Sustainable Remediation Forum (SURF)
SURF 14: July 13 and 14, 2010
Fort Collins, Colorado

SURF 14 was held in Fort Collins, Colorado, on July 13 and 14, 2010, at Colorado State University—Home of the Rams. SURF members that participated in the two-day meeting are listed in Attachment 1 along with their contact information. The meeting marked the 14th time that various stakeholders in remediation—industry, government agencies, environmental groups, consultants, and academia—came together to develop the ability to use sustainability concepts in remedial decision-making. Previous meeting minutes are available at www.sustainableremediation.org.

Meeting Opening

The meeting began with Mike Rominger (meeting facilitator) welcoming members and thanking the staff of Colorado State University and SURF member Tom Sale (Colorado State University) for hosting the meeting.

Mike presented the mission statement of SURF as follows: "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, educating, and reaching out."

Mike discussed meeting logistics and ground rules. He also explained evacuation procedures from our meeting areas to ensure a safe meeting experience for all. Mike stated that it was assumed that nothing discussed or presented contained confidential information. He explained that export control laws that pertain to the transfer of technology to non-U.S. citizens and their countries do not appear to apply, but advised participants to act appropriately for their organizations. Mike read the following antitrust statement:

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

Efforts to achieve "sustainable neutral environmental behavior" continued at this meeting. Name tags and tent cards were reused. Many participants brought their own coffee mugs and water bottles and used public transportation to travel to the meeting location. Some participants reduced the carbon footprint caused by their travel by purchasing carbon offsets. Efforts to achieve sustainable neutral behavior are ongoing and will continue at future meetings.

Mike thanked the Meeting Design Team for their work in planning the meeting agenda and the current SURF sponsors for supporting the organization. Current gold sponsors are AECOM, Boeing, CH2M Hill, DuPont, and Waste Management. Current silver sponsors are Geosyntec Consultants and Terra Systems, and the current bronze sponsor is Langan Engineering. As a reminder, Gold ($5,000 or more), Silver ($2,500), and Bronze ($1,500) sponsorship opportunities are available. Members interested in sponsorship opportunities should contact Brandt Butler, SURF Treasurer (see Attachment 1 for contact information).

Host Welcome

Dave Ellis (SURF President) welcomed participants, thanked SURF 14's host, and noted that this meeting marked the second time that the group has met as a formal organization. Tom Sale (Colorado State University) thanked participants for coming and introduced Dr. Wade Troxel, Associate Dean of Engineering and Director of the Center for Networked Distributed Energy and RamLab. Dr. Troxel welcomed the SURF organization to Colorado State University and provided an overview of sustainability initiatives at the university.

Board of Trustees Activity Update

Dave Ellis (SURF President) provided the following summary of the Board's activities since the last meeting:

- SURF's current bank balance is $53,000. General liability insurance has been obtained, and a Directors and Officers policy was added to cover Board members. A formal audit system has been established, and auditors have been hired.
- Agreements with subcontractors have been signed for facilitation and technical writing services to support SURF meetings.
- SURF has 105 members. The Board set membership criteria as well as criteria for the student chapter.

As a reminder, detailed minutes from the Board of Trustees conference calls are available to members at www.sustainableremediation.org in the members-only portion under "Administrative Documents."

Dave ended his update by presenting a certificate to the first student chapter of SURF. Colorado State University student Kevin McCoy (Chapter President) accepted the certificate on behalf of the chapter.

The Board of Trustees gathered for a brief meeting on Day 2 at lunch. In the meeting, SURF approved a $500 donation to the CSU student chapter, and Terra Systems donated an additional $250 to the chapter as well. Kevin McCoy thanked SURF and Terra Systems for their generosity and said that the donations will go a long way to helping the chapter achieve its goals. Dave thanked Maile Smith (Northgate Environmental Management) for her contributions to SURF's progress. Maile is SURF's webmaster, Secretary, and a co-leader of the Communications and Outreach Committee.

Technical Presentations

Technical presentations at SURF 14 revolved around the meeting theme of sustainable remediation applications at real sites, with an emphasis on covering all three aspects of the triple bottom line (i.e., economic, social, and environmental). The presentations and subsequent discussions are summarized in the paragraphs below. Attachments 2 through 12 contain the presentation slides.

The Multiple Meanings of Sustainability: Values and the Triple Bottom Line

Michele Betsill (Colorado State University) provided a framework for understanding the multiple meanings of sustainability with a particular focus on the role of values in shaping

different perspectives. She defined weak and strong sustainability, with the latter requiring the differentiation of natural and human capital. In strong sustainability, humans are part of the ecological system, resulting in a much more holistic approach.

Michele discussed how different world views shape how people think about sustainability. She outlined the following four categories of people, representing a range of values on the sustainability spectrum: market liberals, institutionalists, social greens, and bioenvironmentalists. Market liberals believe that the starting point for environmental protection begins with the economy and emphasize technology, development, and faith in human ingenuity. Institutionalists create rules and regulations to drive the economy in a particular direction to make sustainability work. Social greens believe that the starting point for environmental protection is societal based and tend to see economic growth as a driver of change that results in environmental degradation and social inequality. Bioenvironmentalists emphasize the biological limits of the earth, believe that population growth is a key stressor on the global environment, and focus primarily on the ecosystem. Elements of all these values are represented in most sustainability discussions. Michele said that ultimately the search for a sustainable future must involve processes by which societies can confront and reconcile these competing values.

As SURF begins to create environmental indicators for sustainability, Michele recommended recognizing value judgments and reconciling competing values by including stakeholders in the discussion. Because sustainability is often context-dependent, Michele thought that one overall set of indicators is questionable. Although a common set of indicators would allow comparison, avoid greenwashing, and force accountability, it is also important to recognize the unique circumstances of individual projects and ensure that indicators are appropriate to the specific context. Presentation slides are provided in Attachment 2.

Discussions after the presentation focused on different aspects of communication and Michele's thoughts about the direction of sustainability. One SURF member asked how best to communicate the societal benefits of remediation, particularly when the remediation is contained within the fence line of an industrial plant. Michele said that the social aspect of sustainability has two dimensions: input and output. One metric for measuring input is stakeholder engagement, and one metric for measuring output is job creation. Michele said that stakeholder engagement can be gauged by asking questions about when stakeholders got involved, whether they participated, whether a credible process existed for speaking to people, and who determined the needs that would be met.

Another SURF member asked how people with the different worldviews communicate with each other. Michele described the interactions in detail, emphasizing that institutionalists tend to serve as the middle ground by creating systems, rules, and regulations to satisfy both the market liberals and social greens. She said that bioenvironmentalists are often outside of the political spectrums and are often not even participating in sustainability discussions.

When asked her thoughts about where sustainability is heading, Michele said that she believes that sustainability in our country will end up with a compromise between the values of the market liberals and the institutionalists. Michele said that, unlike Nordic countries who are successfully implementing the strong sustainability model, the U.S. does not have the infrastructure or political support to advance such a model and so the weak sustainability model is the more realistic outcome.

Addressing the Other Half of the Sustainability Challenge

Carl Hammordorfer (Colorado State University) discussed the Global Social and Sustainable Enterprise (GSSE), which is a MBA program that focuses on sustainability through entrepreneurship. Its partner organization, the Center for Advancement of Sustainable Enterprise, creates a framework for the success of social entrepreneurs and acts as a bridge between CSU research and commercial actors. Over the last three to five years, development has accelerated in Africa and Carl cited various references predicting continuing growth in the country. He described the approach of the program, with students forming Enterprise Teams and work on ventures that serve people and the planet while making a profit. Carl presented a remediation case study in Ethiopia that involved the use of biodigesters to make fuel from coffee leaf husks, which are currently discarded as waste as part of coffee manufacturing. Presentation slides are provided in Attachment 3.

Discussions revolved around the preparation that students undergo in the program and the influence and impacts that are being studied. Carl told members that *Cradle to Cradle: Remaking the Way We Make Things* by William McDonough and Michael Braungart is required reading as part of the program. He also said that the students learn about life cycle analysis and its applications. As a result, when students evaluate products, they look beyond cost and consider factors such as social return. Carl said that he has observed students weighing social impacts higher than economic considerations in the field.

The Role of Yellow Iron in Sustainable Remediation

Scott Denson (SunPro Services) explored the vantage of an environmental contractor, discussed field applications of sustainable remediation, and identified obstacles to achieving sustainable remediation. Throughout the presentation, Scott stressed the importance of collaborating with consultants on-site to maximize sustainability efforts – especially when on-site conditions change the original scope of work. In his experience, sustainable solutions generally cost equal to or less than the traditional approach. Scott said that the key to achieving this success is to take a comprehensive approach and work together. Although most request for proposals (RFPs) that his company receives do not include the concept of sustainability, Scott's company adds a section to address possible sustainability improvements that could be made. Scott ended his presentation by posing the following questions to the group about how to make sustainable remediation better:

- How do we get sustainable remediation into more RFPs?
- Can we have a more collaborative approach during the design phase?
- How can we open up the "confidentiality" of sites to bring sustainable alternatives to SURF?

Presentation slides are provided in Attachment 4.

After the presentation, part of the discussion focused on aspects of emission reduction and waste recycling. Scott acknowledged that his company receives many requests for biodiesel vehicles and retrofitted yellow iron equipment to decrease emissions, but said that they have only used it on a few projects because they focus on reducing fuel costs through planning. He also said that, in his experience, biodiesel vehicles and retrofitted equipment is used more frequently on federal sites. One member mentioned the possibility of reusing the waste that one industry generates as

a by-product for another industry. Scott agreed and cited an example from his presentation where the original Record of Decision (ROD) required a polymer to be used but native soil was used instead. Plants from an overgrown wetland area in another area of the site were used to create the new wetland. How do we get back to the willingness of the 1990s to be innovative in the approaches to sites?

Additional discussions focused on contractor accountability and possible rewards for implementing sustainability concepts. One member said that although it is important to encourage potentially responsible parties to incorporate sustainability at the proposal stage, it is equally important to ensure that sustainability efforts are implemented throughout the project life cycle. If a contractor meets the sustainability expectations outlined in the proposal, then a monetary bonus should be awarded. The member advocated some method of accountability to ensure that the concepts outlined in the proposal are applied.

Finally, the group seemed to agree that SURF's current membership lacks contractor representation. Scott suggested using consultant contacts to recruit contractor members.

Creation of a Sustainable Remediation Site Database

At the last meeting, Steven Murawski (Baker & McKenzie) asked for volunteers to help him explore the idea of creating an on-line Sustainable Remediation Site Clearinghouse. At this meeting, Steven gave members more detail about the idea and said that the proposed clearinghouse will allow users to conduct database searches of sustainability-related elements of remediation projects throughout the United States. Steven began his presentation by providing a brief background of the SURF white paper and the developing regional and national green and/or sustainable remediation policies of the United States Environmental Protection Agency (USEPA). Then, he discussed the key differences between the goals listed in the white paper and the USEPA's policies and said that the clearinghouse will use representative examples from the USEPA's Green Remediation web site. Steven ended the presentation with an outline of suggested next steps to complete this project. Presentation slides are provided in Attachment 5.

Discussions focused on how to fund this effort and other details. One member suggested soliciting funds from the Environmental Security Technology Certification Program (ESTCP) and/or the USEPA. Student chapter members could be recruited to do some of the work with the help of an individual with high-level database skills. Steven noted that if SURF could obtain both funding and buy-in from the USEPA, then the process may move more quickly. Another member asked whether coordinating with international SURF organizations is appropriate at this point. Steven recommended that SURF start off small (i.e., with only U.S. information), focusing on the USEPA green remediation projects that are available online, the case studies listed in the white paper, and information from current members. One member mentioned that the challenge in collecting the information will be that many of the case studies have occurred outside of the regulatory framework. All members seemed to agree that details such as funding and access would need to be discussed further and ultimately decided by the Board of Trustees. Potential action items were not discussed.

Remedial Process Optimization for Green Remediation

Rick Wice (Shaw Environmental & Infrastructure Group) presented a case study showing how remedial process optimization (RPO) is a tool for performing green remediation. The Air Force

Center for Engineering and the Environment (AFCEE) has developed RPO guidance to achieve timely and cost-effective site closures. (The Army and Navy have similar programs.) RPO helps reduce energy and materials use, and RPO principles can be used to help "green" a remediation project. At Air Force Plant 4, a large aircraft manufacturing facility in Ft. Worth, Texas, RPO was used to reevaluate a pump-and-treat system for a large trichloroethylene plume. Improvements included replacing an energy and maintenance intensive acid mix system with an in-line metering mixer; fixing water supply leaks that allowed reducing operations to five days a week instead of seven; and reducing the amount of pumps, sampling frequency, and amount of analytical parameters. In addition, a 1,100-foot permeable reactive barrier was emplaced to replace another pump-and-treat system that was operating at 200 gallons per minute. The system was dismantled, the equipment recycled or scrapped, and the land released for development as a golf course. Presentation slides are provided in Attachment 6.

After the presentation, some members asked Rick technical questions about the project for clarification. One member commented that it is helpful to obtain the input of energy experts to ensure a critical review from a sustainability perspective. In his experience, individuals with knowledge and expertise in the energy field help remediation professionals see the bigger picture. Finally, another member commented that when cleanup work was initiated at this site other technologies besides pump and treat were not available—technology development has responded to the needs of the remediation industry.

Improving the Sustainability of Source Removal

Ralph Baker (TerraTherm) presented a case study of a third-party LCA that was conducted at a site contaminated with dense, nonaqueous phase liquid (DNAPL) in a residential neighborhood (including a graveyard) in Reerslev, Denmark. One objective of the effort was to protect one of the major municipal water supply well fields serving Copenhagen. The LCA compared the following remedial options and technologies: cutting off the hot spot from the plume using soil vapor extraction (SVE), excavating the impacted material and treating and disposing of it off-site, and treating the contamination in place with in situ thermal desorption (ISTD). The LCA selected ISTD as the most preferable alternative because it reduced the neighborhood impacts (i.e., no need to move families or demolish homes) and resulted in the least overall environmental and economic impacts. The LCA concluded that SVE would consume more energy, produce more waste, and generate more greenhouse gases than ISTD while requiring an indefinite period of time (over 100 years) to remove sufficient contaminant mass to achieve site closure. Whether or not excavation and off-site disposal or treatment compared well with ISTD depended primarily on the transport distance to a suitable disposal or treatment site. Ralph described the implementation of ISTD at the site, which involved the treatment of 12,560 cubic meters of contaminated soil. The treatment proved to be even more sustainable than estimated in the LCA, showing that thermal treatment can be sustainable. Presentation slides are provided in Attachment 7.

After his presentation, Ralph answered specific questions about the technical aspects of the case study. One member asked if Ralph could account for the discrepancy between the actual results and the LCA results. Ralph attributed the differences to the conservative nature of the LCA, particularly uncertainties that the LCA authors had regarding the heating period for treatment. Although the thermal designers felt comfortable with the timeframe, more conservative numbers (i.e., longer treatment times) were used in the LCA. Another member asked why the LCA

projected the SVE system operation at 30 to 100 years when most of the mass removal occurred initially. Ralph responded that, due to diffusion-limited mass transport associated with SVE applied to treat low permeability (i.e., moist till in this case), it was recognized that the SVE would soon reach asymptotic extracted vapor concentrations without removing much of the mass. Therefore, the system would have to operate indefinitely to be protective.

Another member asked Ralph to describe some of the challenges associated with performing this work in a residential area. Ralph said that during work, residents needed to be excluded from the thermal well fields and subslab ventilation systems were installed as well. Some heat was felt in the homes, but because it was wintertime the warmth was considered a benefit. Ralph reiterated that qualitative considerations weighed heavily into decision to use ISTD as the remedy. With a graveyard nearby, the neighborhood believed that this approach was the most ethically acceptable vs. the other methods. Ultimately, the neighborhood agreed to moving the graves, treating the contamination, and putting the graves back.

Status and Direction of Alpha Student Chapter of SURF

In the spring of 2010, student initiatives led to Colorado State University recognizing SURF as an official student organization. Kevin McCoy (Student Chapter President) and Tom Sale (Colorado State University) presented the current plans for the student organization and solicited input from the parent organization regarding the mission of the student chapter and future collaborations with SURF. The goal of the chapter is to "provide a student organization that facilitates the independent growth and knowledge sharing among students interested in sustainable environmental practices." The student chapter welcomes students from all backgrounds and departments and plans on trying to expand their membership to other disciplines besides engineering and geosciences. The idea is to get students from different disciplines to work together now so that moving forward there is a solid integrated base of professionals working toward the common goal of sustainable remediation. The chapter will hold regular meetings and hopes to have guest speakers (e.g., local or visiting faculty, professionals) at these meetings. In addition, a field trip to a local sustainably remediated site is planned. Student chapter members were introduced as follows: Kevin McCoy (President), Sonja Koldewyn (Vice President), Anne Maurer (Treasurer), Zachariah Seiden (Secretary), Mitchell Olson, Dustin Krajewski, Natalie Ziemen, and Jonathon Pink. Presentation slides are provided in Attachment 8.

After introducing the members of the student chapter, Kevin initiated an open discussion between SURF and student members to discuss chapter growth, SURF interaction with the student chapter, and the development of student chapters at other schools. Students initiated the discussion by stating their ideas of how SURF members can help the student chapter. Ideas ranged from leveraging students' sweat equity on various initiatives to developing and sponsoring a design competition among student chapters to providing internships. Additional discussions among SURF members revolved around awards for research projects, obtaining speakers for meetings, and matching students to members' expertise and experience as a way to initiate mentorships. All members seemed to agree that the next immediate step is to continue communications between SURF and the student chapter, stressing that the conversations between these two groups cannot end after the meeting.

Another SURF member stressed the importance of students capitalizing on their location within an academic institution. As a first step, he encouraged students to reach out to other fields by

contacting the individuals from Colorado State University who presented at the meeting. He urged students to talk to their friends pursuing other fields and get them involved in their chapter. Another member recommended that students try to integrate LCA into the curriculum or hold a one- or two-day class on LCA to help educate students about this area. Purchasing LCA software and subscribing to professional magazines were also discussed as viable options of helping the learning curve.

Reevaluation of a Record of Decision Using Sustainability Tools

Dave Ellis (DuPont) presented a case study where a sustainability analysis was performed, resulting in a change to the selected remedy and ROD. Dave gave the background of the Bell Landfill, which is a Superfund site located in northeastern Pennsylvania that contains mixed municipal and industrial waste. The original remedy specified a soil cap with a leachate collection system. The tank trucks that collected the leachate and transported it to a publically owned treatment works (POTW) for treatment caused several problems (e.g., noise and disturbance for neighbors, severe rutting of unpaved roads during wet periods). Over time, the leachate composition changed to the point where it no longer contained organic contaminants. After a sustainability analysis, a spray irrigation system was proposed in lieu of trucking the leachate for treatment. Following laboratory and field testing, the system was approved by the state and USEPA Region 3. An Explanation of Significant Difference (ESD) was issued, and the spray irrigation system began operation in 2009. A side benefit is that the vegetation on the cap no longer dies during the summers. Presentation slides are provided in Attachment 9.

After the presentation, some members asked Dave technical questions about the project for clarification. One member asked if methane release off of the pond that was built to hold leachate during the winter months had been considered as part of the greenhouse gas calculation. Dave responded that methane was not considered, but that it should be included in projects moving forward. Another member asked who developed the criteria for the alternatives analysis. Dave said that DuPont developed the criteria and received agreement from the agency on the criteria.

Case Study Using an Economic Model to Estimate Cross-Media Pollution

Maile Smith (Northgate Environmental Management) presented a simulation model as part of a comprehensive evaluation of the benefits, costs, and impacts of groundwater remediation programs for federal Superfund projects in the San Francisco Bay Area. The objective was to model the cross-media impacts and assess the efficiency of Superfund cleanup programs by comparing input and output in terms of cost, estimating direct and indirect pollution, comparing environmental benefits vs. impacts, estimating direct carbon dioxide and groundwater impacts, and assessing health risk due to vehicle travel. The team selected the sites; gathered data; tabulated capital and annual costs; categorized goods and services; simulated economic impacts, air emissions, and wastewater discharges; evaluated groundwater extraction and mass removal rates; and estimated carbon dioxide emissions. Maile's presentation focused on the model, which is based on the IMPLAN® commercial computer software model with associated Social Accounting Matrix. The following three different scenarios were modeled: as installed, optimized, and monitoring only. Maile said that the study results indicate that Superfund site remediation directly and indirectly increases the economic output of the San Francisco Bay area and California. In addition, the pump-and-treat remediation programs result in a net increase in

pollution. Additional conclusions and recommendations based on the study were presented and are provided on the presentation slides (see Attachment 10).

Much of the discussion following Maile's presentation focused on the level of difficulty of applying the model. While Maile agreed that there was a learning curve associated with the jargon and acronyms, she said that she believed that most people would be able to use this mathematical model. If modifying the model was necessary or desired, additional expertise may be required. Maile described the process as a "steep but short learning curve," stressing that the data collection proved to be the most onerous task. It was difficult to find the right person to contact about various data because all of the information and contacts are not provided on the USEPA's Superfund web site.

Working Toward Global Change from Inside the University

Morgan DeFoort (Colorado State University) reviewed the progress on the following three technologies: emissions reduction for the U.S. natural gas pipeline system, clean cookstoves and two-stroke engine retrofits for the developing world, and algae-based biofuels. As co-director of the Engines and Energy Conversion laboratory, Morgan discussed the tailoring of the large-scale dissemination models for each application. This entrepreneurial approach to global impact is now being implemented more widely at the university through campus-wide research organizations such as the Clean Energy Supercluster and through academic programs such as the Global Social and Sustainable Enterprise program in the College of Business. Presentation slides are provided in Attachment 11.

Discussions focused on technical questions about the cookstoves and biofuels. (see below).

- Cookstoves
  In response to questions, Morgan said that the cookstove solves the smoke problem by limiting the air and controlling the draw of air and heat transfer efficiency. The goal is to observe a 90% reduction in smoke; the current reduction is about 60%.
- Biofuels
  Questions revolved around the quantity and use of water. Morgan said that water is recycled in bags and that approximately 10,000 gallons of water is used per gallon of soy biodiesel. Solix uses a few gallons of water per gallon of biodiesel because it is a closed system (except for the water trough) and can use brackish water (i.e., processed water from a plant). Morgan noted that the system also works well offshore, with floating bags in the ocean. Morgan said that he has seen very few technologies that can scale to the point that they can supply all of the liquid fuels that the U.S. needs while being produced domestically.

  When asked about the tradeoff between agriculture and fuel, Morgan stressed the need for a secure source of fuel and food. He said that it's best not to establish a competing environment for these items.

Current Remediation Research at Colorado State University

Tom Sale (Colorado State University) presented an overview of the current remediation research at the university in the areas of in situ soil mixing; electrolytic reactive barriers; use of tracers in light, nonaqueous phase liquid (LNAPL); measuring natural attenuation rates of LNAPL; sheen

formation processes in porous media; use of waste heat to accelerate natural attenuation; computation chemistry to evaluate the fate of persistent contaminants; and tools for selecting site remedies. Presentation slides are provided in Attachment 12.

Discussions focused on the university's work on the 14 Compartment Model for remedy selection. One member mentioned that ASTM finalized a remedy selection guide that discusses some of the same topics as the 14 Compartment Model. He expressed optimism at the consensus that seems to be emerging. Another member asked how the model (and its holistic aspects) could be applied on a typical industrial site where cleanup levels and on-site containment are the norm. Tom emphasized an approach that brings all stakeholders together to discuss opportunities that provide greater social value.

Breakout Sessions

At the meeting, the following groups met: Communications and Outreach Committee, Academic Outreach and Government Employees Outreach Initiatives, Meetings and Program Committee, and the Technical Initiatives Committee. The Technical Initiatives Committee includes the Framework, Parameters and Metrics, and Life Cycle Assessment (LCA) Process Initiatives. Mike Rominger (meeting facilitator) challenged the groups to think about the following questions:

1. What is the next best step for the sustainable remediation database concept?
2. What are your achievements to date?
3. What are the future plans for your group?
4. How can the broader SURF membership help?

A summary of the key action items of the groups is provided below. More detailed information associated with the breakout sessions for each group are provided in Attachment 13. SURF members interested in joining a particular effort should contact the co-chairperson listed in the summaries below.

Communications and Outreach Committee

Jake Torrens (Committee Co-Chair) reported on the progress of the committee. The group began by discussing SURF's outreach effort at Battelle. Although the group thought that the location of the SURF table at Battelle was less than optimal, they acknowledged that people did come by and learn about SURF. Ten individuals joined SURF at the conference. Feedback from Battelle indicated that the sustainability track went well. Some individuals believed that the case for sustainability was not well made in several instances, but also acknowledged that demonstrations of sustainability will continue to improve over time.

Jake presented the group's finalized mission statement as follows: "To provide a unified and consistent message, internally and externally, for effectively communicating SURF's objectives, activities, and future goals." A list of specific tasks performed by the committee is provided in Attachment 13.

Additional topics and action items discussed by the committee are as follows (a more detailed list is provided in Attachment 13):

- SURF Outreach Presentations
  Version 1 of the PowerPoint presentation "Who Is SURF?" is complete. Jake reminded members that both the short and long versions of the presentation are available on the web site in the members-only portion under "Working Files, Communications and Outreach." Members are encouraged to use these standard presentations as a starting point when giving presentations about SURF. Members should let the committee know if they are making presentations about SURF. Upcoming presentations at publicly accessible conferences and events will be posted to the existing sustainable remediation event calendar. In addition, the committee will keep an eye out for conflicts or redundancies if multiple SURF members are presenting on the same topics or at the same events.

