, we should differentiate between regulator-required community involvement and external stakeholder engagement
- Does sustainability assessment provide **real** value to the decision?

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Key Country Themes

- UK
  - Focus on SuRF-UK Framework, which has influenced cleanup regulations
  - Focus on soil, redevelopment, and flexible cleanup objectives
- Netherlands
  - Quantitative "SCORE" tool incorporates CBA, risk, soil directives, and uncertainty
- Austria
  - Balancing risk and sustainability with use of CBA
- Belgium
  - Multi-criteria decision analysis integrating TBL used to facilitate property sale
- Taiwan
  - Sustainability is emerging; redevelopment is the driver due to land scarcity; resistance from site owners

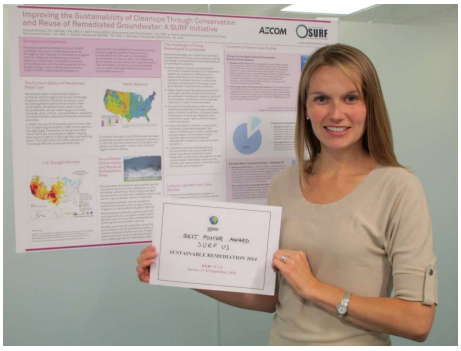
Key Country Themes, con't

- Italy
  - Emerging topic in decision making; working to integrate into regulatory process.
  - Keynote from Environment Ministry
  - Publication of white paper
- Canada
  - Regulatory and Federal participation; focus on sustainability
  - Currently working on a SR white paper
- Australia
  - Focus on redevelopment support and CBA
- Peru
  - Emerging

Major Takeaways

- Environmental footprint tools are well established
- Internationally, redevelopment and land use are drivers for sustainable remediation
- Widespread use of LCA for remediation
- Increasing interest in the social and economic aspects
- Incorporating worker safety into sustainability
- The need for case studies persists
- A case study sustainability rating system may be beneficial

Groundwater Reuse Poster



Voted Best Poster of the Conference

Kudos to the Groundwater Conservation and Reuse Technical Initiative Team!

Questions?