- SURF Facebook and LinkedIn Pages
  The committee will test a SURF page on Facebook and LinkedIn consisting of a link to the SURF web site and mission statement. Jake said that the hope is that Facebook will help reach potential student members, and LinkedIn will help reach professionals in a variety of disciplines. Maile Smith (Committee Co-Chair) will track the traffic to determine the pages' effectiveness.

- New Member Outreach
  The committee discussed ways to increase membership. The group plans to follow up with those individuals who have not yet joined SURF but have participated in the past or shown interest in joining. In addition, the group discussed creating a quarterly electronic newsletter containing a President's Note, highlighting different conferences, and detailing a case study. The newsletter could be sent to other organizations' distribution lists as a way to obtain new members. One member responded with caution, stating that some organizations' distribution lists contain over 150,000 people. Jake acknowledged that it would be necessary to work with the organization to identify the most appropriate listing of names.

Finally, Maile reminded meeting participants to complete the SURF Satisfaction Survey initiated by this committee. Results from the survey will be reported to membership.

The Academic Outreach and Government Employees Outreach Initiatives fall under the purview of the Communications and Outreach Committee. Brief summaries of the breakout discussions of these groups are provided below. Detailed notes are provided in Attachment 13.

- Academic Outreach Initiative
  Mike Miller (Initiative Chair) reported on the group's discussions regarding the possibility of a sustainable remediation database. The group agreed that the long-term objective of the database would be to demonstrate the value of sustainable remediation to the regulatory community and provide a resource for sustainable remediation practitioners. If the project were to move forward, funding would be necessary and might be achieved in part through academic partnering. Student chapter members expressed interest in the database and thought it was a way to facilitate the interaction between student chapters and SURF. The group recommended that the first steps in determining the feasibility of such a project would

be the development of a plan. If the project were to move forward, the group discussed the need for a template for database entries and links to legal documents, work plans, and results. After Mike finished his report, Board of Trustees members reiterated that it has not been decided whether SURF will proceed with the project. Mike agreed. Potential action items were not discussed.

Mike told members that the group had developed the following mission statement: to encourage academic participation in SURF as a means to promote the organization, establish linkages, and foster research and innovation.

Stewart Abrams (Initiative Scribe) reported on the group's discussions regarding a "letter of support" for research. This idea was conceived during the initiative's breakout session at SURF 13 and was further developed during an initiative conference call before the meeting. Stewart then developed a draft policy for supporting research proposals. Board of Trustees members indicated that, on a prior Board conference call, the Board had generally agreed that SURF was not currently in the position to provide letters of support. In addition, the Board had agreed that perhaps individual SURF members could be provided the opportunity to provide letters of support if they so wished. The Board acknowledged that this message was not communicated to the appropriate individuals and that followup communication after conference calls is paramount. In later discussions, Board members suggested that they might entertain a formal presentation of this proposal during an upcoming Board meeting. It was agreed that SURF needed to be involved in the research arena is some way, and the committee was challenged to come up with new or additional ideas.

- Government Employees Outreach Initiative
  Kurt Beil (Initiative Scribe) reported on the group's discussions regarding two fundamental issues: (1) funding restrictions on government employees that limit travel and hinder in-person attendance at SURF meetings and (2) misperceptions regarding both government employee participation in SURF and SURF's mission (i.e., greenwashing in disguise). To overcome these obstacles, the group agreed that it is necessary to have honest and open discussions with government employees about sustainable remediation. As a starting point, the group discussed developing a sustainable remediation webinar and presenting it to a small group of state agency personnel and former government SURF participants for their feedback. The feedback would be used to help define the scope of the webinar so that the content addresses some of the interests and concerns of government employees. Ideally, a government employee or academic would lead the webinar and case studies from government employees and others would be included. Kurt said that initiative members agreed to biweekly meetings to ensure continued progress between SURF meetings.

Meetings and Programs Committee

Dave Ellis (Committee Co-Chair) reported on the progress of the committee. Since the last meeting, the committee developed a survey, distributed it to members, and compiled the responses. Based on the results, the committee is tentatively planning on three meetings per year

(with the knowledge that most members would attend two out of three meetings in person). Results indicated a strong preference for meetings that spanned two full days (vs. the shortened second day that has been customary to date). Survey respondents appreciated rotating the meeting locations geographically. One member suggested holding the meetings in the same locations every year on the same approximate dates so that members can plan (i.e., scheduling and budgetary purposes) and so that the time spent on meeting logistics is streamlined. Dave said that feedback has indicated that Chicago and Sacramento stand out as favorite meeting locations. He also said that survey respondents indicated a strong desire to try to coordinate a SURF meeting with another meeting. In fact, respondents were in favor (by a five to one margin) of holding one 2011 meeting in Reno, Nevada to coordinate with the Battelle meeting. It was noted that because the Battelle meeting extends over four days, it may be necessary for SURF members to remain in Nevada over a weekend in order to attend a potential SURF meeting. Regardless, all seemed to agree that selecting a location should include criteria such as excellent public transportation and facilities with advanced technology. One member suggested that SURF obtain remote air cards for wireless internet access so that SURF does not have to rely on the facility for this need.

In the future, Dave said that the committee hopes to achieve a six-month lead time for selecting meeting locations. He said that the Pacific Northwest may be one possible location for a meeting in early 2011.

Technical Initiatives Committee

The technical initiatives addressing Framework, Parameters and Metrics, and the LCA Process are included under the Technical Initiatives Committee. Brief summaries of the breakout discussions of these groups are provided below. Detailed notes are provided in Attachment 13.

- Framework
  Karin Holland (Initiative Chair) reported on the group's discussions regarding the draft framework. The framework is designed to encompass all phases of the remediation life cycle. A tiered sustainability evaluation, similar to that being devised for the ASTM framework but without the detail, is proposed for the different phases. Following the implementation of the sustainability evaluation, the results may be used to revise the conceptual site model. After some discussion and with the benefit of face-to-face interactions, the group decided that the draft framework looked too linear. Instead, they proposed a spiral that begins in the middle and extends outward (see Attachment 13). The group reached consensus on the diagram and is prepared to begin writing the SURF sustainable remediation framework document. One member commented that risk-based decision making is getting lost because the framework considers only sustainability. He said that the group needs to include the concept that risk-based decision making is an evolution of this framework. Karin said that this issue will be addressed in the framework document and that the document will be aligned with existing regulatory requirements.

- Parameters and Metrics
  Brandt Butler (Initiative Chair) reported on the group's discussions regarding parameters and metrics. The group is identifying each phase of the remedial action process, determining the considerations of each phase, and proposing metrics that could be considered. Brandt stressed that the group is taking a smorgasbord approach

rather than a proscriptive approach. The goal is for the remediation practitioner to determine which metrics are appropriate for a particular project. The group is including the set of metrics developed by SuRF-UK for the triple bottom line. Brandt said that the group discussed creating a database of the information and making it available online through SURF's web site. After some discussion by members, it was recommended that the Board decide whether the information would be placed in the members-only portion of the web site or in the public portion for all to access.

- LCA Process
  Paul Favara (Initiative Chair) reported on the group's progress during the breakout session. Paul said that the goal of the group is to develop a preeminent process for individuals performing impact assessments. The group's approach takes the current ISO standards and distills it so it can be applied to impact assessments. The process would be communicated via a white paper in a technical journal. The methodology proposed in the document will be flexible so that the misperception of excessive required training and high costs associated with LCA will be eliminated. Paul outlined an aggressive schedule, with a final draft of the document expected in September. Some members expressed that a one-week window for SURF member review was insufficient. Additional discussions focused on other anticipated deliverables and the need for a formal review process. All seemed to agree that the Board of Trustees should develop a uniform approach to peer and membership review for deliverables and communicate the approach to initiative groups and members.

  After Paul's presentation, the group discussed tool comparisons. A few members mentioned their participation in studies comparing tools. Members stressed the need to share information with each other to help advance the practice. After some discussion about the risks of association with tool comparisons, members seemed to agree that SURF is not recommending specific tools. Paul said that comparisons are designed to show that all tools could be used, outlining the strengths and appropriate applications for the tools evaluated. SURF stresses the importance of the practitioner lending his/her expertise to select a particular tool.

Action Items

The following action items were identified during the meeting:

1. SURF 15 will be held October 5 and 6, 2010 at Carnegie Mellon University in Pittsburgh, Pennsylvania. Additional details will be posted on the web site. Volunteers for helping plan the meeting are as follows: Stewart Abrams, Ray Lewis, Mike Miller, Dick Raymond, Matt Spurlin, Jake Torrens, Rick Wice, and Dave Woodward. SURF members who would like to participate in the Meetings and Programs Committee should contact Dave Ellis.
2. The work of the committees and initiatives will continue. All scheduled conference calls for the various committees and initiatives are shown on a calendar on the web site. The calendar is located on the members-only portion of the SURF web site under "Member Resources, Committee Calendar." SURF members interested in joining a particular effort should contact the co-chairperson directly.

3. The following action items were mentioned as appropriate for the Board of Trustees to address: (1) recommend a uniform approach to peer and membership review of expected deliverables from initiatives, and (2) determine whether the information stemming from the work of the Parameters and Metrics Initiative should be placed in the members-only portion of the web site or in the public portion for all to access.

Attachment 1
SURF 14 Participant Contact Information

SURF 14 Participant Contact Information

Participant	Affiliation
Abrams, Stewart	Langan Engineering & Environmental Services
Adams, Kathy	Writing Unlimited
Andrews, Matt	Portolan Solutions
Armstead, Robert	WRS Compass
Baker, Ralph	TerraTherm
Beil, Kurt	ARCADIS
Bhargava, Mohit	Battelle Environmental Restoration
Bull, Louis	Waste Management
Butler, Brandt	URS Corporation
Claypool, John	AECOM Environment
Denson, Scott	Sunpro Services
Deutsch, Paul	AMEC Geomatrix
Ellis, Dave	DuPont
Favara, Paul	CH2M Hill
Fiorenza, Stephanie	BP
Fisher, Angela	GE Global Research
Foster, Ben	ARCADIS
Garson, Nick	Boeing Company
Hamilton, Lisa	General Electric
Hawthorne, Jayme	BP (intern)
Holland, Karin	Haley & Aldrich
Koldewyn, Sonja	Colorado State University Student Chapter
Krajewski, Dustin	AECOM and Colorado State University Student Chapter
Lewis, Ray	Sunpro Services
Lovenburg, John	CH2M Hill
Marotte, Rick	MACTEC Engineering and Consulting
Martin, Todd	Integral Consulting, Inc.
Maurer, Anne	Colorado State University Student Chapter
McCoy, Kevin	Colorado State University Student Chapter
Miller, Mike	CDM
Murawski, Steven	Baker & McKenzie
Olson, Mitchell	Colorado State University Student Chapter
Pink, Jonathon	Colorado State University Student Chapter
Raymond, Dick	Terra Systems
Reeter, Charles	U.S. Navy - NAVFAC Engineering Service Center
Rominger, Mike	MCR Facilitation Services
Sale, Tom	Colorado State University
Seiden, Zachariah	Colorado State University Student Chapter
Smith, Maile	Northgate Environmental Management
Spurlin, Matt	ARCADIS
Stanley, Curt	Shell Global Solutions
Taege, Deborah	Boeing Company
Thomson, Michelle	DuPont
Tollin, Shawn	FMC Corporation

SURF 14 Participant Contact Information

Participant	Affiliation
Torrens, Jake	AMEC Geomatrix
Truxell, Wade	Colorado State University
Unrue, David	Microseeps, Inc.
Wice, Rick	Shaw Environmental & Infrastructure Group
Woodward, Dave	AECOM Environment
Zemen, Natalie	Colorado State University Student Chapter
Remote Attendees	
Baker, Carol	Chevron Energy Technology Company
Larsen-Hallock, Lorraine	California Dept. of Toxic Substances & Control

Attachment 2
The Multiple Meanings of Sustainability: Values and the Triple Bottom Line

http://sketchcountry.com/2010/01/05/

The Multiple Meanings of Sustainability: Values and the triple bottom-line

Michele M. Betsill
Associate Professor of Political Science
Colorado State University

Presentation to the SURF 14 Conference, 13 July 2010

POLITICS

"who gets what, when, and how"

What is an acceptable level of risk that society is willing to incur?

What role should science play in decision-making?

How do we manage risks posed by environmental problems?

Who should bear the economic costs of addressing environmental problems?

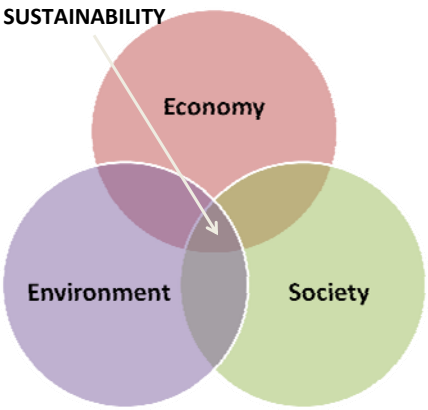
How can we balance risks from environmental degradation with other pressing problems?

What is a "fair" approach to addressing environmental problems?

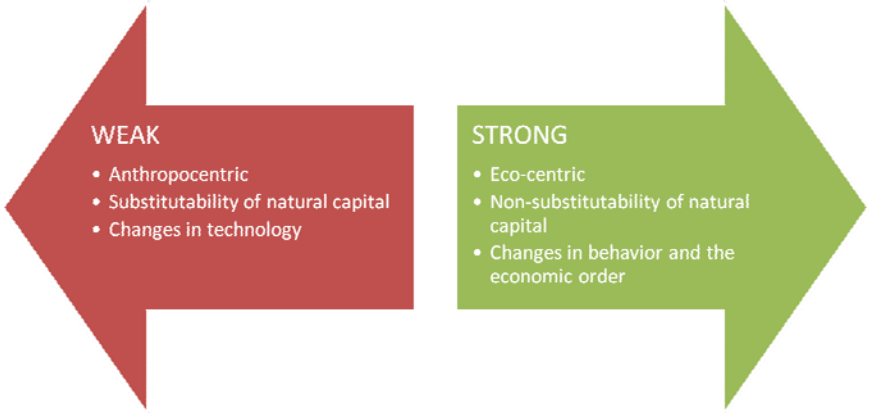
What role should the market play in providing incentives to protect the environment?

Defining Sustainability

- *Meeting the needs of present generations without compromising the ability of **future generations** to meet their needs* (Brundtland Commission, 1987)
- Balancing the relationship between the **economy**, **environment** and **society**

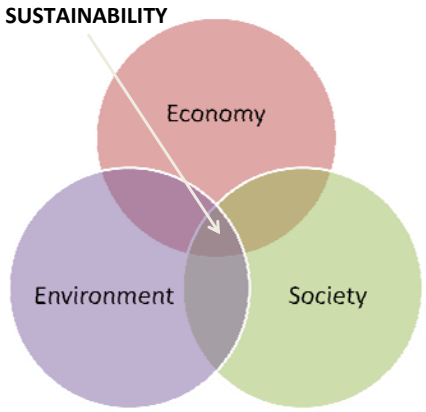


Weak vs. Strong Sustainability

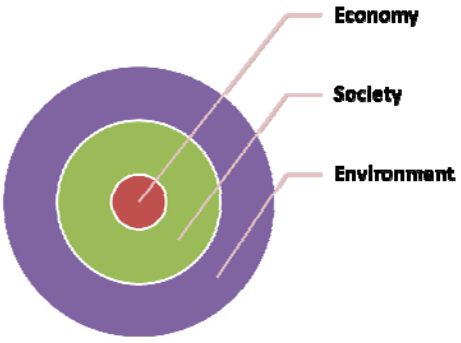


Weak vs. Strong Sustainability

Weak Sustainability



Strong Sustainability



Worldviews and Sustainability

(Clapp and Dauvergne 2005)

Market Liberals

- Economic growth as a positive force for environmental protection
- Reject idea of “environmental crisis”
- Faith in science and technology to help address environmental problems
- Importance of open markets to promote economic growth and technology development

Institutionalists

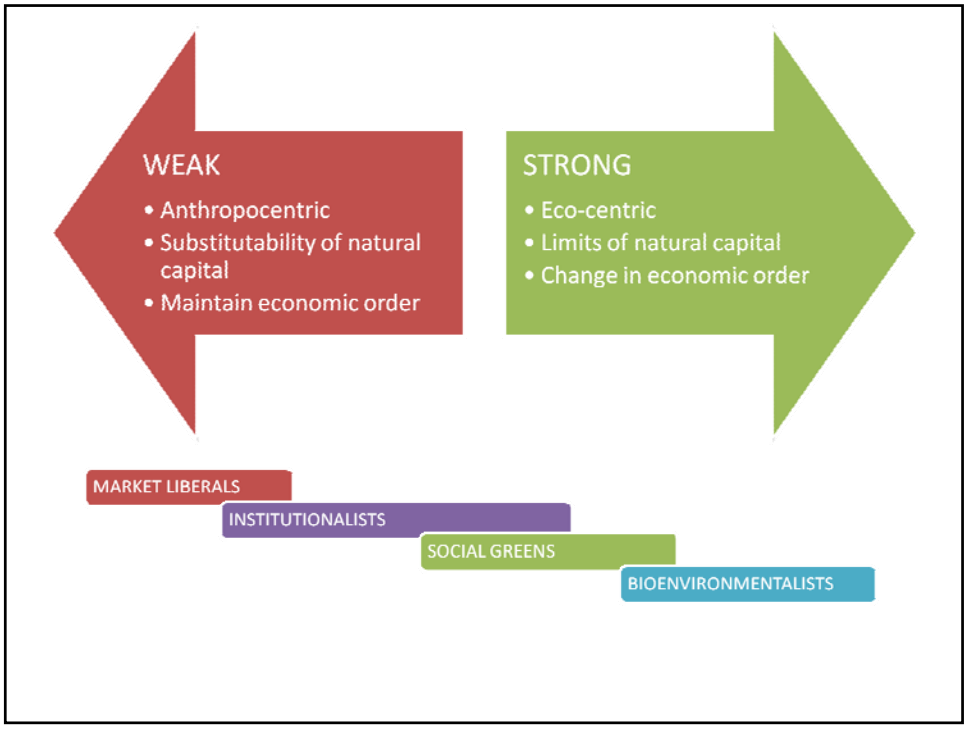
- Economic growth important but needs to be managed to ensure environmental protection
- Optimistic about the ability of society to address environmental problems
- Faith in science and technology
- Institutions can guide economic activity toward social and environmental goals

Social Greens

- Social and environmental problem inseparable
- Global capitalism destructive
- Skepticism of technology
- Physical limits to economic growth
- Dismantle the global economic structure and return to local autonomy

Bioenvironmentalists

- Emphasize limits to Earth's carrying capacity (biological limits)
- Challenge notion of infinite economic growth
- Technology as a driver of degradation
- Population growth a key stressor on the global environment


WEAK
• Anthropocentric
• Substitutability of natural capital
• Maintain economic order
STRONG
• Eco-centric
• Limits of natural capital
• Change in economic order
MARKET LIBERALS
INSTITUTIONALISTS
SOCIAL GREENS
BIOENVIRONMENTALISTS

Attachment 3
Addressing the Other Half of the Sustainability Challenge

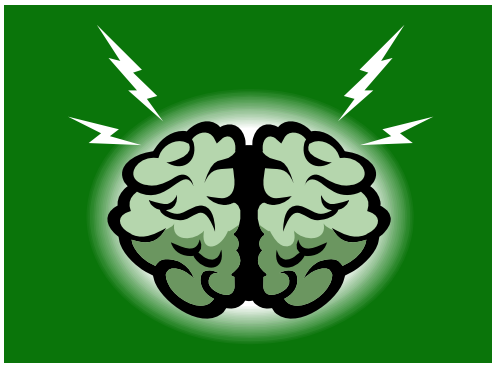
Colorado State University

Carl Hammerdorfer, Director
Hammerdorfer@gmail.com

Colorado State University

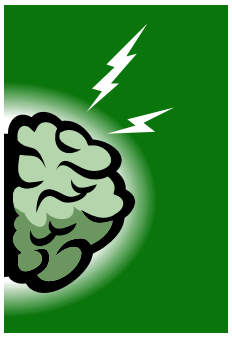
The GSSE is a Masters of Business Administration (MBA) that prepares a new generation of entrepreneurs to leverage research, technology and business know-how to create, build and grow sustainable enterprises with lasting impact.

Where is Sustainability Going?



Climate / Renewable / ENV

- CoC says 'no' to C.C.
- Walmart, GE, et al.
- Think Green
- Think Clean
- Think Integrated
- Think Global



Wal-Mart sustainability scorecard

15%	based on Greenhouse Gas (GHG)/CO2 per ton of Production
15%	based on Material Value
15%	based on Product/Package Ratio
15%	based on Cube Utilization
10%	based on Transportation
10%	based on Recycled Content
10%	based on Recovery Value
5%	based on Renewable Energy
5%	based on Innovation

From WM's 2009 annual report :

Our U.S. logistics team saved almost $200 million last year through productivity and fuel-efficiency programs. These initiatives not only saved money, but also improved energy usage and reduced our emissions. Equally as important, they are now a permanent part of our transportation program.

Fine Print from the officer/director section on financial results, linking bottom line directly to sustainability efforts when speaking to the financial analysts reading the report :

"Membership and other income as a percentage of net sales for fiscal year 2008 increased compared to the prior year due to continued growth in our financial services area and in recycling income resulting from our sustainability efforts."

"We need an honest bottom line. Today that bottom line is vastly subsidized. If anyone of us were paying the full cost of oil our bottom lines would be very different. If you internalize the cost of oil, look at the cost of the war in the Middle East or the cost of global warming for future generations, if you internalize those external costs and what you pay, that bottom line would look very different, what ever business you are in. If we somehow put a value on species extinction and factor that into our costs that bottom line would look very different. IF we put any resource depletion into costs our bottom line would change. So what we have is a dishonest market that does not take into account all the costs when it establishes its prices. We need an honest marketplace before we can let the market work for sustainability rather than against it as it works today." **Ray Anderson, Interface CEO**

Colorado State University

Picking up Speed despite C.O.C.

Dupont
Interface
Goldman Sachs
General Electric
Intel
Procter and Gamble
Adidas
TESCO

Set Big Goals

Colorado State University

Cut greenhouse gas emissions 65% 1990–2010

Raise revenues 6%/y 2000–10 with no increase in energy use

By 2010, 10% of energy & 25% of feed stocks from renewables

Since 1990 have kept energy use the same and increased production 30%

GHGs from global operations are down 67%

Savings of $3 billion over 12 year

ST Micro-electronics' Goals

Zero net CO_2 emissions by 2010

40-fold increase in production over 1990

Commitment to this goal has taken the company from the #12 chipmaker to the #6

Set 2010 goal of 15% renewable energy 55% cogeneration and 30% conventional

Won 04 Best Industrial Renewable Energy Partnership from EU.

When ST is climate neutral, it will have saved $900 million

Colorado State University

GHG Policy = Competitive Edge

Business Leaders	Reduced Emissions	Savings
Dow	↓ 20%	$4 BB
BRITISH TELECOM	↓ 35%	£ 1.5 BB
ABN AMRO	↓ 15% since 2004	3.5 MM Euros

Colorado State University

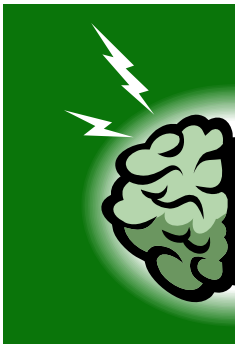
Business Leaders	Reduced Emissions	Savings
IBM	↓ 38%	$786 MM
ALCOA	↓ 37%	$7 MM
WESTPAC	↓ 45%	$100 MM

Colorado State University

"Oppose efforts to regulate greenhouse gas emissions through existing environmental statutes, including, but not limited to, the Clean Air Act, the Clean Water Act, the Endangered Species Act, and the National Environmental Policy Act." CoC Policy 2010

Colorado State University

BoP Sustainability



- 7 B going to 10 B
- 4-6 B at BoP
- Think Impacts
- Think Markets
- Think Customers
- Think Culture

Colorado State University

GSSE students form Enterprise Teams and work in bottom of pyramid markets on ventures that serve people, planet and profit.

A triple bottom-line product is magic: the more you sell the better your customers' lives become and the better we all do environmentally.

Colorado State University

MAKE A DIFFERENCE COLLEGE OF BUSINESS

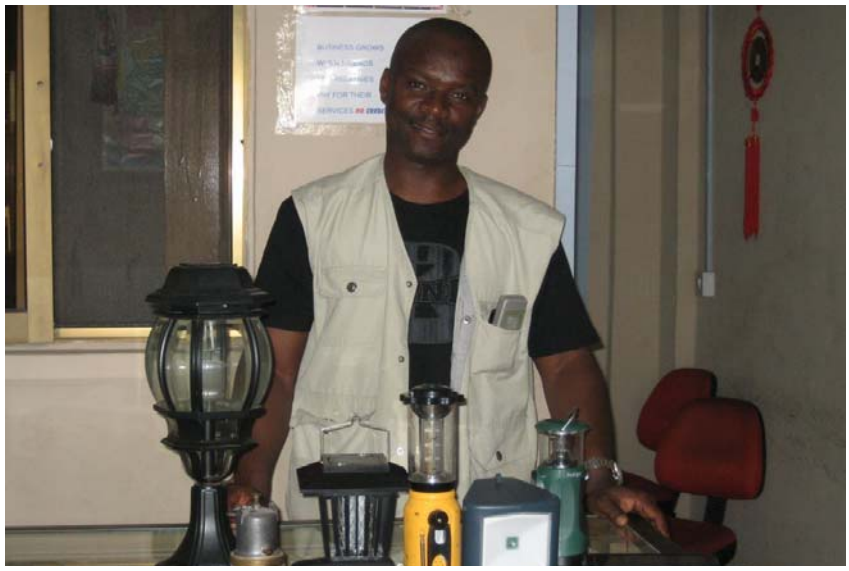
Colorado State University

MAKE A DIFFERENCE COLLEGE OF BUSINESS

"Forget China. The next big growth story in the next decade is Africa. With a population that's fast approaching the one billion mark, **Coca-Cola's** CEO Muhtar Kent believes that "Africa is really going to blossom in the next decade." Kent wasn't the only one to talk up Africa's potential last week. Qatari Prime Minister Sheikh Hamad bin Jasim bin Jasir al-Thani told Maria Bartiromo in an interview that Africa is where the growth will be." (Source: http://www.cnbc.com/id/33074459/Coca_Cola_Africa_The_New_China)

This year and in 2011, Africa will grow by 4.8 percent—the highest rate of growth outside Asia, and higher than even the oft-buzzed-about economies of Brazil, Russia, Mexico, and Eastern Europe, according to newly revised IMF estimates. In fact, on a per capita basis, Africans are already richer than Indians, and a dozen African states have higher gross national income per capita than China.

(source: http://www.newsweek.com/id/233501)



Attachment 4
The Role of Yellow Iron in Sustainable Remediation

Where Iron Meets Ideas

When Yellow Iron Contractors Implement
Sustainable Remediation Practices

SUNPRO

Excellence thru Teamwork

SAFETY – QUALITY - PRODUCTIVITY

Four score and seven years ago…

…the vision of our SURF forefathers forever changed how our industry viewed and conducted environmental remediation...

A Review of Our Mission

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**

SURF and Sunpro – Take a look

1. **Sunpro's vantage point**

2. **Examples of sustainable approaches and implementations**

3. **Obstacles impeding sustainable efforts and inspirations**

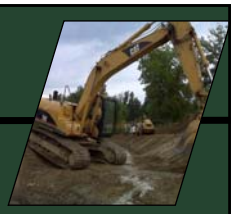
Sunpro's Vantage Point

- ✓ Field Services Contractor…
  - Environmental Remediation & Construction
  - High Voltage Electrical Maintenance & PCB Mitigation
  - Time Critical / Emergency Response
- ✓ It is no secret that dig and haul is still a common remediation practice
- ✓ It's not pretty, often not overly complex, nor does it involve many scientific breakthroughs … but when implemented correctly, it has a high probability of "success"
- ✓ "Success" for a contractor typically means the removal or control and containment of contaminants from/at Client's Site

Sunpro's Vantage Point

- ✓ Major focus on stabilizing and moving contaminated soils and sediments
- ✓ Yellow Iron plays a considerable role in the execution of these projects
- ✓ We approach each project with sustainability in mind
- ✓ Using much of what we learn from experience and SURF discussions as well
- ✓ Our input as a contractor often brings us to the table to collaboratively (redesign *more* sustainable alternatives)

Sunpro's Vantage Point



- ✓ **Yellow Iron work is Energy Crucial**
  our improvements are often reductions in energy use, labor or transit of people and materials

- ✓ **Much of the raw material savings are designed by consultant – so they are more or less baked in at the time of implementation with some degree of flexibility**

- ✓ **Our Sustainability Matrix, by design, drives us to review areas we can improve or put into action remedial measures in a more sustainable manner**

Examples of Sustainable Approaches and Implementations – Midwest # 1

Active Worksite in 5.9-acre Flood Plain Impacted by 100-year Flood Event

- o **Recovered 1.7 million gallons of impacted water**
- o **Contained in 78 frac tanks**

- o **Original response and scope of work was for *Offsite T&D* involving:**
  - o **300+ tankers**
  - o **160 miles (RT) to TSDF * 300 tankers = 48,000 miles**
  - o **$1.77/gallon cost T&D * 1.7 million = ~$3million**

Examples of Sustainable Approaches And Implementations – Midwest # 1

- **Contractor encouragement shifted remedy to *Onsite T&D***
  - **Mobilized temporary onsite WWTP**
  - **Discharged to local POTW per limits**
  - **~$330,000 construction, treatment & discharge (onsite treatment cost at $0.175 / gallon)**

- **Sustainable impacts:**
  - **Environmental : reduced air emissions, reduced fuel use, reusable treatment system, minimized trucking-related releases**
  - **Social : use of local labor pool, reduced trucking impact to community quality of life including air, noise, traffic congestion, pedestrian safety (2 schools, 3 day cares, 1 retirement home along intended route)**
  - **Economic : big savings in T & D. But just how much?**

Examples of Sustainable Approaches And Implementations – Midwest # 1

T & D savings =

$2.7 million dollars…

And everyone loves that!

Examples of Sustainable Approaches And Implementations – Midwest # 2

15,400 tons of DNPL Impacted Sediments



- **Original record of decision (ROD) called for *Mechanical Dredging and Offsite T&D***
  - **700+ truckloads**
  - **600 miles (RT) to TSDF * 700 truckloads = 420,000 miles**
  - **$179 per ton T&D (direct pass thru billing) = ~$2.75M**

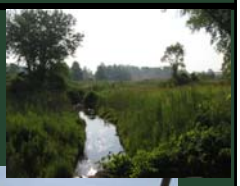
Examples of Sustainable Approaches And Implementations – Midwest # 2

- **Altering site conditions (PCBs encountered and increase to 30,000 tons of impacted sediments *and soils*) drove *collaborative effort to modify ROD***
  - **Onsite entombment of impacted sediments and soils**
  - **Temporary relocation of brook**
  - **Construction of final and permanent location of brook with HDPE lining, in-line sedimentation, product recovery system**




Examples of Sustainable Approaches And Implementations – Midwest # 2

- **Sustainable impacts:**
  - **Environmental: reduced air emissions, reduced fuel usage, minimized trucking-related releases**
  - **Social: use of local labor pool, reduced trucking impact to community quality of life (air, noise, traffic congestion, pedestrian safety)**
  - **Economic: reduced by 127 man days**



Original ROD – Offsite T&D	Modified ROD – Onsite Entombment
7-man crew 2 technicians lining truck beds 2 traffic control coordinators 1 excavator operator 1 trucking coordinator 1 grounds man (cross-contamination)	4-man crew 1 excavator operator 1 ATV dump truck driver 1 dozer operator 1 working project manager
175 man days	***48 man days***

Examples of Sustainable Approaches And Implementations – Midwest # 3

Winter removal of 14,250 tons of Impacted Sediments (PCBs, PAHs, & Lead)

- **Original scope of work called for *Mechanical Dredging, Solidification, Offsite T&D* of impacted sediments & soils**
  - **2.89 acres of clearing, grubbing and offsite T&D of green waste**
  - **1 acre of stream restoration**
  - **1 acre of wetlands restoration**

Examples of Sustainable Approaches And Implementations – Midwest # 3

- **Contractor encouragement shifted scope of work**
  - **selective clearing & grubbing (~25% reduction in C&G, equipment maneuvered around >16" trees)**
  - **onsite reuse of C&G wastes for general construction, erosion control & sediments stabilization (reduced offsite hauling by 100+ truck loads)**
  - **recovery & recycling of discarded debris (~60k pounds of recyclables & 2 tractor trailer loads of tires, netted $30,000 for PRP)**
  - **utilized native soils in lieu of super absorbent polymer (reduced ~$1MM in material cost [PRP owned disposal facility])**
  - **reduced restoration of access roads by newly constructing 2.44 acres of wetlands (saved 40 man days, utilized native eco materials from other site owned by PRP, created additional capture points [in-line treatment train] for remaining risk-based impacted sediments)**

Examples of Sustainable Approaches And Implementations – Midwest # 3

April 2010

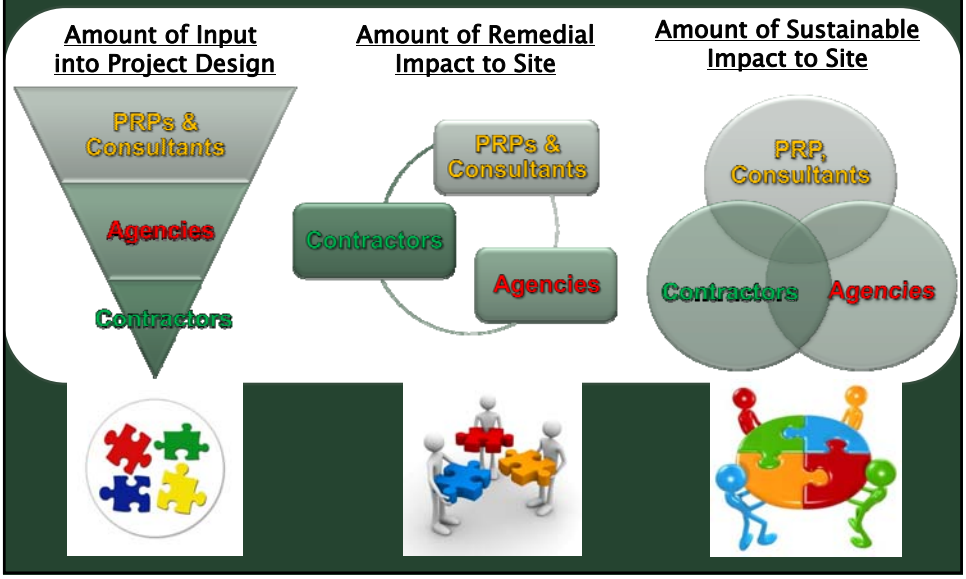
Scott,
…"I must say I was really impressed with the way this part of the project has been completed and came out better than I expected given the starting conditions and the fact that this was completed over the winter months in adverse weather conditions. I walked most of the creek with (the project manager) and observed ***the wetlands you were able to construct adjacent to the creek which apparently pleased (the agency)***."

…affic congestion, pedestrian safety)

- **Economic: $1MM in material cost savings, $30K netted by PRP from recycling discarded debris, restoration reduced by 40 man days**



Obstacles impeding sustainable efforts and inspirations



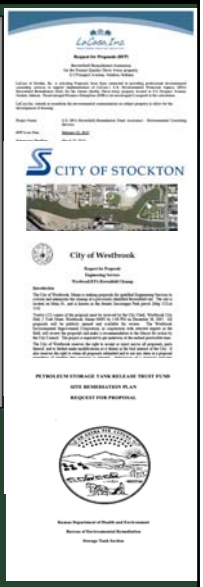
Obstacles impeding sustainable efforts and inspirations

June, 2010

Scott:

Based upon an evaluation completed with ***respect to the quotes*** that were submitted for the Construction and Environmental Service associated with the Site ABC at the Typical American Manufacturing facility, your proposal and associated costs have been accepted.

As discussed earlier this morning, we would like to begin Monday June 21st. If you have any questions, please give me a call.



Obstacles impeding sustainable efforts and inspirations

Heavy metals impacted soils & sediments

Bid Specs for Firm-Fixed Costs:

- Partial onsite soil stabilization & partial dig and haul
- Demolition and onsite reuse of multiple cinder block buildings
- On/off-site recovery of impacted sediments and stream restoration

Sunpro bid:

- Proposal for project as requested AND proposed alternate approach (fixed cost) to relocate stream & treat sediments in place
- Sunpro total bid ~$500k and came in second

Obstacles impeding sustainable efforts and inspirations

Low bid

- $460k including dig & haul of offsite impacted sediments
- Total project costs $750k due to change orders that ultimately resulted in moving steam and treating sediments in place

Obstacles impeding sustainable efforts and inspirations

Sustainability Projects are a Bit Like Waldo

There's the Sustainability Project!

Obstacles impeding sustainable efforts and inspirations

Surf's Goal…

Sustainable Remediation becomes the norm not the exception for remediation projects.

Obstacles impeding sustainable efforts and inspirations

How many of these *can we make happen* yet this year?

City of Tomorrow

Request for Proposal

Sustainable Remediation Services
Great American Past-time Manufacturin

Introduction
The City of Tomorrow is seeking proposals from qualified vend
oversee and administer the ***sustainable remediation*** of the site
located at 121 Main Street.

Twelve copies of the proposal mu

Remediation Inc.

Date: **July 15, 2010**

To: **Mr. John Doe**
Environmental Director
City of Tomorrow
Anywhere, USA

Re: **Sustainable Remediation Services** **P-12345**
Great American Past-time Manufacturing Site

We appreciate the opportunity to provide you with the following proposal for ***sustainable remediation services*** and our ***suggested alternatives to increase the sustainable impact*** for the site at the

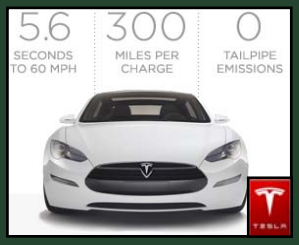
The enclosed action plan includes a break
availability, scheduling, regulatory is

Obstacles impeding sustainable efforts and inspirations

Buckminster Fuller:

"You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete."

Obsolete Model



New Model

Obstacles impeding sustainable efforts and inspirations

With that said, don't ever underestimate the power of a like minded group of individuals sharing passions and ultimately implementing these ideas in a sustainable fashion.

Its Good – So, How do we make it Great?

How do we get sustainable remediation into more RFPs?

Can we have a more collaborative approach during the design phase?

How can we open up the 'confidentiality' of sites in order to bring the (sustainable) alternatives to SURF?

How do we get back to the willingness of the 90's to be innovative in the approaches to sites?

Thank You

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22 years of remedial design and implementation

Attachment 5
Creation of a Sustainable Remediation Site Database

BAKER & McKENZIE

Taking the SURF White Paper to the next level: Creation of a Sustainable Remediation Site Database

Topics

- Brief Background on SURF White Paper and EPA Policies
- Key similarities and differences between the SURF White Paper's goals and EPA's Policies
- Description of Sustainable Remediation Site Database
- Next Steps

Background - Definition of Sustainability

- Triple Bottom Line (TBL)
  - Social Responsibility
  - Environmental Responsibility
  - Economic Well-Being

Background - SURF White Paper

- Published in 2009
- Culmination of the work of SURF members over 10 meetings since 2006
- Describes ways to integrate sustainable principles, practices, and metrics into remediation projects
- Offers thoughts about moving the concept of sustainable remediation forward (i.e., “A Vision for Sustainability”)

Background - SURF White Paper

- Focuses primarily on environmental component of TBL
- Among other things, identifies the need for a project-based compendium to allow for an objective comparison of sustainable remedies from site-to-site
  - Expand project knowledge
  - Address existing societal and governmental barriers

Background - SURF White Paper

- Advocates for Sustainable Approaches that:
  - Minimize or eliminate energy consumption or the consumption of other natural resources
  - Reduce or eliminate releases to the environment, especially air
  - Harness or mimic a natural process
  - Result in the reuse or recycling of land or otherwise undesirable materials
  - Encourage the use of remedial technologies that permanently destroy contaminants

Background – Key EPA Policies

- *Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites (April 2008)*
  - Establishes "Core Elements" for consideration as BMPs
    - Energy requirements "of the treatment system"
    - Air emissions
    - Water requirements and impacts on water resources
    - Land and ecosystem impacts
    - Material consumption and waste generation
    - Long-term stewardship actions

Background – Key EPA Policies

- *U.S. Environmental Protection Agency Office of Solid Waste and Emergency Response (August 2009)*
  - Establishes Five Elements for "Greener" Cleanups
    - Minimize Total Energy Use and Maximize Use of Renewable Energy
    - Minimize Air Pollutants and Greenhouse Gas Emissions
    - Minimize Water Use and Impacts to Water Resources
    - Reduce, Reuse and Recycle Material and Waste
    - Protect Land and Ecosystems

Background – Key EPA Policies

- EPA Regional Policies
  - Developed since Fall 2009
  - Primarily reiterate Primer and OSWER Elements
  - Provide some additional sustainable practice and solution examples beyond those in national policies

Background – Key EPA Policies

- EPA Regional Policies (continued)
  - Variances in regional policies
    - Specificity
    - Voluntary benchmarks
    - Sampling and testing recommendations
    - Incentives for taking up sustainable remediation
    - Links to tools
    - Recommendations to include verifiable sustainable solutions in decision documents

Key Similarities Between SURF and EPA

- Primary focus is on environmental component of TBL
  - Struggle with identifying relevant social and economic concepts and metrics
- Recognize that existing regulations and policies may currently limit certain sustainable remediation solutions
- Appreciate that the concept of sustainable remediation is new and dynamic
- Consider carbon footprint and greenhouse gas impacts

Key Differences Between SURF and EPA

- SURF view of sustainable remediation is more expansive
  - Energy
    - EPA – four corners of a site
    - SURF – analysis can extend beyond the site
  - Natural resources
    - EPA – primary focus on conservation
    - SURF – goal of minimizing/eliminating consumption
  - Air emissions
    - EPA – four corners/project-based only
    - SURF – analysis can extend to life cycle

Key Differences Between SURF and EPA

- SURF view of sustainable remediation is more expansive
  - Natural attenuation
    - EPA – afforded limited consideration
    - SURF – concentrated focus
  - Land and material recycling and reuse
    - EPA – focus primarily on materials
    - SURF – important goal of overall approach
  - Technologies
    - EPA – meet objectives and minimize waste
    - SURF – experimentation and contaminant destruction

Key Differences Between SURF and EPA

- SURF view of sustainable remediation is more expansive
  - Incentives and reasoning driving sustainable remediation choices
    - "Good thing"/Policy
    - Economic
    - Social
    - Other
  - Monitoring obligations
    - Innovation vs. historic practices

Sustainable Remediation Site Database

- Create a searchable resource for sustainable remediation projects throughout the U.S.
- Research since last SURF Meeting
  - SURF Resources
  - EPA Green Remediation National and Regional Policies and Guidance
  - EPA Profiles in Green Remediation (27 projects)
    - Focus on 8 profiles
    - Contacted EPA, listed or identified contacts

Sustainable Remediation Site Database

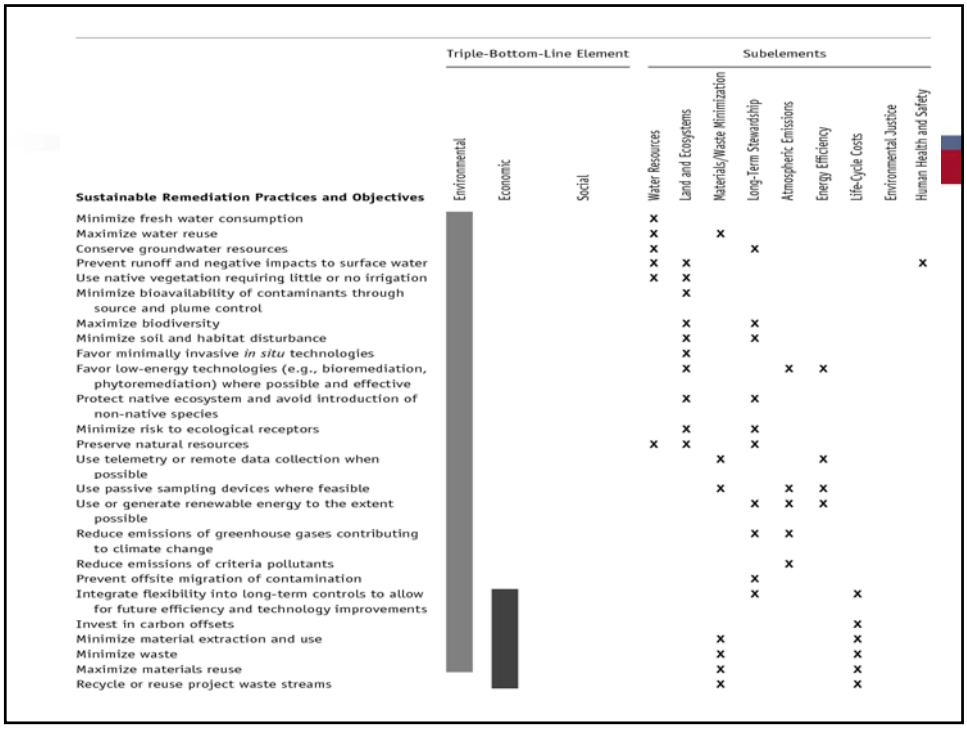
- Search criteria
  - ***Governing Law(s)***
    - RCRA Corrective Action
    - CERCLA
    - State or Local Law
    - Voluntary
  - ***Legal Criteria Implicated***
    - RCRA Corrective Performance Standards
    - CERCLA NCP Criteria
    - Other

Sustainable Remediation Site Database

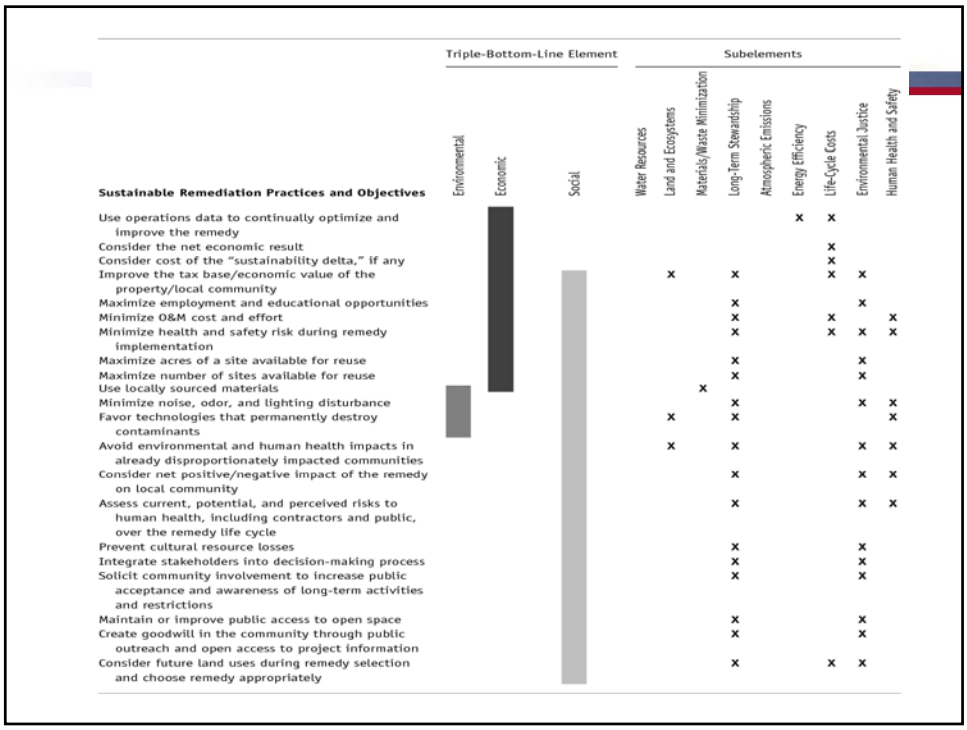
- Search criteria
  - ***Relevant Agreement or Enforcement Document***
    - Consent Decree
    - Order
    - Agreement
    - None

Sustainable Remediation Site Database

- Search criteria
  - ***Environmental Considerations***
    - EPA Only (i.e., EPA's "Elements")
    - All (i.e., EPA's "Elements" and SURF-based)
  - ***Social Considerations***
    - Similar to Environmental Justice?
    - Outreach, community livability, end uses, quality of life (others from SURF's Exhibit 5-3)
  - ***Economic Considerations***
    - Company costs, property value changes, increased employment (others from SURF's Exhibit 5-3)



Sustainable Remediation Practices and Objectives	Environmental	Economic	Social	Water Resources	Land and Ecosystems	Materials/Waste Minimization	Long-Term Stewardship	Atmospheric Emissions	Energy Efficiency	Life-Cycle Costs	Environmental Justice	Human Health and Safety
Minimize fresh water consumption				x								
Maximize water reuse				x		x						
Conserve groundwater resources				x			x					
Prevent runoff and negative impacts to surface water				x	x							x
Use native vegetation requiring little or no irrigation				x	x							
Minimize bioavailability of contaminants through source and plume control					x							
Maximize biodiversity					x		x					
Minimize soil and habitat disturbance					x		x					
Favor minimally invasive *in situ* technologies					x							
Favor low-energy technologies (e.g., bioremediation, phytoremediation) where possible and effective					x			x	x			
Protect native ecosystem and avoid introduction of non-native species					x		x					
Minimize risk to ecological receptors					x		x					
Preserve natural resources				x	x		x					
Use telemetry or remote data collection when possible						x			x			
Use passive sampling devices where feasible						x		x	x			
Use or generate renewable energy to the extent possible							x	x	x			
Reduce emissions of greenhouse gases contributing to climate change							x	x				
Reduce emissions of criteria pollutants								x				
Prevent offsite migration of contamination							x					
Integrate flexibility into long-term controls to allow for future efficiency and technology improvements							x			x		
Invest in carbon offsets										x		
Minimize material extraction and use						x				x		
Minimize waste						x				x		
Maximize materials reuse						x				x		
Recycle or reuse project waste streams						x				x		



Sustainable Remediation Practices and Objectives	Environmental	Economic	Social	Water Resources	Land and Ecosystems	Materials/Waste Minimization	Long-Term Stewardship	Atmospheric Emissions	Energy Efficiency	Life-Cycle Costs	Environmental Justice	Human Health and Safety
Use operations data to continually optimize and improve the remedy									x	x		
Consider the net economic result										x		
Consider cost of the "sustainability delta," if any										x		
Improve the tax base/economic value of the property/local community					x		x			x	x	
Maximize employment and educational opportunities							x				x	
Minimize O&M cost and effort							x			x		x
Minimize health and safety risk during remedy implementation							x			x	x	x
Maximize acres of a site available for reuse							x				x	
Maximize number of sites available for reuse							x				x	
Use locally sourced materials						x						
Minimize noise, odor, and lighting disturbance							x				x	x
Favor technologies that permanently destroy contaminants					x		x					x
Avoid environmental and human health impacts in already disproportionately impacted communities					x		x				x	x
Consider net positive/negative impact of the remedy on local community							x				x	x
Assess current, potential, and perceived risks to human health, including contractors and public, over the remedy life cycle							x				x	x
Prevent cultural resource losses							x				x	
Integrate stakeholders into decision-making process							x				x	
Solicit community involvement to increase public acceptance and awareness of long-term activities and restrictions							x				x	
Maintain or improve public access to open space							x				x	
Create goodwill in the community through public outreach and open access to project information							x				x	
Consider future land uses during remedy selection and choose remedy appropriately							x			x	x	

Sustainable Remediation Site Database

- Search criteria
  - ***Technology Used and Practices Employed***
    - Renewable energy, increased efficiency
  - ***Methodology/Metrics Used***
    - Cite sources
    - Include optional explanation of choices
  - ***Relevant resources consulted***
  - ***Similar or relevant sites identified***
    - From Sustainable Remediation Site Database
    - Other

Sustainable Remediation Site Database

- Initial sites for database
  - EPA Profiles in Green Remediation (27 sites)
  - Projects volunteered by SURF Members
    - Exhibit 6-1 of the White Paper (42 projects)
    - Others
- Collection point for future projects and sites
  - On-line
  - Questionnaire consistent with search criteria
  - Copies of relevant documents
  - Point of contact for additional information and questions

Next Steps

- Determine whether SURF wants to proceed with development of database
- Incorporate other ideas to reflect SURF consensus
- Identify the resources needed to develop and maintain the database
- Develop a team to work on project
- Commit to developing a database prototype within a realistic timeframe
- Regularly report to SURF on progress

Thank You

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Attachment 6
Remedial Process Optimization for Green Remediation

AFP 4 Texas
Remedial Process Optimization Taking Us to Green Remediation

Rick Wice - Presenter
Shaw Environmental & Infrastructure, Inc., and
George Walters, Wright-Patterson AFB

SURF 14, CSU, July 2010

Presentation Outline

- RPO
- Green Remediation
- AFP4 Examples

Remedial Process Optimization

- Reduce operating cost and time to cleanup (Site Closure)
- Establish site closure goals and exit strategies
- Is the treatment technology operating effectively and efficiently?
- Is the current remedial technology going to reach site closure goal?
- Monitoring network optimization

Remedial Process Optimization (continued)

IMPLEMENTATION

- Evaluate recovery, treatment, and monitoring system
- Develop RPO Plan
- Focus on end point site closure or exit strategy

Green Remediation

- Reduce energy use and materials use
- Reduce environmental and carbon footprint
- Reduce life cycle impact of remediation
- Reduce land use, social and economic impacts (sustainability – restore land use and increase social/economic benefits)

IMPLEMENTATION

- Evaluate recovery, treatment, and monitoring systems
- Develop a Green Remediation Plan

Green Remediation (continued)

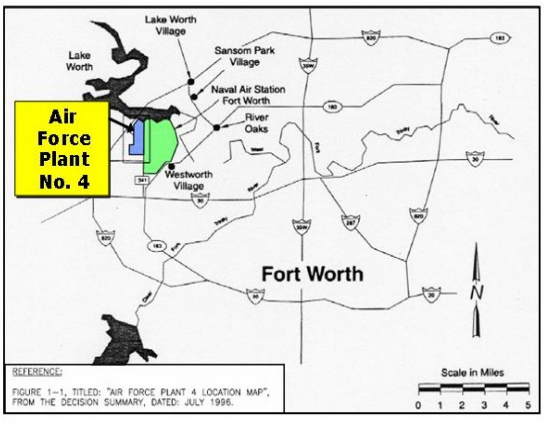
By optimizing remedial systems and remediation programs; monitoring programs, and accelerating Site Closure, we are performing Green Remediation, and possibly sustainable remediation.

AFP4 Where RPO is Helping Achieve Green Remediation

- AFP4 Plume Management
  - EPL Pump and Treat
  - Carswell LF 4 Pump and Treat to PRB; and Phytoremediation
- B181 Source Area Remediation

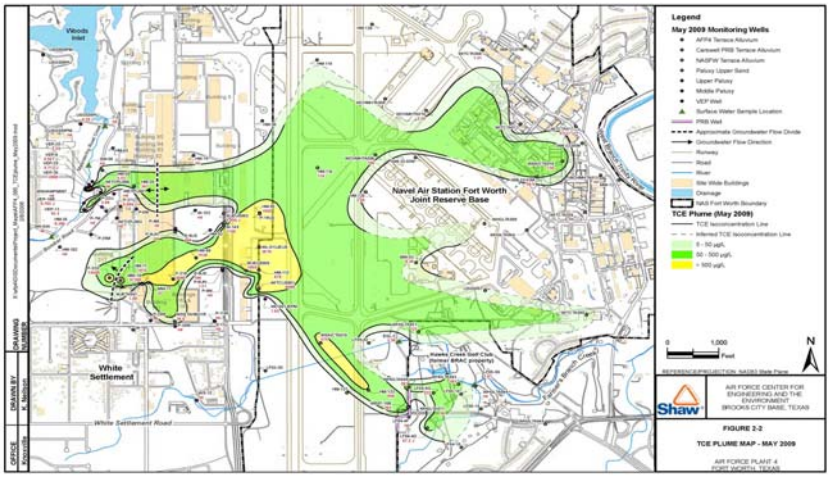
Air Force Plant No. 4 Ft. Worth, Texas -Location Map

AFP4 is an active Government-Owned Contractor-Operated (GOCO), aircraft Manufacturing facility Located approximately seven miles west of downtown Fort Worth Texas AFP4 provides aircraft Manufacturing and Support for the F-16, F-22 and F-35 Joint Strike Fighter (JSF) Programs for the USAF

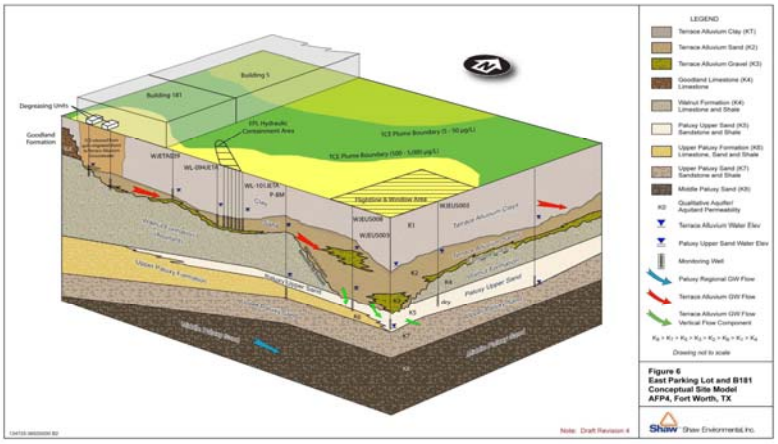


AFP 4 and Former Carswell AFB

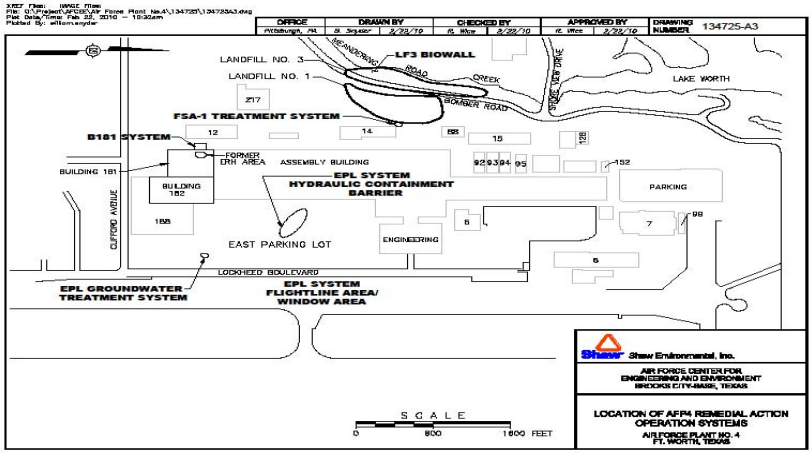
Large TCE Plume is the Concern



CSM EPL Area



Air Force Plant No. 4 Area—Installation Restoration Program Remediation System Locations

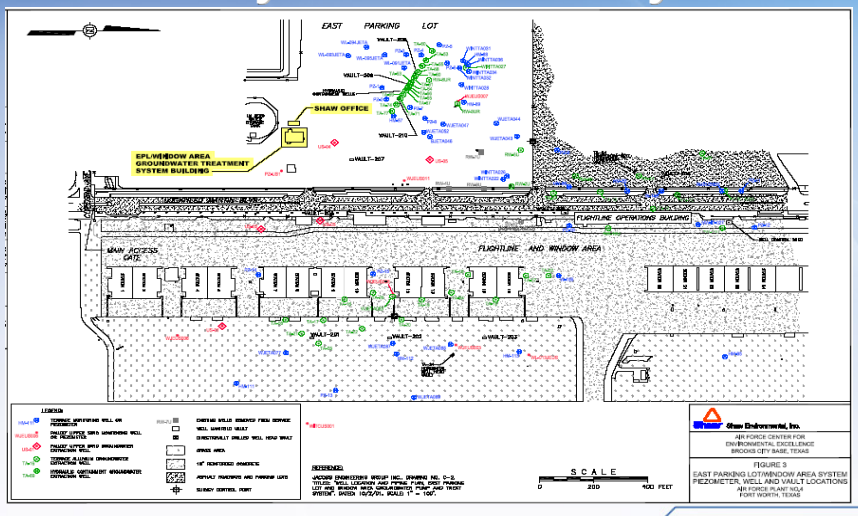


AFP4 Plume Management

Pump and Treat
East Parking Lot

1,100 ft
Permeable Wall At
Carswell Fence

East Parking Lot (EPL) Groundwater Recovery and Treatment System



AFP4 EPL Pump and Treat

- 51 Wells
- 100 to 120 GPM Design,
- Plant Leaks were major source of Groundwater-repaired by LM Aero
- 50 to 60 GPM Operating Flow Rate
- TCE Influent <1,000 ppb; once 2,000 to 3,000 ppb

AFP4 EPL Pump and Treat

RPO/Green

- Replaced energy and materials intensive pH adjustment system with in-line metering mixer
- Reduce operation to 5 day weeks due to lower groundwater flow (drought – plant leaks fixed)
- Reduced plant sampling and well field sampling frequency and parameters
- Potential to reuse effluent discharge water on site
- Increased discharge allowance levels from MCLs to POTW requirements. No need for LPGAC changeout
- Shut-off parts of well field and evaluate alternative remediation technologies-In situ bio?

LF 4 Pump and Treat System

Carswell LF4 Pump and Treat

- Very expensive 200-300 gpm P&T, multiple skids
- Capture zone limited to paleochannel
- 1,100 foot PRB well installed
- Plume migration stopped
- PRB knocked down TCE, some daughter product concern

Carswell LF4 Pump and Treat (continued)

RPO/Green

- LF4 P&T effluent used for irrigation of golf course prior to PRB (1994)
- PRB replaced P&T, over time less energy use
- PRB being evaluated
- System dismantled and recycled or scrapped
- One of largest and earliest Air Force phyto sites was at Carswell

Irrigation Pond

PRB Wall Footprint

PRB Wall Footprint (continued)

Carswell Phytoremediation

Inside the Phyto Forest

ECONOMIC BENEFITS

AFP4 B181 DNAPL Source Area

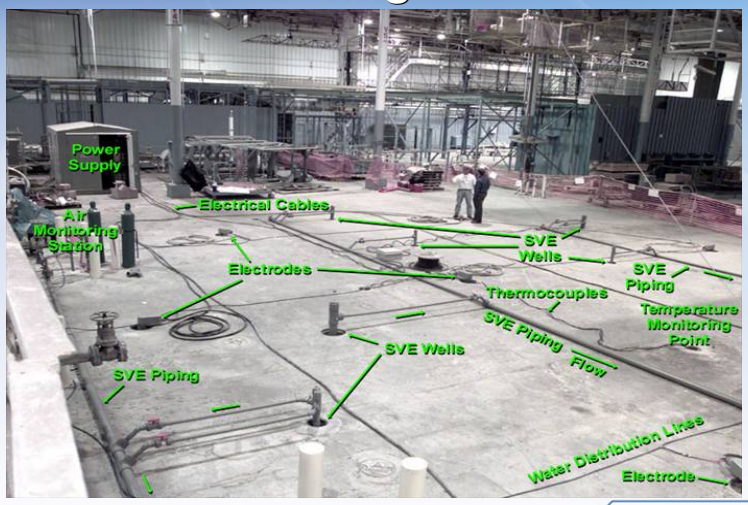
- SVE System built in several phases with carbon and catox off gas treatment
- Electric Resistance Heating (ERH) brought TCE down to low levels, all soils met cleanup goal. All but one well met cleanup goal.
- SVE operated intermittently after ERH (Rebound Studies)
- Bioaugmentation to finish residual hot spot areas
- Performance Monitoring (LTM)

AFP4 B181 DNAPL Source Area (continued)

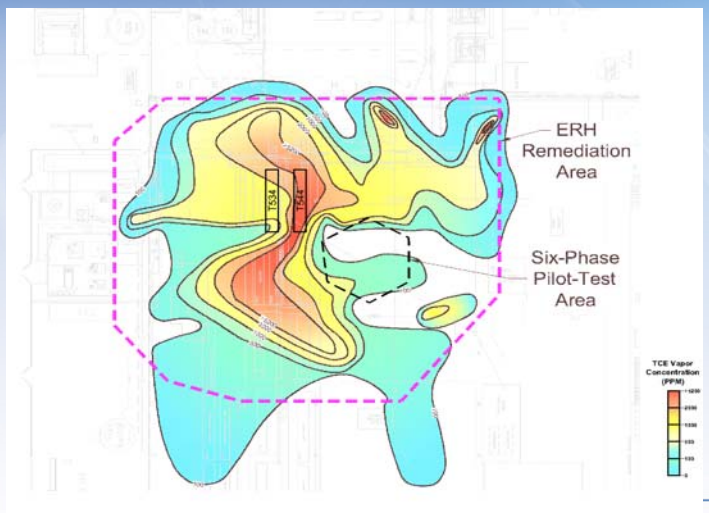
RPO/Green

- ERH determined to be best technology to reach cleanup goal
- CATOX replaced with small carbon units
- Down gradient extraction wells turned off
- SVE turned off December 2008
- Bioaugmentation and performance monitoring
- Return Plant Areas to Aircraft Manufacturing

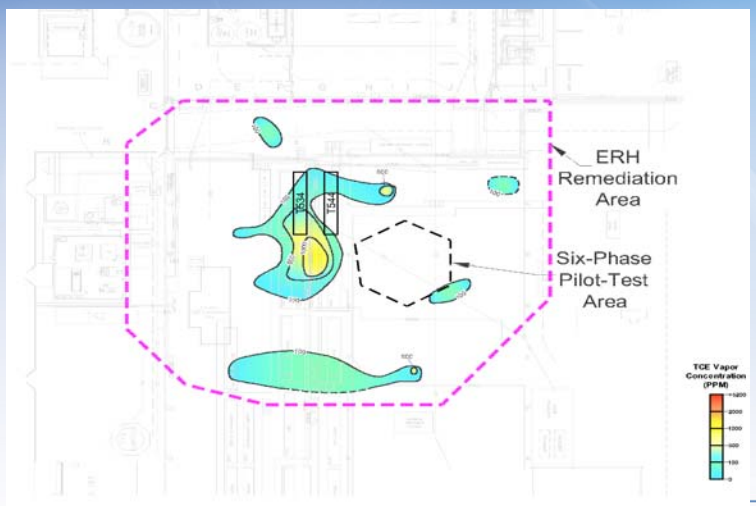
ERH/Bioaugmentation Area Inside Building 181



B181 Area-VOC Soil-Vapor Concentrations Before ERH



B181 Area-Post-ERH VOC Soil-Vapor Concentrations



2006 TCE Hotspot Concentrations from ASU/Battelle Mass Flux Study

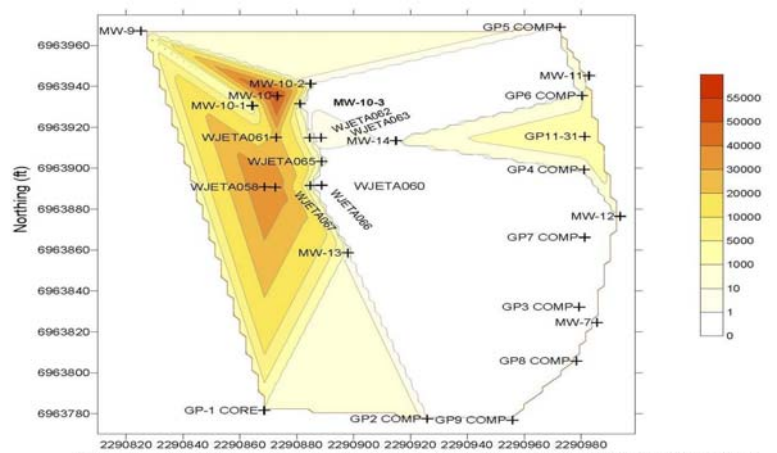
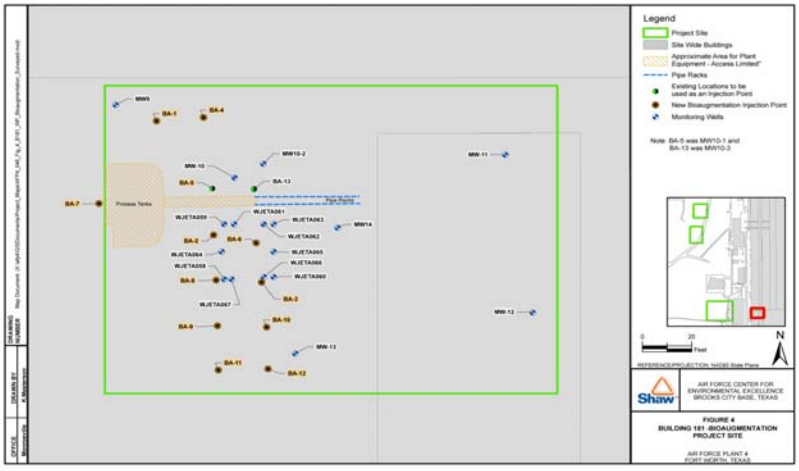


Figure 21. Aerial Contour Map of TCE Groundwater Concentrations (µg/L) for Monitoring Wells and Composite Direct-Push Sampling Locations

Shaw a world of Solutions

The Shaw Group Inc.

Shaw Bioaugmentation Layout



Shaw a world of Solutions

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Bioaugmentation EOS Injection

Shaw a world of Solutions

The Shaw Group Inc.

SDC-9™ Culture Injection

Shaw a world of Solutions

The Shaw Group Inc.

Acknowledgment

The presenter recognizes that the AFP4 remediation program has been, and continues to be, a collaborative effort among multiple contractors and technical professionals, and acknowledges the contributions from members of ASC, AFCEE and Lockheed Martin Aeronautical Company.

Attachment 7
Improving the Sustainability of Source Removal

Improving the Sustainability of Source Removal

Ralph S. Baker (rbaker@terratherm.com) and Tim Burdett
(TerraTherm, Inc., Fitchburg, Massachusetts, USA)
Steffen Griepke Nielsen (Niras A/S, Aarhus, Denmark)
Maiken Faurbye, Niels Ploug and Jesper Holm (Krüger A/S, Søborg, Denmark)

SURF 14
Ft. Collins, CO
July 13, 2010

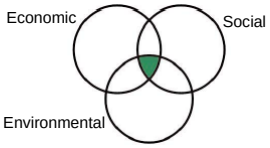
TERRATHERM®

Overview

- Sustainability Considerations
- Reerslev Site Description
- Life Cycle Assessment
- Remedy Selection
- ISTD Design and Implementation
- Results
- Conclusions

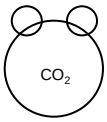
TERRATHERM®

Sustainability Considerations



The "Triple Bottom Line"

not solely



Sustainability honors remedial approaches that favor/enable:

- Reutilization of idle brownfields
- Restoration of groundwater resources
- Cost-effective implementation
- Respect for community values
- Minimization of other impacts.

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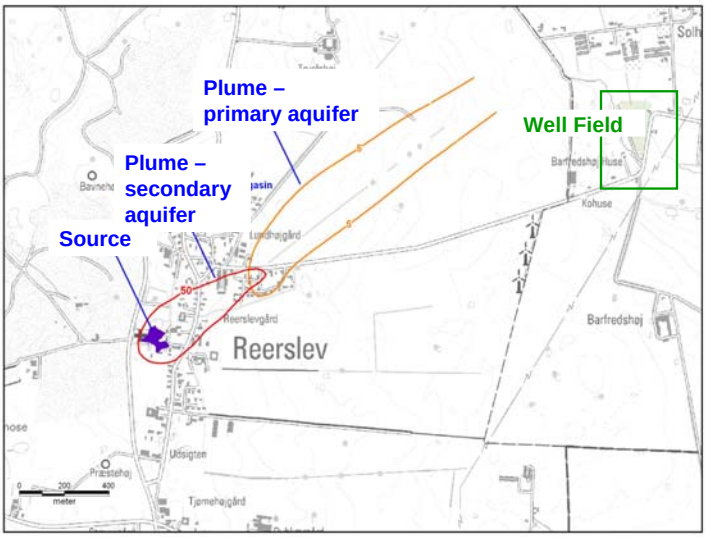
Reerslev – in the Capitol Region of Copenhagen, Denmark

Region Hovedstaden NIRAS KRÜGER TERRATHERM®

Reerslev – Locus



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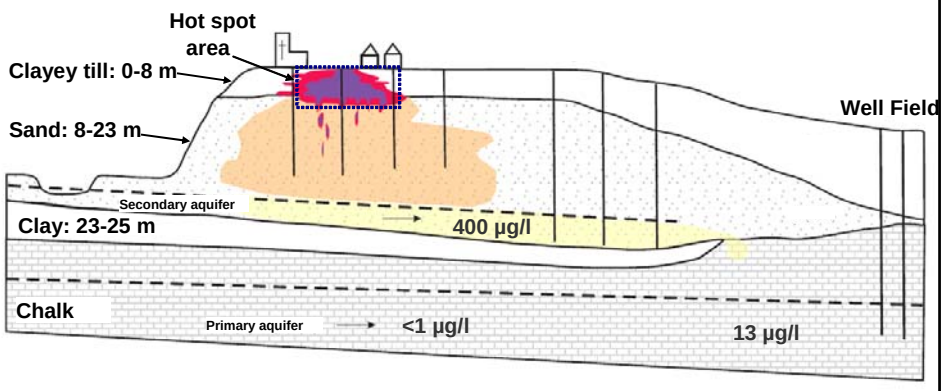
6

Conceptual Site Model



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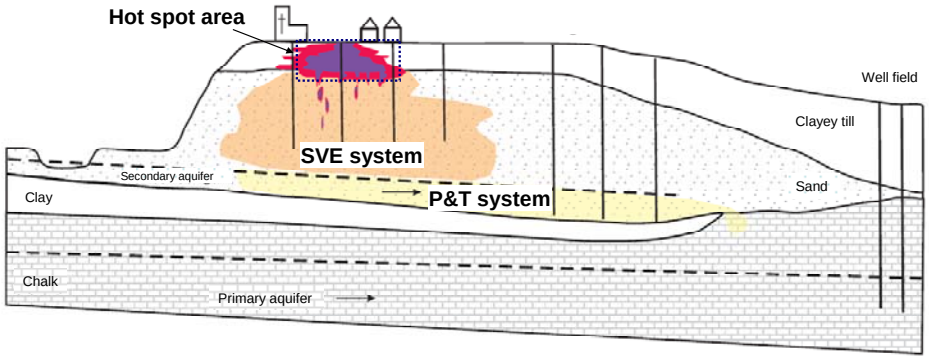
Initial Remedies



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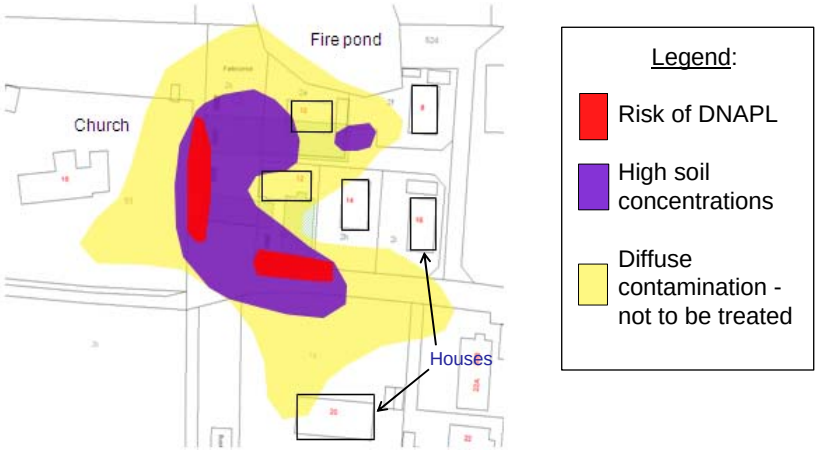
Reerslev – Site Description



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Technology Evaluation

- Excavation and off site treatment
- In Situ Thermal Desorption (ISTD)
- Cutting off hotspot by SVE

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10

Life Cycle Assessment (LCA)
(Pfeilschifter et al. 2007)

Evaluation parameters

	Activities		Impacts		Effects
Setting-up	Transport Excavation Drilling Building equipment Commissioning	Consumables	Power Fuel/gas Plastic Concrete Iron/steel Activated carbon	Resources	Inadequate raw materials Metals Sand/gravel Water
Operation	Operation period Electrical effect Supervision Service	Emissions	CO_2, CO, NO_x, SO_4 VOC's Noise and vibrations Dust or odor	Environment	Global warming Acidification Toxicity Landfill Dangerous waste
Dismantling	Transport Waste	Exposure	Risk of fire or explosions Dangerous work Inconvenience/disturbance of neighbors	Human	Working environment Inconvenience/disturbance of neighbors

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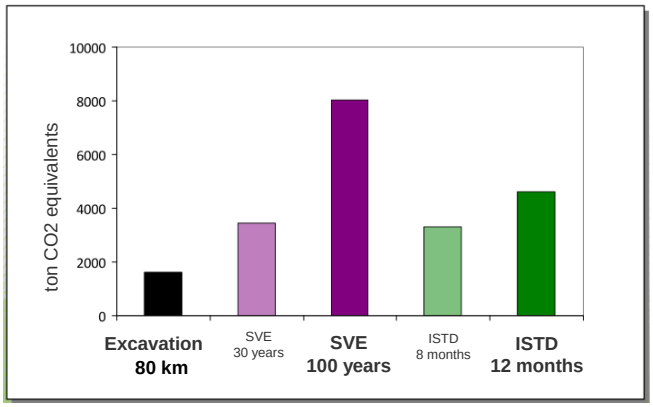
LCA, cont.
(Pfeilschifter et al. 2007)

Carbon footprint – ton CO_2 equivalents



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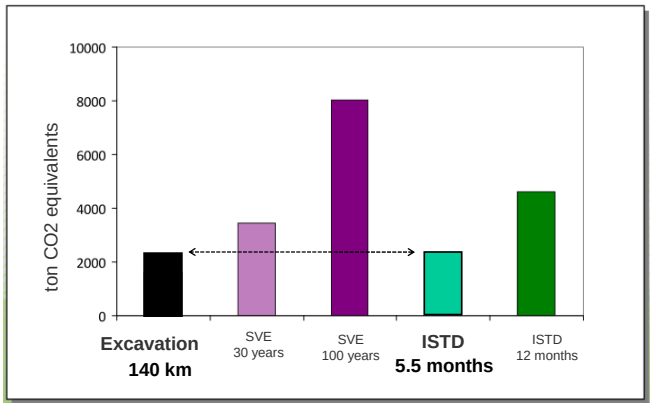
LCA, adjusted for:

Actual ISTD Duration; Transport Distance

Carbon footprint – ton CO_2 equivalents



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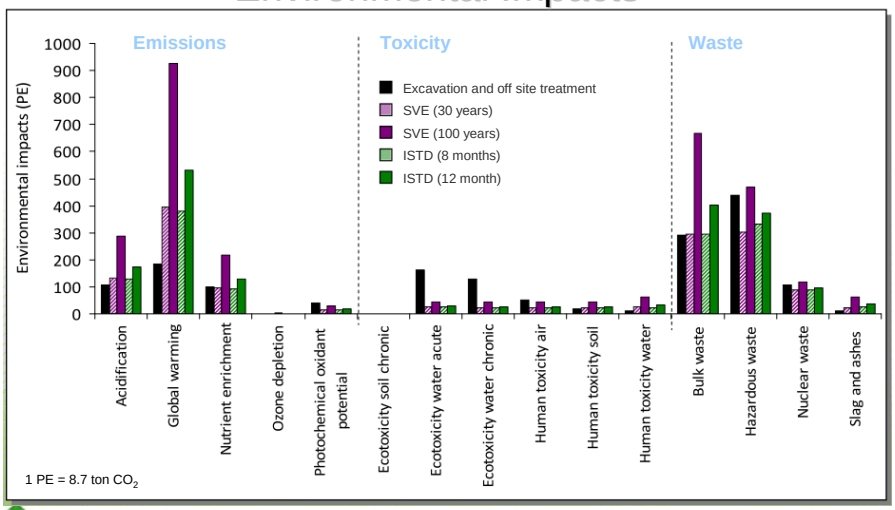
LCA, cont. (Pfeilschifter et al. 2007)

Environmental Impacts



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LCA, cont. (Pfeilschifter et al. 2007)

Comparison of Methods

"Most likely" scenarios are marked

	Excavation		SVE		Heating	
	BC	WC	30y	100y	0.7 y	1 y
Impacts quantified in LCA						
Emissions (GW, AC, NE, OD, POP)	+		+	-		
Toxic effects		-	+			
Waste	+		+	-		
Resource consumption	+	+	-	-	-	-
Impacts described qualitatively						
Working environment						
Inconvenience	-	-				
Remediation efficiency	+	+	-	+	+	+

Green = best environmental performance
Red = worst performance
Yellow = intermediate environmental performance

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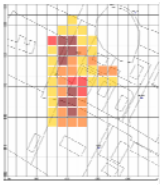
Factoring in all considerations, heating was selected as the preferred remedy

15

NIRAS

Selection of Remedial Goals



Concentration (mg-PCE/kg)	Area (m^2)	Flux (kg/y)
25	900	32.4
10	400	1.6
1	1500	0.5
0,1	2100	0.1

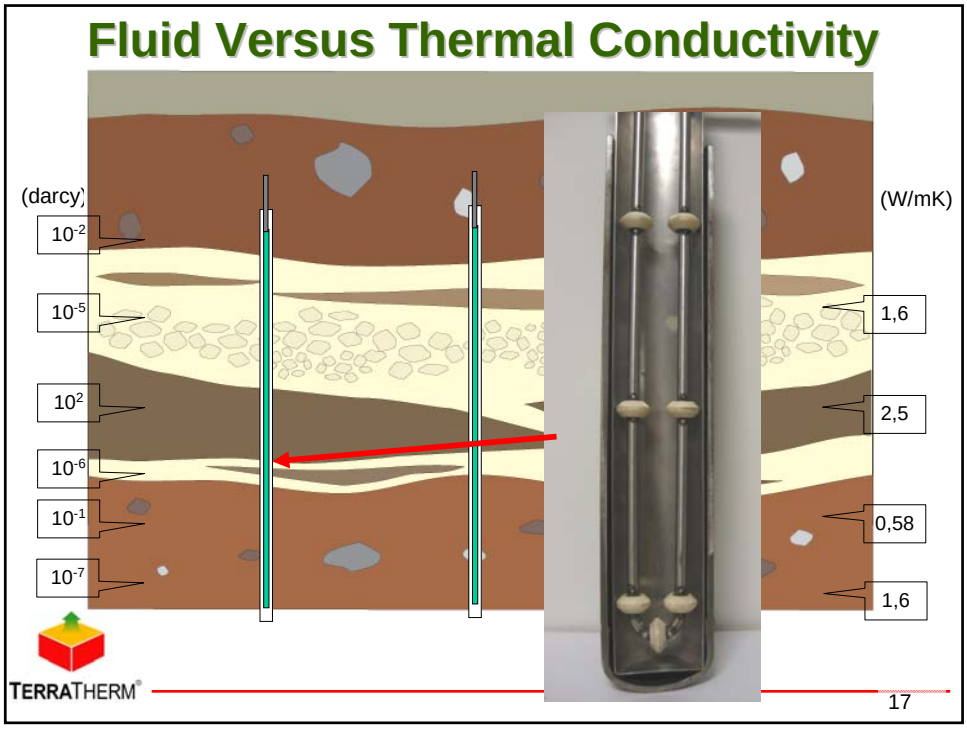
34.6 kg/y is the current flux of PCE into the vadose zone underlying the source area

Remediation scenarios considered:

- **Reduction to 10 mg/kg (900 m^2) → Flux 2.2 kg/y**
- **Reduction to 1 mg/kg (1300 m^2) → Flux 1.2 kg/y**
- **Reduction to 0.1 mg/kg (1300 m^2) → Flux 0.7 kg/y**
- **Reduction to 0.1 mg/kg (2800 m^2) → Flux 0.2 kg/y (original design)**
- **Reduction to 0.1 mg/kg (6000 m2) → Flux 0.07 kg/y (complete remediation)**

⇒ Scenario should achieve < 1 µg-PCE /l at well field

16


Fluid Versus Thermal Conductivity
(darcy)
(W/mK)
10-2
10-5
10-2
10-6
10-1
10-7
1,6
2,5
0,58
1,6
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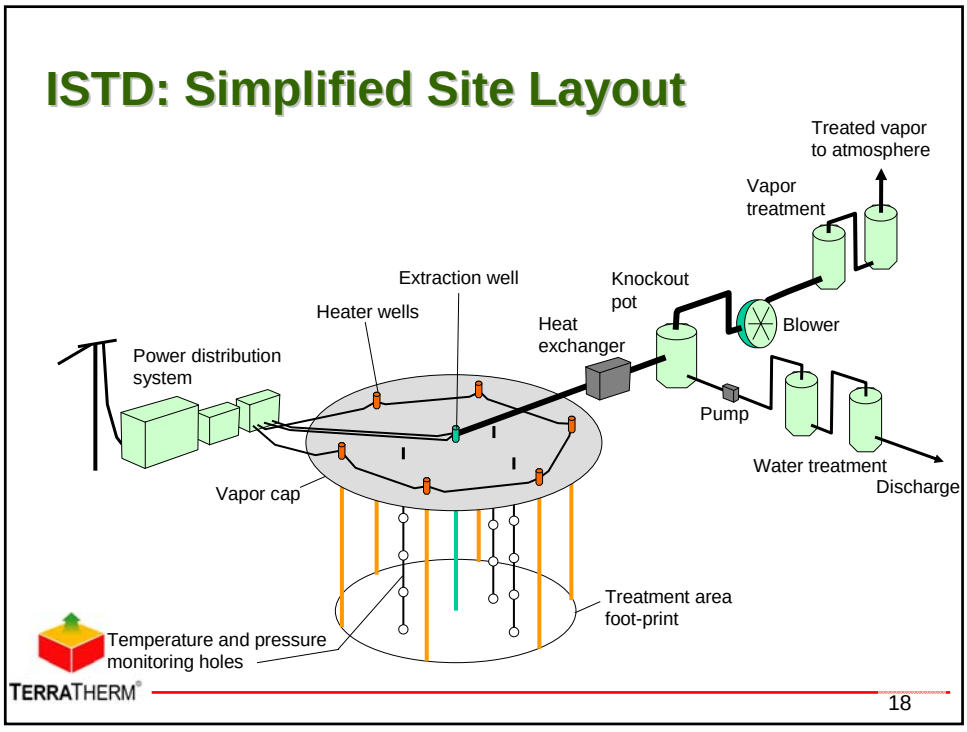
17


ISTD: Simplified Site Layout
Treated vapor to atmosphere
Vapor treatment
Extraction well
Knockout pot
Heater wells
Heat exchanger
Blower
Power distribution system
Pump
Water treatment
Discharge
Vapor cap
Treatment area foot-print
Temperature and pressure monitoring holes
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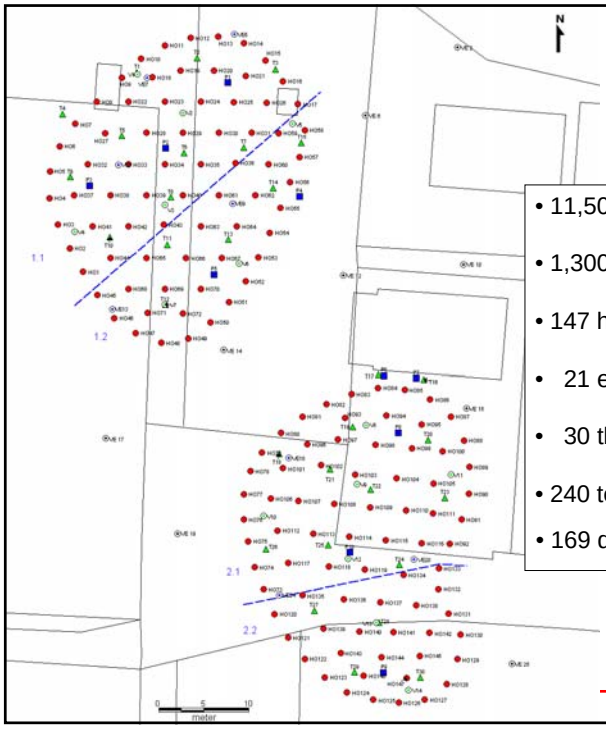
18

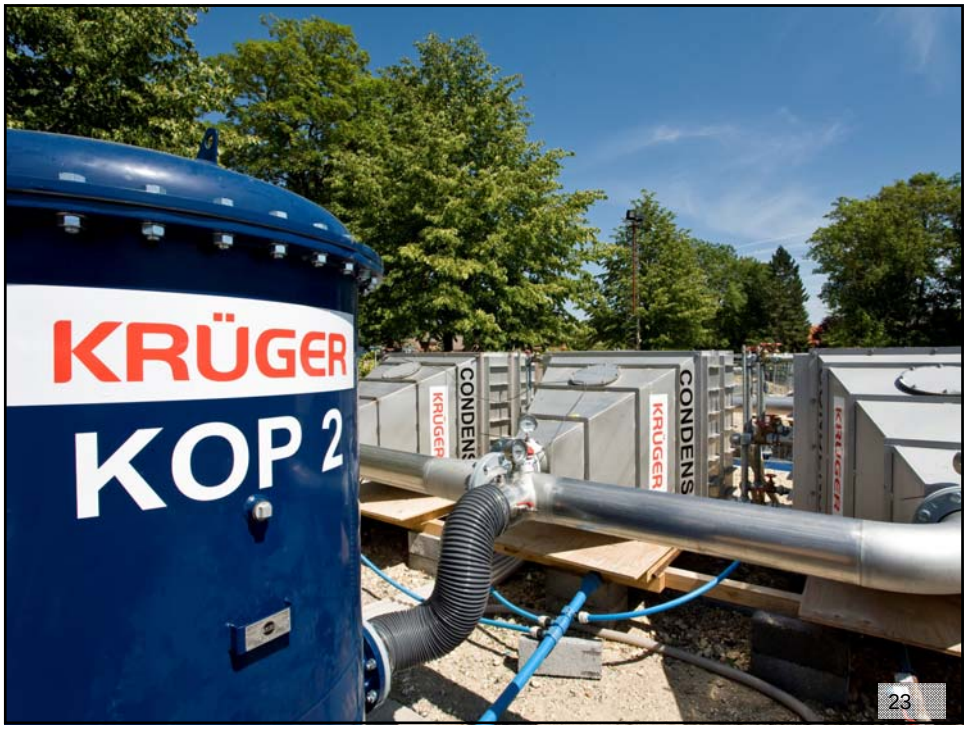


ISTD Stats

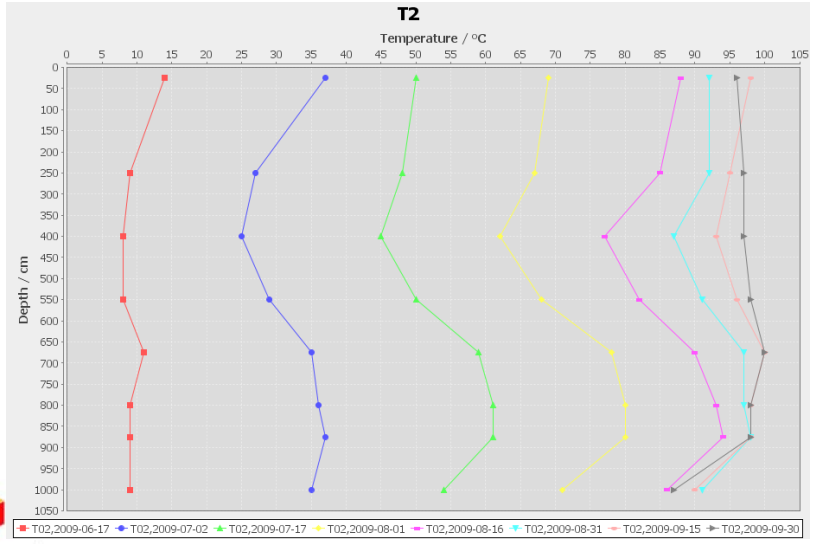
- 11,500 m^3 soil treated
- 1,300 m^2
- 147 heater wells
- 21 extraction points
- 30 thermocouple wells
- 240 temperature monitoringpoints
- 169 days of heating


21


22



ISTD Temperature Progression



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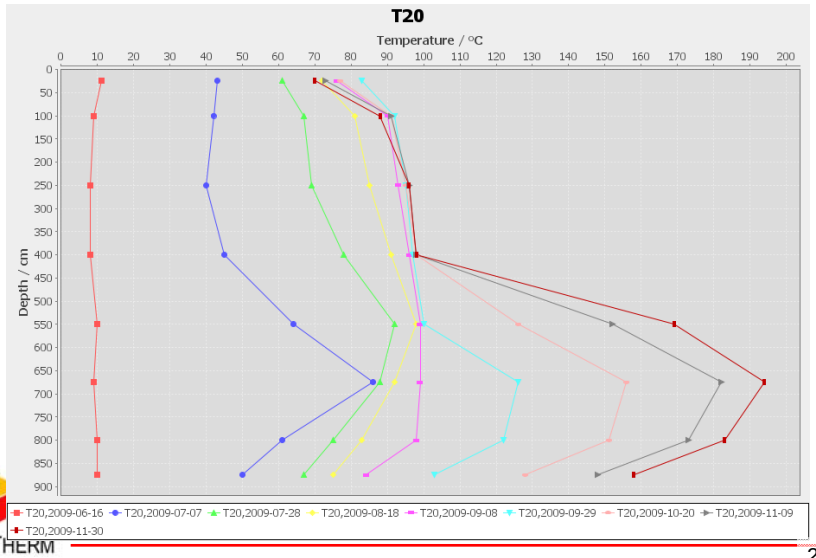
24

ISTD Temperature Progression, cont.



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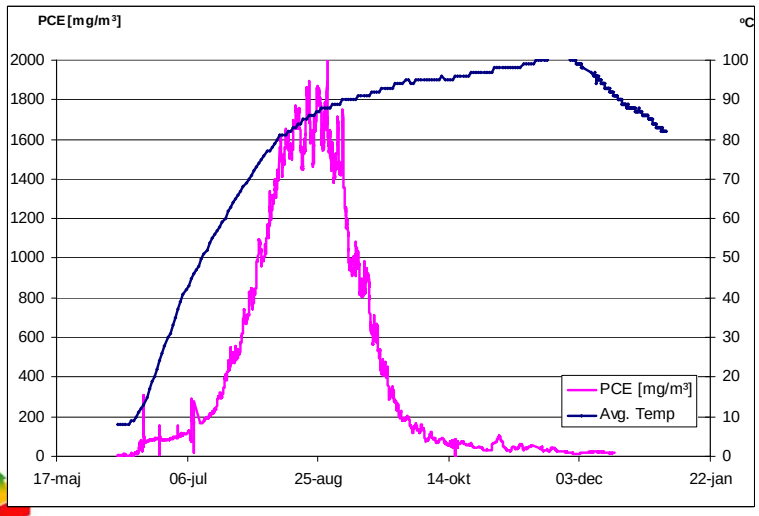
25

Extracted PCE during ISTD



2,500 kg of PCE removed

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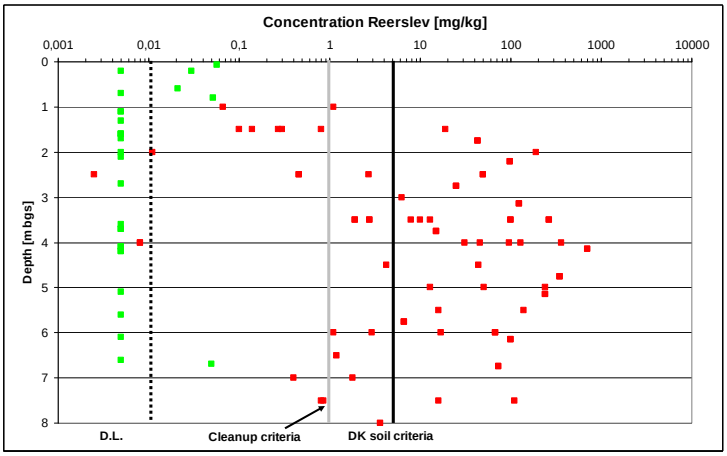
26

Results of ISTD Heating

Actual heating time: 5.5 months



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27

Conclusions

- LCA selected ISTD over excavation and cold SVE
- Actual ISTD Heating Time = 5.5 months (46% of the LCA estimate of 1 year)
- Energy consumption ~ 340 kWh/m^3 (72% of the LCA estimate)
- PCE concentrations were reduced 17 times below cleanup criteria $\rightarrow$ 99.99%
- Total ISTD budget = $3.8M (88% of LCA est.)

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28

Sustainability in Context of Source Removal

- The carbon footprint associated with electrically heating 1 m^3 of contaminated soil ≈ digging and hauling it 140 km (85 mi)
- Meanwhile, in-situ treatment has a lower neighborhood impact, and is environmentally friendly
- With In Situ Thermal Remediation (ISTR), liability is eliminated, not merely moved to another location
- Most ISTR projects are performed under Guaranteed-Fixed Price Contracts

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⇒ certain outcome; short time-frame; **highly sustainable**

Attachment 8
Status and Direction of Alpha Student Chapter of SURF

Status and Direction of Alpha Student Chapter of SURF

Kevin McCoy - MS Candidate

Dr. Tom Sale – Associate Professor

CSU Department of Civil and Environmental Engineering

SURF 14 - July 13, 2010

Overview of Discussion

- Student Interest and Development of Alpha Chapter
- Current Status and Activities to Date
- Going Forward
- Opportunities
- Introduction of Officers and Student Members
- Solicitation of Input from SURF

Student Interest and Development of Alpha Chapter

- Students introduced to sustainability and conservation are enthusiastic to learn more and apply the concepts. Courses provide an introduction, but students want more.
- In February, 2010 CSU students began to develop a student organization to augment their education through social networking, independent study, and interaction with faculty and practicing professionals.
- The SURF student chapter facilitates this development and provides an important bridge between academia and professional practice.

Current Status and Activities to Date

- Students worked with SURF and University representatives over the spring semester to develop the student organization.
- As of July 10, the student chapter at CSU has been officially recognized by SURF and the University.
- Regular officer meetings during the spring semester, and one full presentation meeting.
- Upcoming planned activities include a field trip to a local sustainably remediated site.

Going Forward

- The goal is to provide a student organization that facilitates the independent growth and knowledge sharing among students interested in sustainable environmental practices.
- The student chapter welcomes students from all backgrounds and departments. Current members mostly from engineering and geology. Invitations have been forwarded to many departments.
- Target departments for future development include: water resources, soil and crop sciences, chemistry, chemical engineering, and business.

Going Forward (continued)

- Planned activities and goals for the student chapter include:
  - Regular chapter meetings
  - Guest speakers by local or visiting faculty and/or professionals (consultants, regulators, industry representatives)
  - Social gatherings (social hours, BBQs)
  - Field trips and technology demonstrations
  - Community outreach (cleanups, science fairs, presentations to elementary students)
  - Major meetings (SURF, NGWA, Posters?)

Going Forward (continued)

- Chapter meetings to include presentations by students, lectures by faculty and professionals, and discussion of relevant research.
- Guest speakers: show students real world applications, facilitate networking between students and professionals. Broad background of speakers from academia, regulatory, industry, and consulting to familiarize students as they transition to practicing professionals.

Going Forward (continued)

- Social gatherings allow students from various disciplines who may not have otherwise met to interact and become familiar with each other's work, which will facilitate critical interactions in their future work.
- Field trips provide an opportunity for students to get an up close view of applications, and gain a first hand appreciation of sustainable remediation.
- Technology demonstrations will allow students to learn about cutting edge technologies and practices.
- Community outreach allows students to give back to the community and share the organization with the community at large.
- Attending major meetings allows students to broaden the network, and learn about national and possibly international pracitces and developments.

Opportunities

- SURF interaction with student organization:
  - Goals
  - Speakers
  - Development
  - Student research opportunities and poster presentation?
- Fund raising in support of chapter growth and activities: Dr. Sale has provided startup funding. The chapter needs to develop additional fund raising activities.
- Locations for field trips and technology demonstrations. Safety, nearby sites, site access?
- Student work experience. Research scholarships? Internships? Environmental career fair? Resume workshop?

Introduction of Officers and Student Members

- We would like to introduce the members of the Alpha Student Chapter.

Thank You…

- We would like to extend a special thank you to the following people who were integral in establishing the student chapter:
  - Dave Ellis, Dan Watts, and the SURF academic committee
  - Tom Sale
  - Student officers and members
  - CSU Student Leadership, Involvement and Community Engagement (SLICE) office

Solicitation of Input from SURF

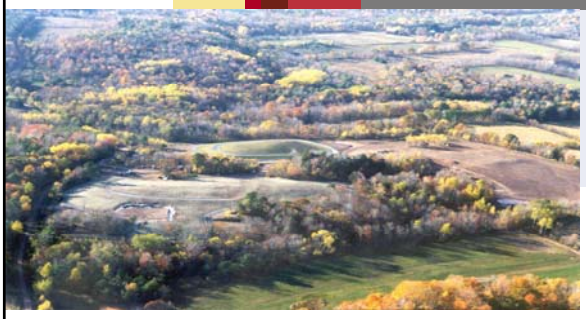
- At this time we would like to initiate an open discussion between SURF and student members to discuss chapter growth, SURF interaction with the student chapter, and development of student chapters at other schools.

Attachment 9
Reevaluation of a Record of Decision Using Sustainability Tools

Re-evaluation of a ROD Using Sustainability Tools

DuPont Corporate Remediation Group

July , 2010



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Background

Bell Landfill - 33 acre site

Used for municipal and industrial disposal

ROD Issued in 1994

Construction of remedy in 1999

- **Consolidated and capped waste**
- **Natural attenuation of ground water**
- **Provide leachate collection system**
- **Offsite disposal**

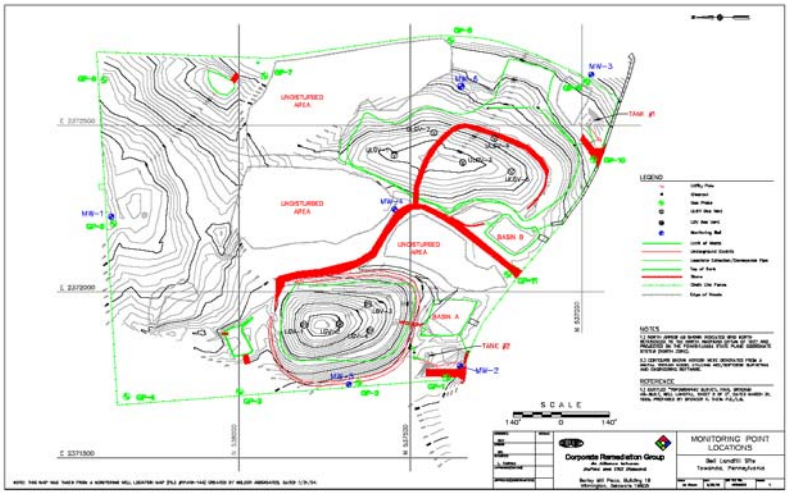
Example Sustainability Assessment: Managing Bell Landfill Leachate

Former industrial landfill
- **13 hectare**
- **Soil cap, grass**
- **200 m^3/yr leachate**

Current off-site disposal
- **Leachate collection**
- **Every two weeks**
- **Transport (170 km)**
- **Disposal at POTW**

Alternate technologies
- **Constructed wetland**
- **Spray irrigation**

Bell Landfill Site Layout



Trucking Issues

More Trucks Than Desirable

Damage to unimproved Roads

Noise

Residential/Rural Neighborhoods

Parallel Work Streams

Can Leachate Be managed On-Site?

Internal Technical and Financial Evaluation

Administrative and Regulatory Requirements

Sustainability Analysis

Leachate Volume Issues

Year	Unlined Cell Tank 1 (gal)	Lined Cell Tank 2 (gal)	Total (gal)	Truck Loads
1999	59,900	173,418	233,318	36
2000	55,653	326,062	381,715	59
2001	26,321	205,410	231,731	36
2002	47,734	429,416	477,150	73
2003	56,117	588,423	644,540	99
2004	56,582	669,418	726,000	112
2005	75,000	457,500	532,500	82
Total:	377,307	2,849,647	3,226,954	496
Average:	53,901	407,092	460,993	71

Flow Rate of Tank 1: 0.12 gal/min
Flow Rate of Tank 2: 0.90 gal/min

Leachate Analytical
Tank 1 Historical Analytical Summary

Leachate Collection Tank 1 - Historical Analytical Summary								
Sample ID	TANK-1	TANK1	TANK-1	TANK1	TANK-1	TANK1	TANK-1	TANK-1
Date	8/21/01	11/6/01	8/21/02	11/12/02	8/20/03	11/18/03	11/10/04	11/9/05
Analyte								
2-HEXANONE	<3. U	<3. U	8. J	<3. U	<3 UL	<3 U	<3 U	<3 U
ACETONE	<6. U	15. J	92	9. J	16 J	8 J	<6 U	7 J
BENZENE	2. J	<1. U	0.9 J	<0.5 U	0.7 J	<0.5 U	<0.5 U	<0.5 U
CIS-1,2 DICHLOROETHENE	21	9	7	2. J	3 J	2 J	1 J	1 J
ETHANE	5.6	3.9 J	6.3	2.3 J	6.2	2.7 J	<1.0 U	1.3 J
ETHENE	2. J	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
ETHYL CHLORIDE	3. J	<2. U	3. J	1. J	2 J	<1 U	<1 U	<1 U
ETHYLBENZENE	2. J	1. J	2. J	<0.8 U	<0.8 U	<0.8 U	<0.8 U	<0.8 U
METHANE	13,000	7,900	16,000	3,700	7,700	3,300	260	1,800
METHYL ETHYL KETONE	8. J	8. J	21	5. J	3 J	<3 U	<3 U	<3 U
METHYL ISOBUTYL KETONE	10	<3. U	5. J	<3. U	<3 U	<3 U	<3 U	<3 U
METHYLENE CHLORIDE	5. J	<2. U	3. J	<2. U	<2 U	<2 U	<2 U	<2 U
TOLUENE	65	30	21	2. J	5 J	<0.7 U	<0.7 U	<0.7 U
TRICHLOROETHENE	2. J	<1. U	<1. U	<1. U	<1 U	<1 U	<1 U	<1 U
VINYL CHLORIDE	5. J	1. J	3. J	<1. U	2 J	<1 U	<1 U	<1 U
XYLENES	10	6	6	1. J	3 J	1 J	0.8 J	<0.8 U
IRON	92,200	74,800	65,300	81,800	60,800	42,100	17,300	40,000
MANGANESE	13,400	13,100	7,030	25,100	12,300	9,450	10,500	12,200
ALKALINITY, BICARB. AS CACO3 AT PH 4.5 *	1,260,000	1,160,000	1,310,000	885	1,010	812	649,000	570
ALKALINITY, CARB.AS CACO3 AT PH 8.3*	<410 U	<410 U	<410 U				<410 U	
CHLORIDE	9,400	9,200	365,000	201,000	238,000	187,000	132,000	127,000
NITRITE	79	121	17 J	24 J	94	19 B	<15 U	<15 U
TOTAL ORGANIC CARBON	110,000	89,000	114,000	58,700	77,500	56,500	40,800	34,200
Units µg/L except *, w hich is mg/L as CACO3 All analysis Total, not filtered.								

Sampled per project QAPP.
Only detects summarized.

Tank 1 Historical Analytical Summary

Steady Decrease in Organic Compounds - trace concentrations

Historically more organics at higher concentrations than Tank 2

Steady State for Iron & Manganese

Higher Iron, Lower Manganese than Tank 2

Evidence of Reductive Dechlorination (Methane, Chloride, TOC)

Project Evaluation for Management

NPV calculations

Reduced annual maintenance

Construction cost

Other (trucks, roads, neighbors)

Sustainability

Address Regulatory Concerns

Runoff - runoff from precipitation. System balanced/rotated to prevent excess application in single area

Lateral drainage - no leachate discharged, treated water

Synthetics Compatibility - design to include either literature evaluation or 9090A leachate compatibility test results

Module 14 - will be updated to include organics

Module 20 - depth to water at impoundment area greater than required

Vegetative Cover - O&M plan for system will include maintenance of vegetative cover

Regulatory Interaction

Reviewed alternatives with agencies

Protection of surface waters is concern

Administrative steps worked out

Explanation of Significant Difference (ESD) needed

PA Modules for Land Application Review

Technical Program

Test leachate on cover soils

Test soil for Cation Exchange Capacity

Conceptual design for PADEP Land Application Permit Modules

Field measurements of soil moisture

Weather station to verify assumptions

Bell Landfill Technology Assessment

Technology	Energy Consumption	Resource Use	Releases to Environment
Off-site disposal	• Transportation - Disposal • Electricity - Pumping - Disposal	• Diesel fuel	• Carbon dioxide • Mobile-source pollutants • Fixed-source (electricity) pollutants
Constructed wetlands	• Construction - Holding cell - Wetlands • Electricity - Pumping	• Diesel fuel • Soil for holding cell	• Carbon dioxide (fuel less fixation) • Mobile-source construction equipment pollutants • Fixed-source (electricity)
Spray irrigation	• Construction - Holding cell - Spray field • Electricity - Pumping	• Diesel fuel • Soil	• Carbon dioxide (fuel less fixation) • Mobile-source construction equipment pollutants • Fixed-source (electricity) pollutants

Bell Landfill Sustainability Metrics

Sustainability Metric	Offsite GW Disposal	Wetland	Spray Irrigation
Energy			
Fuel (GJ)	**(46,222)**	**(439)**	**(439)**
Resources			
H_2O (cubic meters)	**(5,734)**	**0**	**0**
Land (hectare)	**0**	**0**	**0**
Releases			
CO_2 (ton)	**610**	**(2,859)**	**(2,826)**
NOx (ton)	**97.3**	**1.6**	**1.7**
SOx (ton)	**8.4**	**0.1**	**0.1**
VOCs (ton)	**0.0**	**0.4**	**0.4**
PM-10 Fugitive (ton)	**748**	**0.4**	**0.4**
PM-10 Combustion (ton)	**7**	**0.1**	**0.1**
Sludge (ton)	**(0.1)**	**0.0**	**0.0**
Exposure Hours	**25000**	**2300**	**2300**

Water Balance

Annual Stored Volume Total, V (gal) = V_{tw} + V_{ls} +V_{ps} - V_{es}

- V_{tw} = Total volume stored in winter
- V_{ls} = Volume of leachate during spray season
- V_{ps} = Volume of Leachate in Impoundment from Precipitation
- V_{es} = Volume loss due to evaporation

Design Assumptions:
- 25,000 SF impoundment
- No evaporation loss in winter
- Et must exceed Stored Volume

Water Balance Summary	Average Case	Worst Case
Stored Volume (gal)	550,078	838,683
Seasonal Add (gal)	391,786	601,877
Evaporation Loss (gal)	389,583	389,583
Total Season Spray Volume (gal)	552,280	1,050,976
Total (Et-precip) (gal)	810,499	1,163,480
Net volume (gal) (Spay - (Et-precip))	-258,219	-112,504
(Et-precip) (in/month)	1.19	1.71
Spray (in/month)	0.81	1.55
Assume 8 sprinklers, each with 100 ft radius of influence.		

Average case assumes SF = 2 for (Et-precip)
Worst case assumes SF = 1 for (Et-precip)

Cation Mass Balance & Exchange

Cation Exchange Capacity of the Cap Soil calculated per acre, 88.7E+06 meq/acre

Mass loading based on May 2006 Tank 2

Mass loading checked for avg. & max flow per year

Cumulative load to soil < PADEP non-resident soil Statewide Health Standard

Ion Selectivity Na(+) < Ca(2+) and Mg (2+) < Mn (2+) < Cu (2+) < Al (3+) < Fe (3+) < As(5+)

Design Assumptions:
- Use 1/2 MDL for non-detects
- Assume 100% adsorption
- Use 5 acres of landfill cap
- 22 years of irrigation at constant load

Soil Adsorption Capacity Summary	Average Case	Worst Case
Leachate Volume (gal/yr)	4.76E+05	7.18E+05
Application period (years) =	22	
Equilibrium Concentration of Leachate (meq/L)	4.15	
Leachate mass load of equivalents (meq) =	1.64E+08	2.48E+08
Net CEC in 1 acre of soil (24" thick) (meq/acre) =	8.87E+07	
Number of acres required =	1.85	2.79
OK since leachate will be sprayed over 5 acres.		

Soil adsorption capacity calculated from CEC for 1 soil sample of cap cover soil.
Maintaining adsorption capacity is a function of soil pH.


The spray irrigation system

Timeline

Proposed Alternatives	**June ‘06**
Sustainability review	**Oct ‘06**
Proposal to Agencies	**Oct ‘07**
Approval	**April ‘08**
ESD	**July ‘08**
Design	**June ‘08**
Construction	**August ‘08**
Operating	**July 2009**

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Attachment 10
Case Study Using an Economic Model to Estimate Cross-Media Pollution

Using an Economic Model to Estimate Cross-Media Pollution: SF Bay Area Superfund Sustainable Remediation Case Study

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Northgate Environmental Management, Inc., Oakland, California

SURF 14
Colorado State University
Fort Collins, Colorado
July 14, 2010

Acknowledgments

Northgate Staff and Interns:
Mallika Kumar, Anya Starovoytov, Kevin Hultgren
Sam Leavitt, Sarah Price, Corinne Nelson

Christopher Dumas, University of North Carolina
Peter Berck, University of California, Berkeley

US EPA Region IX
San Francisco Bay Regional Water Quality Control Board

Outline

- Introduction
- Study objectives and approach
- Case study sites
- Economic model
- Model results
- Sustainability / efficiency assessments
- Conclusions
- Applications / recommendations

Introduction

- Goal of remediation: reduce pollution and protect human health and the environment
  - Restore groundwater quality, remove soil
  - Risk-based cleanup levels
  - Risks from site COCs only
- Side-effect of remediation: cross-media pollution
  - Transfer from one medium to another
  - Related activities as pollution source
- New paradigm: balance benefits and impacts of remediation activities

Study Objectives

- Model cross-media impacts and assess the efficiency of Superfund cleanup programs by:
  - Comparing $ input to $ output
  - Estimating direct/indirect pollution
  - Comparing environmental benefits to environmental impacts
  - Estimating direct CO_2 and groundwater impacts
  - Assessing health risk due to vehicle travel

Study Approach

- Select sites and gather data
- Tabulate capital and annual costs
- Categorize goods and services
- Simulate economic impacts, air emissions, and wastewater discharges
- Evaluate groundwater extraction and mass removal, and estimate CO_2 emissions

Remediation Sites

Study Approach

- Select sites and gather data
- Tabulate capital and annual costs
- Categorize goods and services
- Simulate economic impacts, air emissions, and wastewater discharges
- Evaluate groundwater extraction and mass removal, and estimate CO_2 emissions

Study Approach

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Study Approach

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- Evaluate groundwater extraction and mass removal, and estimate CO_2 emissions

Economic Model

- Input-output model (IMPLAN™)
  - Economic data – remediation expenditures for capital improvements and consumable goods (e.g., annual O&M)
    - 440 industrial categories (aggregated to 74)
  - Calibrated with site-specific data
  - Pollution data – direct and indirect impacts (e.g., pollution from linked economic activities)
    - CARB database for air emissions
    - SWRCB database for water discharges

Economic Model Results

- Economic effects
  - Scenario 1 - as installed
  - Scenario 2 - "optimized"
  - Scenario 3 - monitoring only
- Remediation costs (capital, annual) → Change in economic output
  - Indirect (inter-industry) and induced (households) output
- % change in regional and California output
- Direct/indirect cross-media impacts

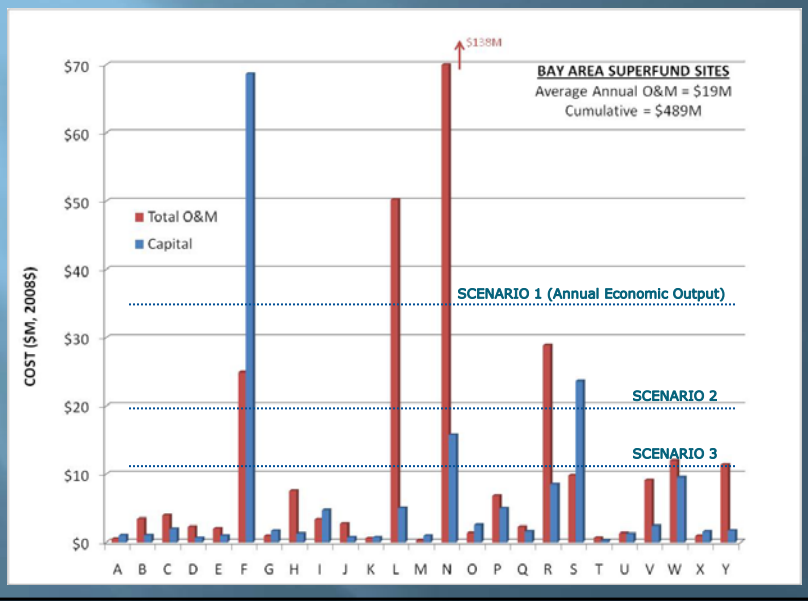
IMPLAN™ Model & Cross-Media Pollution Results

PARAMETER		SCENARIO 1 Capital Investment Year	SCENARIO 1 Annual O&M Year	SCENARIO 2 Annual O&M Year	SCENARIO 3 Annual O&M Year
Reactive Organic Gases (VOCs)	tons	85	4.3	2.3	1.1
Carbon Monoxide (CO)	tons	160	24	14	7.4
Nitrogen Oxides (NO_x)	tons	42	6.8	4.1	1.9
Sulfur Dioxide (SO_x)	tons	5.3	0.9	0.5	0.2
Particulate Matter (PM)	tons	52	6.5	3.6	2.0
Wastewater (MGal)		73	10	5.6	3.1
California (% change)		0.007%	0.001%	0.0005%	0.0003%
Bay Area (% change)		0.02%	0.003%	0.002%	0.001%
Bay Area (net change)		$247M	$34M	$19M	$11M

Cross-Media Air Pollution Results

IMPLAN INDUSTRY SECTOR	ROG (VOCs)	CO	NO_x	SO_x	PM
Waste management and remediation services	49	3.9	3.1	0.83	2.6
Asphalt shingles and coatings	11	0	0	0	0.01
Ground/road transportation	9.1	80	21	0.07	18
Rail, air, and water transportation	3.7	21	10	3.0	0.90
Other fuel combustion	3.5	52	4.3	0.25	22
Other consumer goods and miscellaneous manufacturing	2.5	0	0	0	0
Chemicals, paint, and adhesives	2.3	0.01	0.02	0.05	0.07
Petroleum refining and products	2.3	0.69	0.84	0.85	0.19
Miscellaneous consumer services	0.58	0	0.0002	0	0.001
Agriculture and forestry	0.27	0.26	0.25	0	0.62
Fertilizers	0.18	0	0	0	0
Electric power generation, transmission, and distribution	0.18	1.8	1.2	0.15	0.28
Printing	0.13	0.0001	0.0002	0	0.002
Oil and natural gas	0.08	0	0	0	0
Pesticides and other agricultural chemicals	0.06	0	0	0	0
Heavy machinery and machine tools	0.05	0.02	0.02	0.003	0.10
Water, sewage and other treatment and delivery systems	0.03	0.01	0.01	0.01	0.001
Primary metals production	0.02	0.26	0.36	0.10	0.38
Pulp and paper	0.02	0.01	0.01	0.0002	0.10
Wood products	0.01	0.003	0.003	0.0001	0.03
Fabricated metal products	0.004	0.01	0.01	0.0002	0.02
Communications equipment and computers	0.002	0	0.0002	0	0.0002
Electrical equipment	0.001	0	0.0002	0	0.0002
Brick, glass, and ceramics	0.0002	0.005	0.04	0.01	0.01
Construction	0	0	0	0	6.32
Total Emissions	**85**	**160**	**42**	**5.3**	**52**

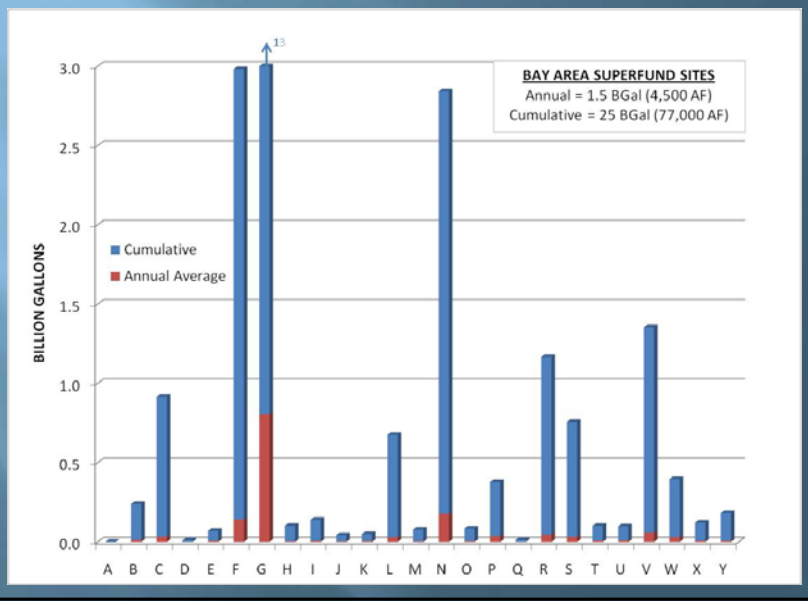
Remediation Costs



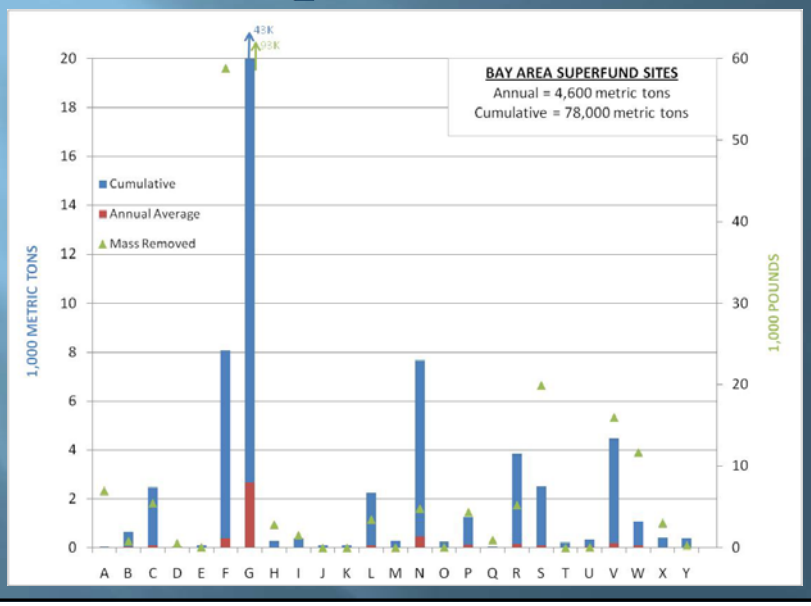
Sustainability Assessment

- Groundwater consumption
- Carbon dioxide emissions
  - System operation (electricity)
  - Travel to/from site (O&M, GAC delivery)
  - Treatment consumables (GAC, acid, etc.)
- Mass removal efficiency
- Traffic risk and excess benzene emissions

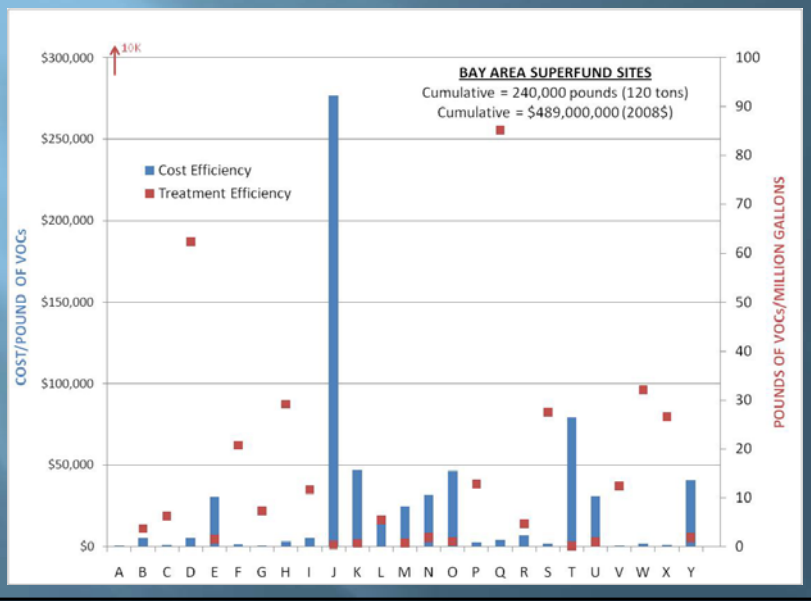
Groundwater Extraction



CO_2 Emissions



Mass Removal Efficiency



Vehicle-Related Travel Risk

- Direct cross-media pollution risks
- Traffic fatalities
  - 1.04 fatalities per 100 million miles (CalTrans)
  - 3.3 x 10^{-4} annual fatalities

    EPA uses the general 10^{-4} to 10^{-6} risk range as a "target range" within which the Agency strives to manage risks as part of a Superfund cleanup. *EPA OSWER Directive 9355.0-30*
- Excess benzene emissions
  - 0.062 grams of hydrocarbon emissions per mile (CARB)
  - ~1.4 kg of benzene emitted annually

    Excess cancer risk due to inhalation of ambient benzene concentrations is on the order of 1 x 10^{-4}. *California ARB*

Conclusions

- Superfund site remediation directly (~$19M/yr) and indirectly (~$11M/yr-$34M/yr) increases the economic output of the San Francisco Bay Area and California
  - Water, sewage, and other treatment and delivery systems
  - Fabricated pipe and pipe fitting manufacturing
  - Engineering, science, and architectural consulting services
  - Pump and pumping equipment manufacturing
  - Electric power generation, transmission, and distribution
  - Automotive repair and services
  - Miscellaneous rentals and leasing

Conclusions

- Superfund P&T remediation programs result in a net increase in pollution
  - Large water and CO_2 footprints and costs likely outweigh the benefits
  - ~160 tons of VOCs generated > 120 tons of VOCs removed via gw extraction and treatment
    - + 568 tons CO, 158 tons NO_x, 21 tons SO_x, 163 tons PM
- Minimizing groundwater extraction produces large net decreases in cross-media pollution
- Using the least energy-intensive technologies or making selective expenditures in the least polluting industry sectors would produce less cross-media pollution
  - increase mass removal rates!

Applications / Recommendations

- Itemized cost data can be used to estimate economic impacts by:
  - City
  - County or Region
  - State
  - Entire US or Outside US

…and changes in:

- Employment
- Household income
- Taxes

Applications / Recommendations

- Compare modeled cross-media pollution generation and economic impacts of various remedial technologies during the FS process
- Compare modeled cross-media pollution generation and economic impacts of onsite treatment, regional treatment, or at the tap
- Continue the dialogue with regulators and stakeholders regarding “common agency” and acceptable objectives, mechanisms, and metrics to balance pollution reduction and pollution generation

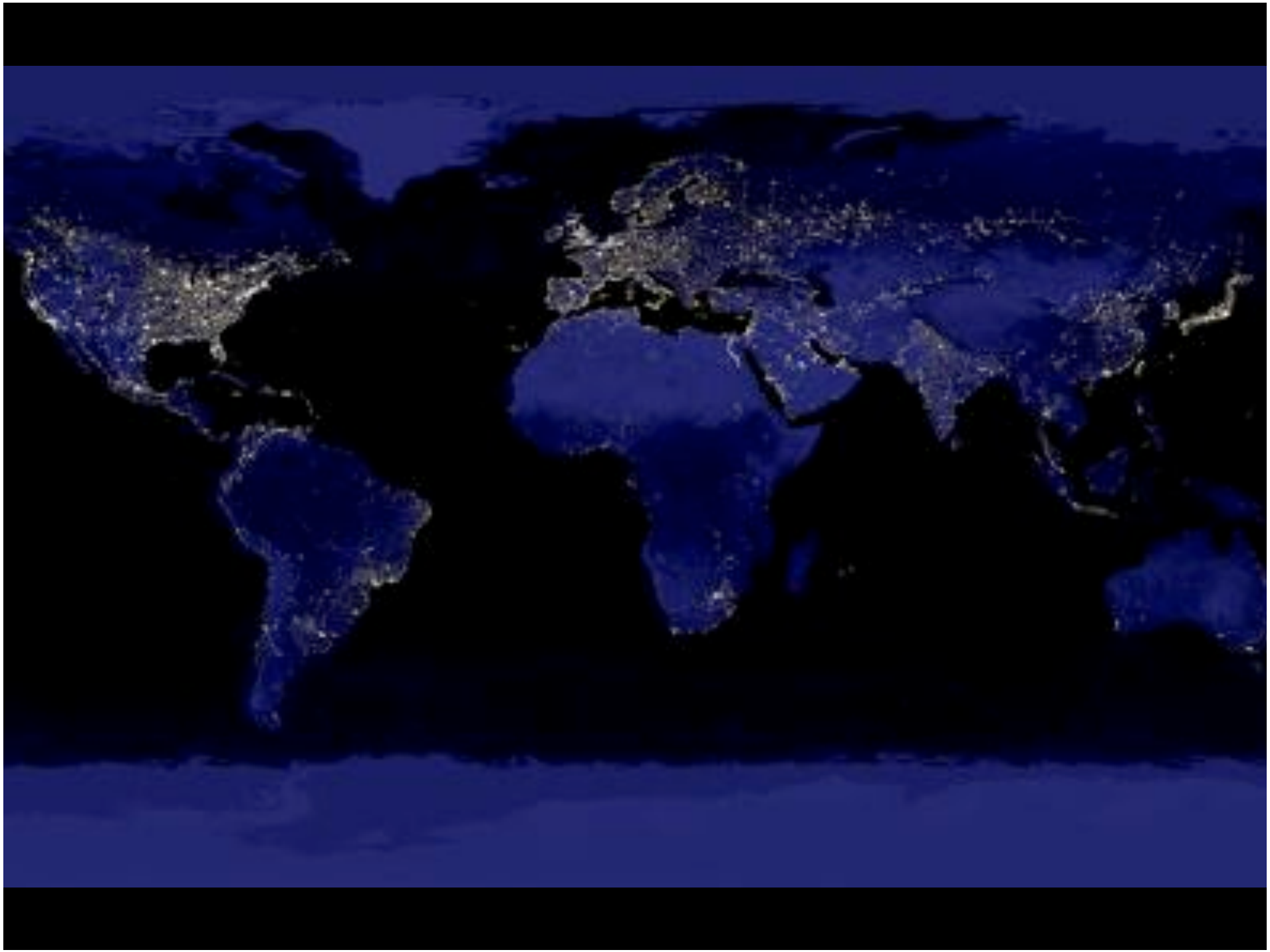
Attachment 11
Working Toward Global Change from Inside the University

SURF Conference, Wednesday July 14, 2010

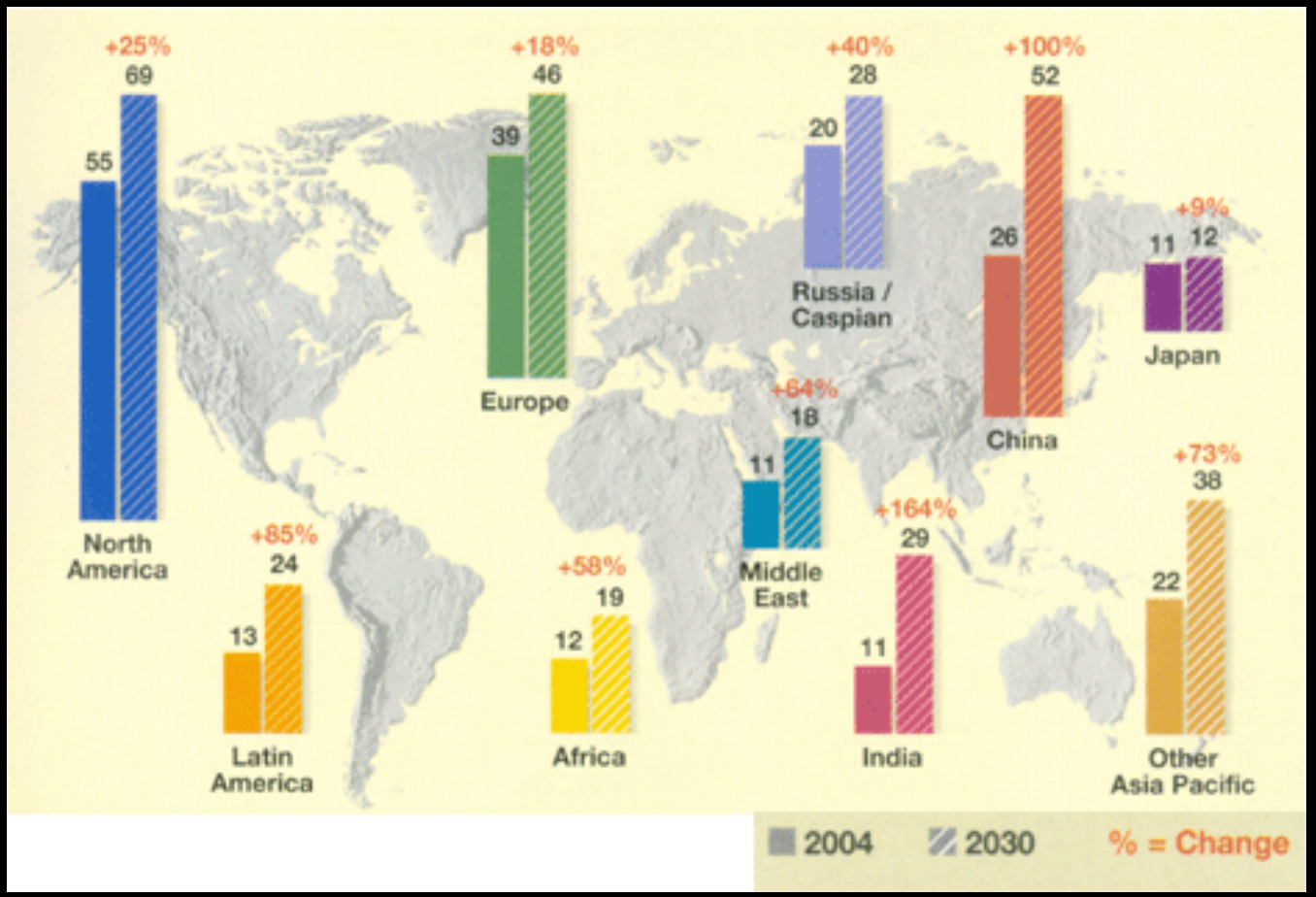
Dr. Morgan DeFoort, Co-Director, Engines & Energy Conversion Laboratory

ENERGY AT SCALE – GOT IMPACT?

Colorado State University

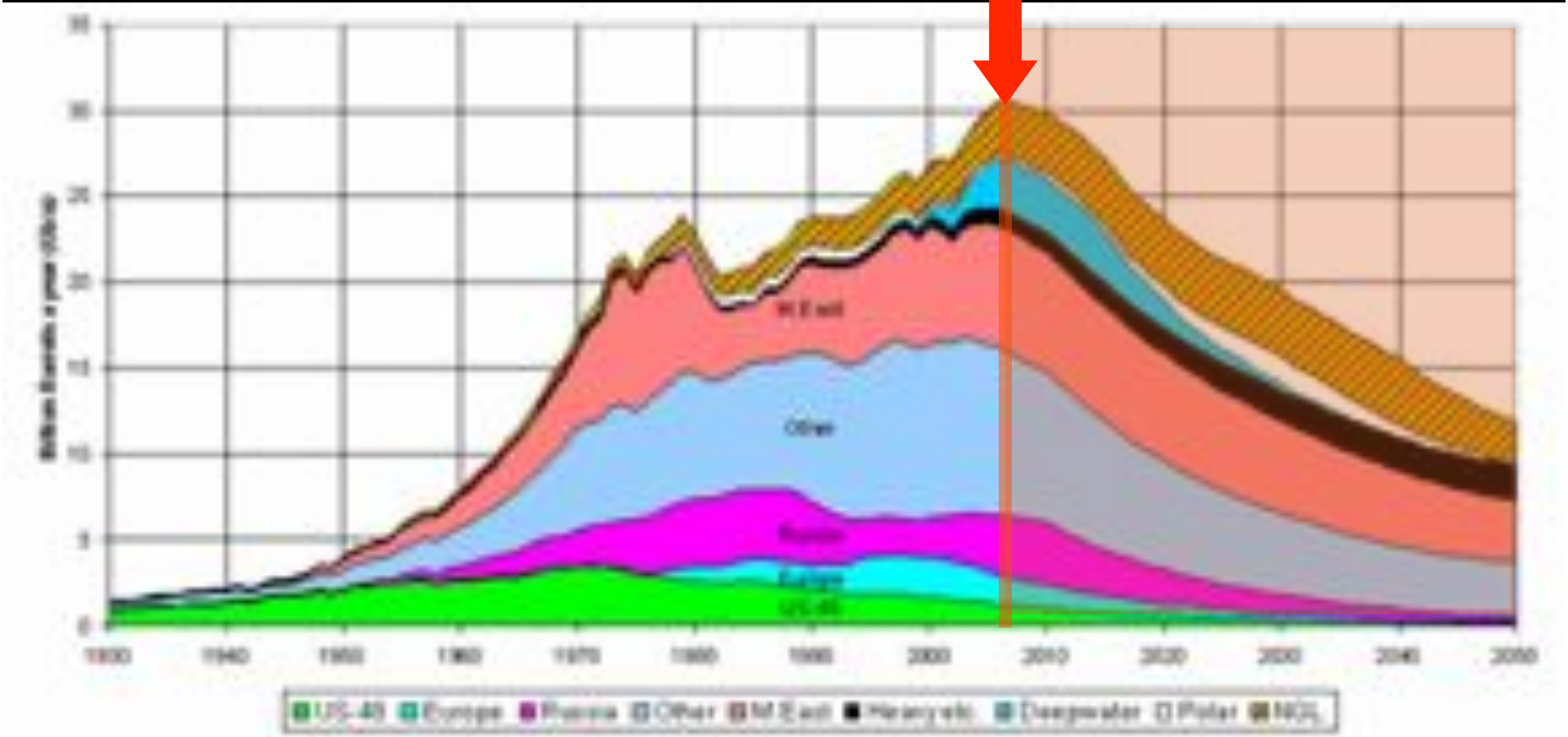


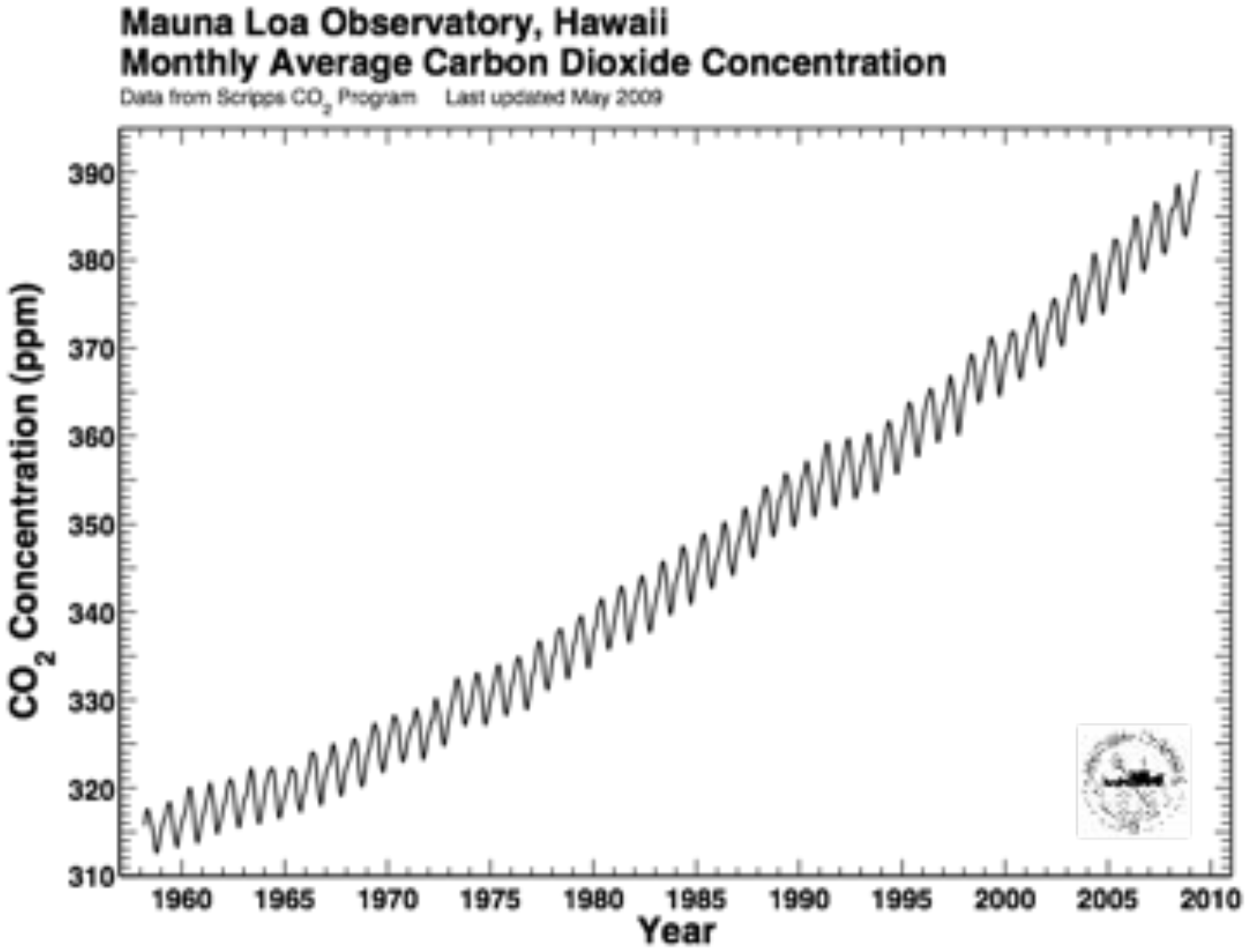
Growing World Oil Demand



World Oil Production

We're About Here



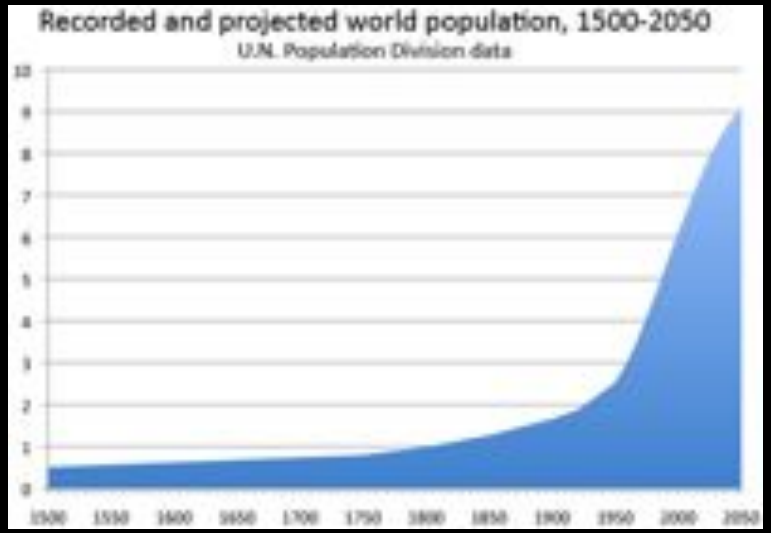

Mauna Loa Observatory, Hawaii
Monthly Average Carbon Dioxide Concentration
Data from Scripps CO2 Program Last updated May 2009
CO2 Concentration (ppm)
390
380
370
360
350
340
330
320
310
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
Year

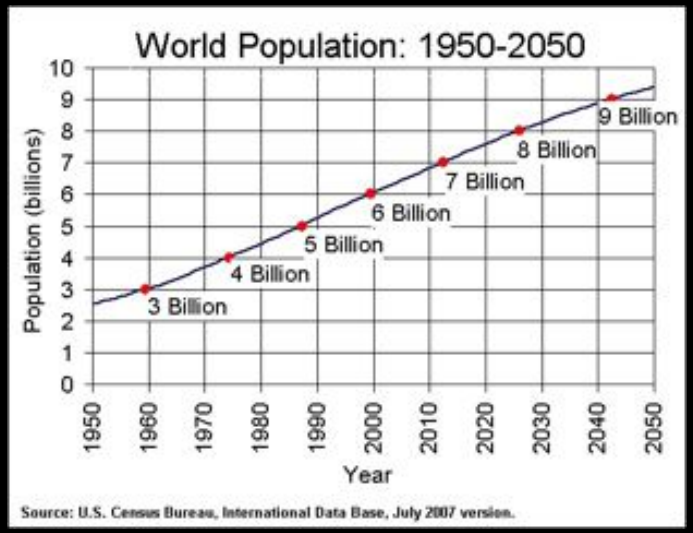
Sustainable Solutions?

The World Is Growing
6,832,886,582 . . . 583 . . . 584

On April 14, 2010:

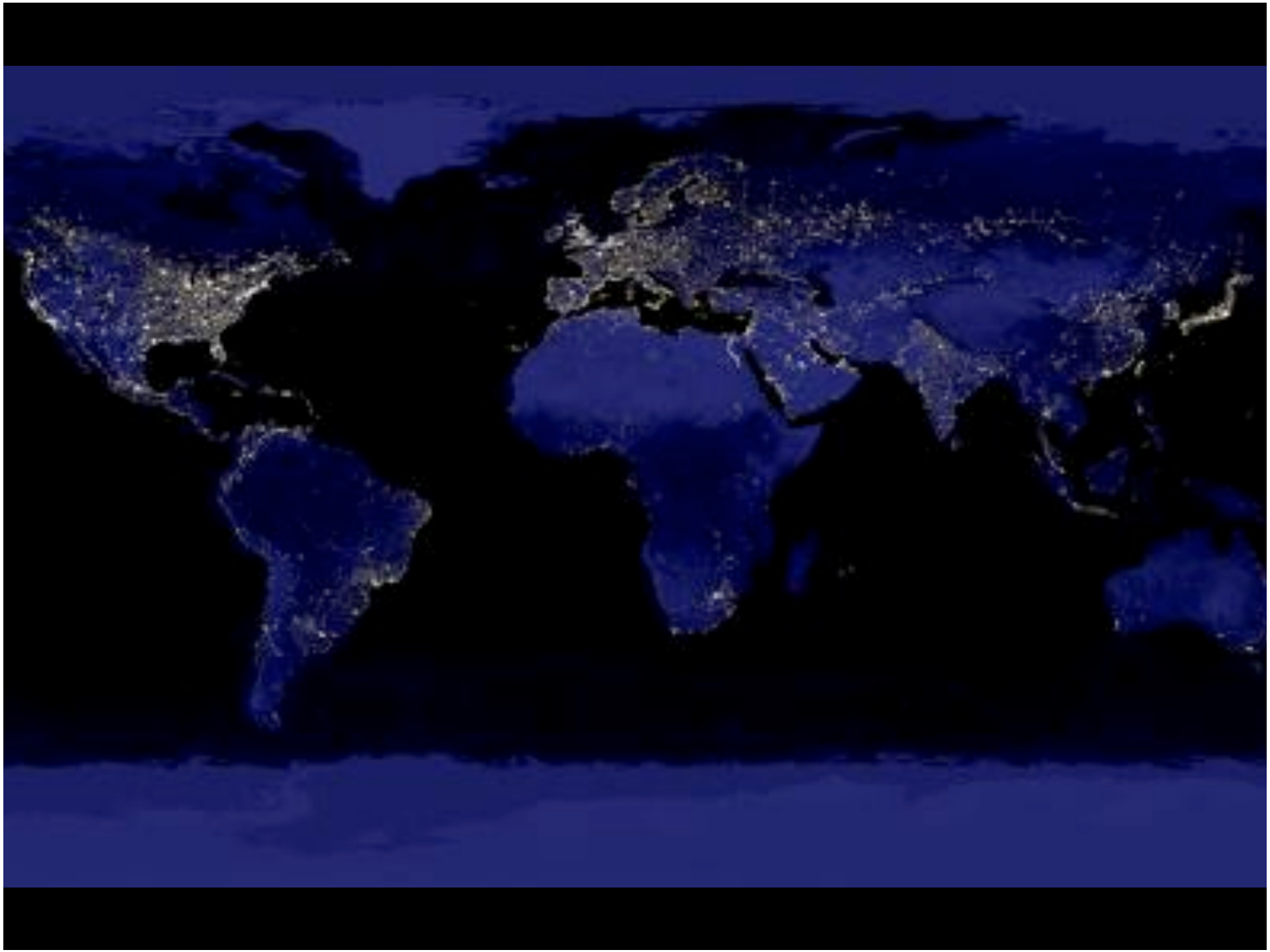
- **136,731 Births today**
- **59,742 Deaths today**
- **76,989 Net population growth for today**





Solutions in Energy & the Environment

- Energy is a basic human right
- The environmental and health impacts of energy are particularly high in LDCs
- Conventional enterprise has not served many energy markets
- Solutions are possible



Innovation is…

"Making a Dent in the Universe"

-Andy Hargadon, UC Davis School of Entrepreneurship

How does the EECL make a Dent?

What size of a Dent ~~can we make~~? *are we making?*

Indoor Air Pollution: The Result of Biomass Fuels

Classic 3-Stone Fire
Mwandi, Zambia (March '09)

Photos: B. Willson

“Improved” Cookstove
(Uganda, March ‘09)

Photos: B. Willson

Chimney from "Improved Cookstove"
(Uganda, March '09)

Photos: B. Willson

Photos: B. Willson

Design Studies

The Core of the Envirofit Cooking System™ **G3300**

Aspirational - Product that inspires people to want to own


ENVIROFIT
G-1100 COOKSTOVE


G-3300
Energy-Saving Chaotha
Clean-Burning, Time-Saving
FIVE YEAR WARRANTY
ON COMBUSTION CHAMBER
TWO YEAR WARRANTY
ON ALL OTHER COMPONENTS
ENVIROFIT

Retail Outlet

“Voice of the Customer”

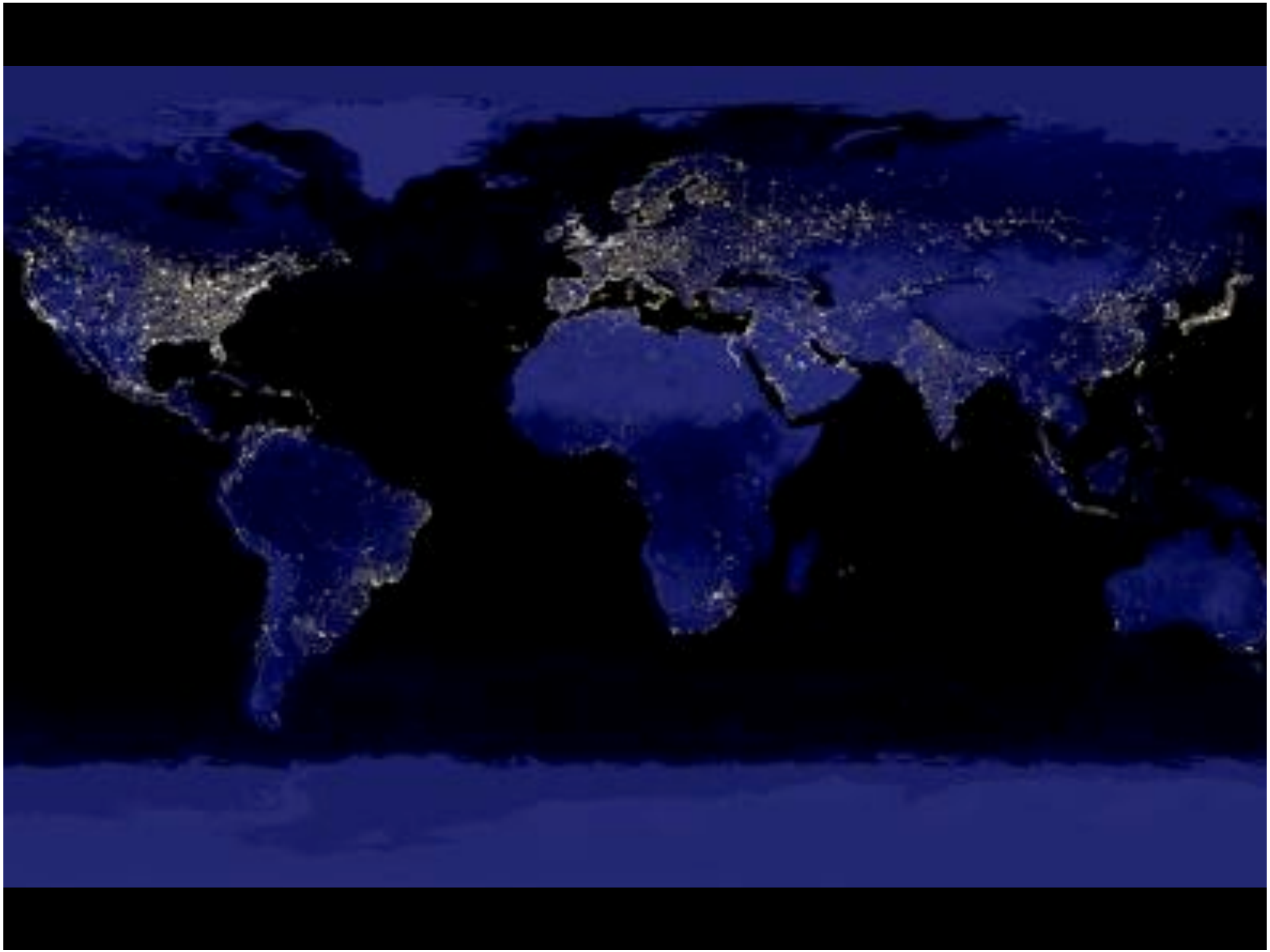
Women's Self-Help Groups
Village Entrepreneurs

“Bollywood” Van Campaign

. . . and painted houses. . .

. . . and painted elephants!

18 months: 100,000 stoves

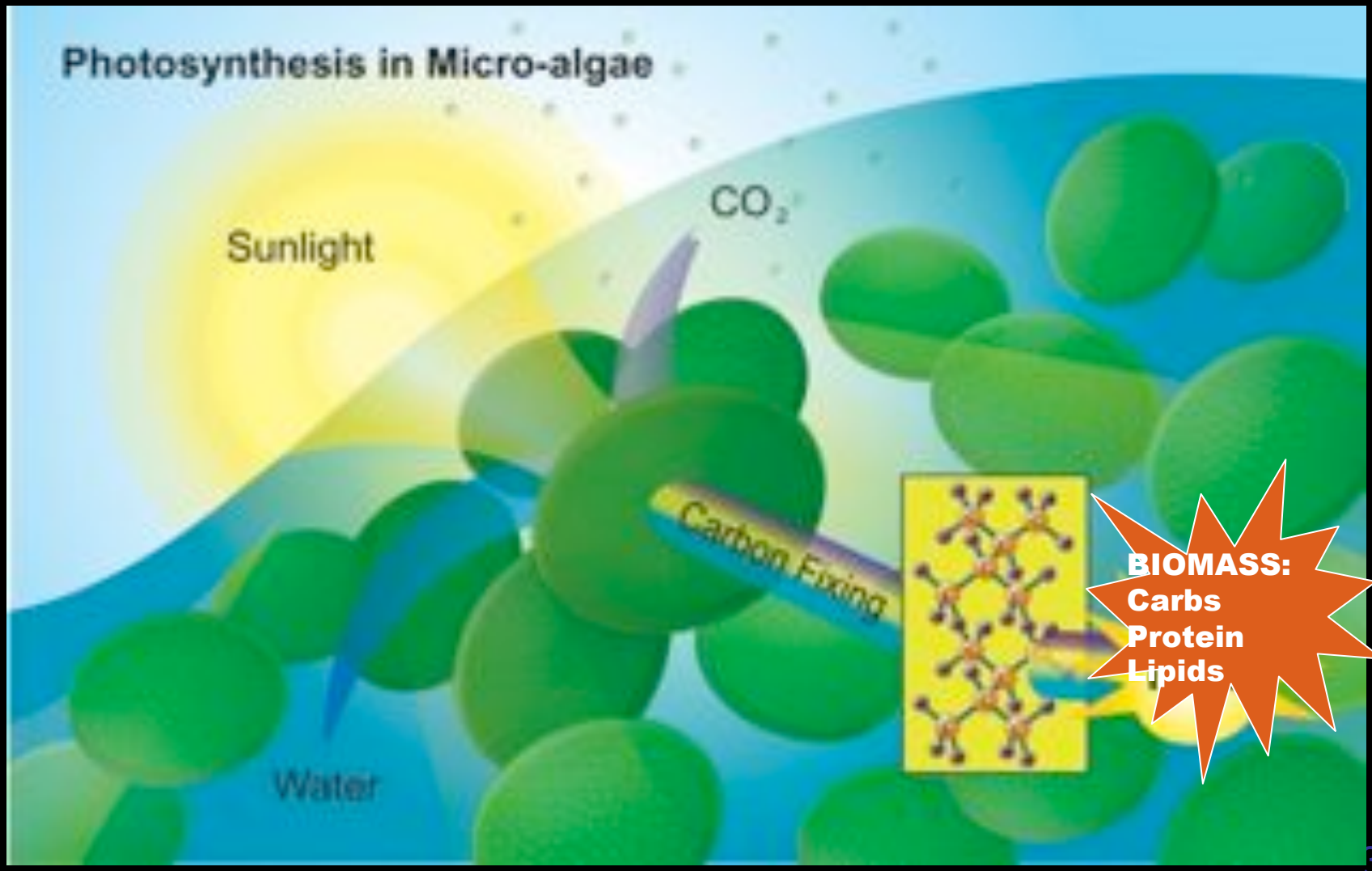



BERGE NORD
1

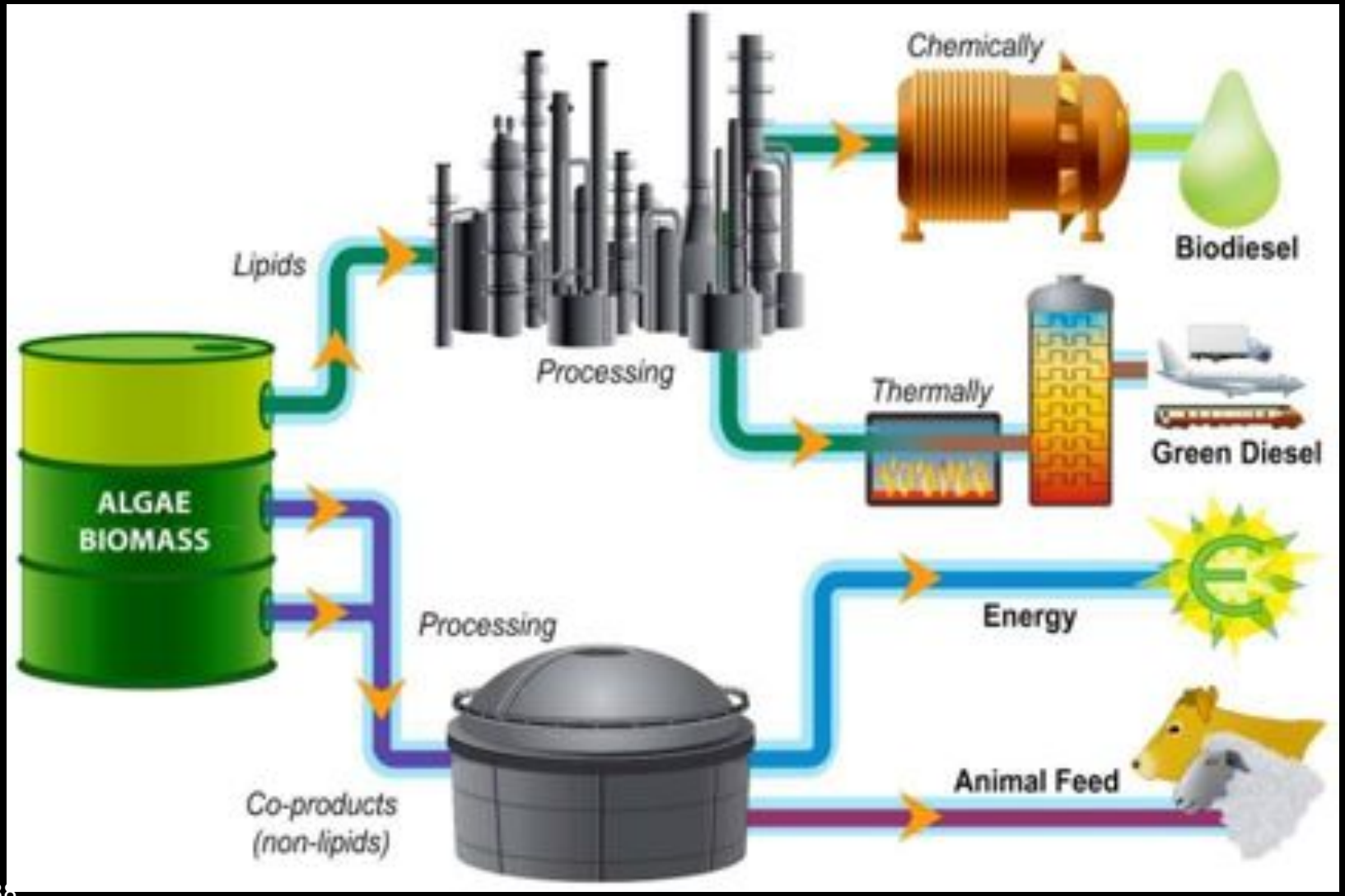
5 gallon gas = 85,000 AA's


Brooks Range
Mackenzie Mts
Alaska Range
Coast Mts
Canadian Shield
Baffin Island
Greenland
Hudson Bay
Labrador Sea
Gulf of Alaska
C A N A D A
Great Plains
Laurentian Plateau
Labrador
Newfoundland
Great Lakes
Nova Scotia
Cascade Mts
Rocky Mts
Central Lowlands
Appalachian Mts
Pacific Ocean
U S A
Coastal Plain
Atlantic Ocean
Gulf of Mexico
MEXICO

Photosynthetis / Algae

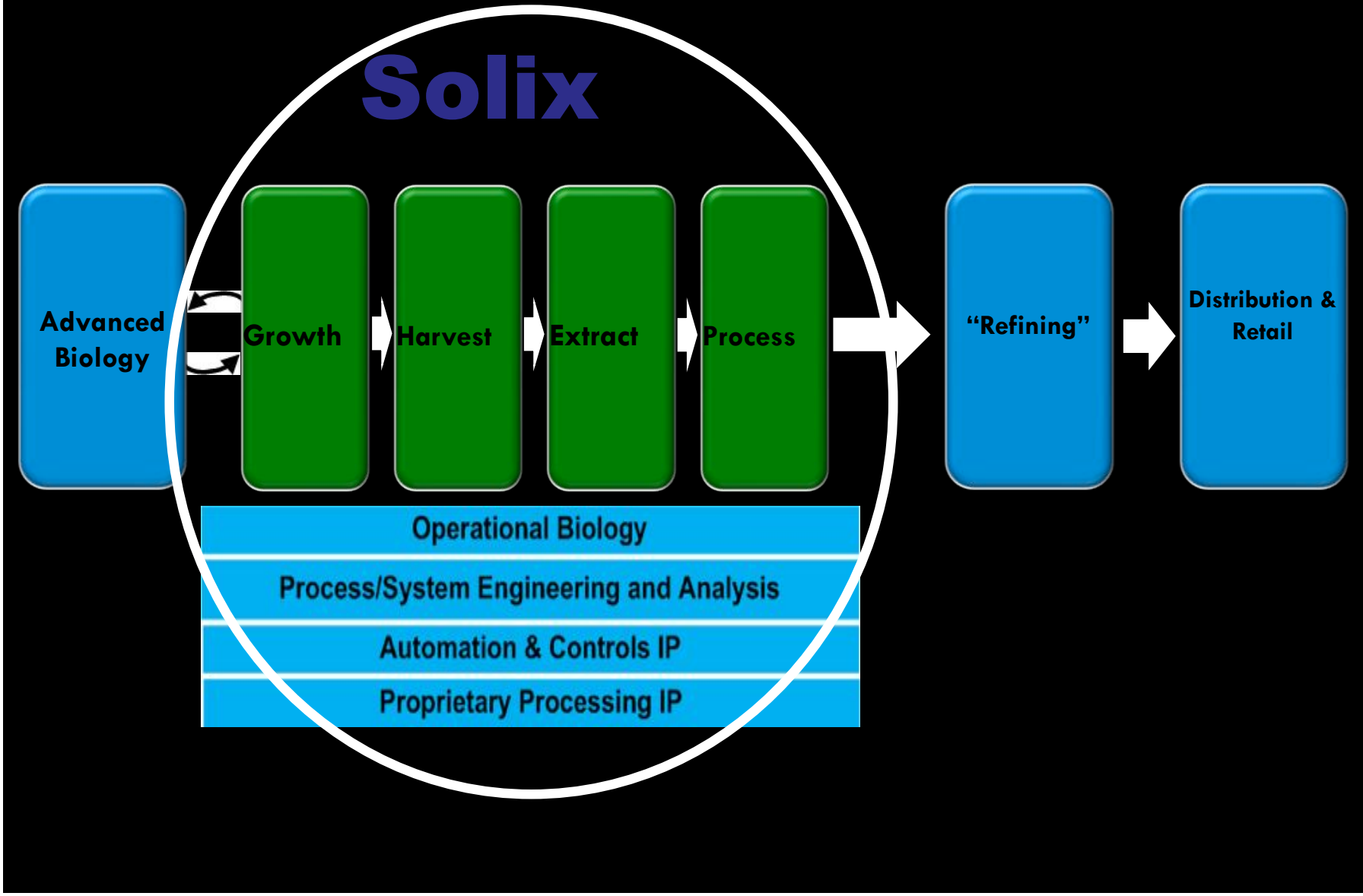


Processing



38

Solix Value Chain Positioning



Increasing Focus on Algae

Open Pond Cultivation: Dunaliella - Eilat, Israel

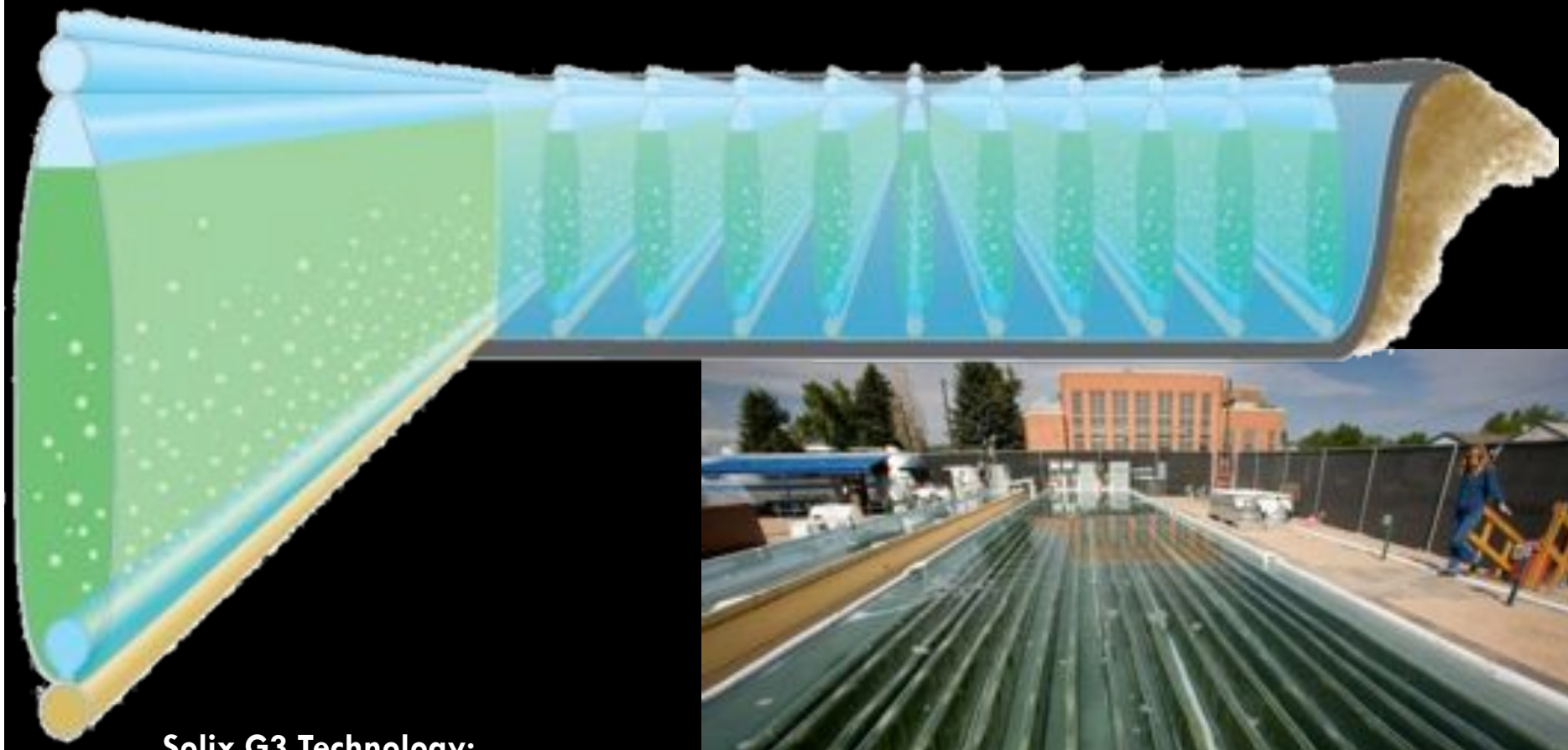
Direct Light PBRs:
GreenFuels, 1st Gen

Cost vs. Productivity

Direct Light PBR:
Low Cost & Productivity

Diffuse PBR:
High Cost & Productivity

3rd Generation PBR –Nov '07

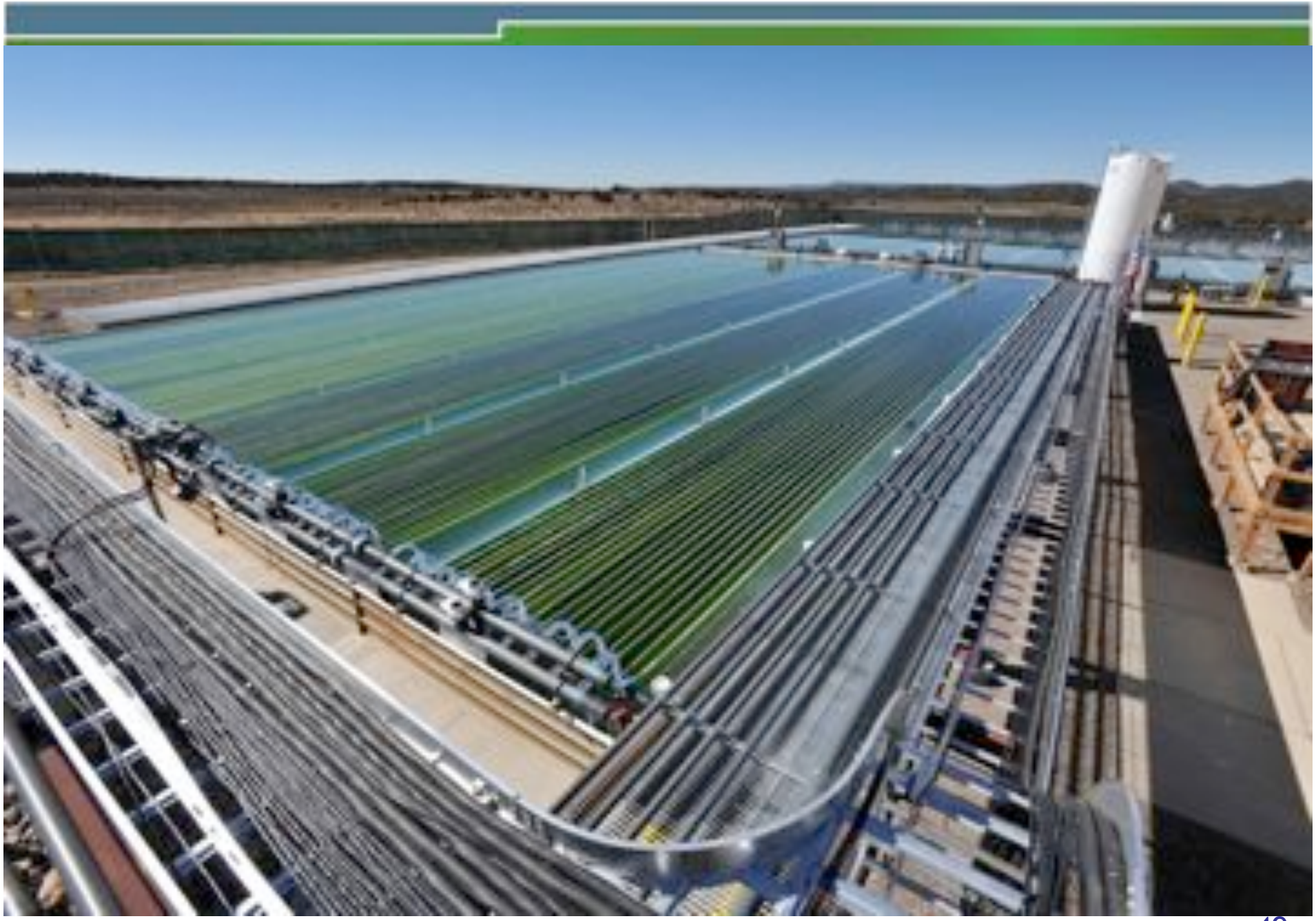


Solix G3 Technology:

- Extended surface area
- Water supported
- Integrated CO_2 / air sparging
- G4 under development


SOLIX
Algae. A better world


SOLIX




SOLIX

The Science of Scale

Attachment 12
Current Remediation Research at Colorado State University

Current Remediation Research at Colorado State University

Dr. Tom Sale
Colorado State University
970-491-8413

Presented at SURF 14

Wednesday, July 14, 2010

Colorado State University (CSU)

Dr. David McWhorter – Co-founder of the University Consortium and Principle Investigator (1987-2001). Emeritus faculty currently supporting students and faculty at CSU and ongoing studies at the Santa Susana field site in California.

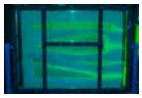
Dr. Tom Sale – Consortium funded PhD 1998. Consortium supported researcher since 1999. Currently:

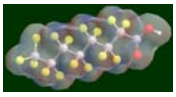
- Associate Consortium Director
- Associate Professor CSU
- Director of the Center for Contaminant Hydrology in Civil and Environmental Engineering at CSU

Center for Contaminant Hydrology in Civil and Env. Engineering

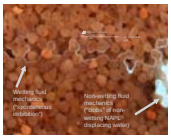
- Full Time Staff
  - Dr. Tom Sale
  - Dr. Julio Zimbron
  - Mitch Olson
  - Gary Dick
- Current Students
  - Three Ph.D.
  - Five MS
  - Four Undergraduates
- Resources
  - 7,000 ft² of office and laboratory space
  - Extensive analytical and field equipment
  - Large and small-scale sand tanks
- On Campus Affiliates
  - Dr. Mike Ronayne - Department of Geosciences
  - Dr. Chuck Shackelford – GeoEnvironmetal Engineering
  - Dr. Dave Dandy – Chemical Engineering
  - Dr. Thomas Borch – Soil and Crop Science

CSU Focus Areas





- Remediation
  - Source treatment via admixing reactive media
  - Treatment of contaminants in low permeability zones
  - Electrolytic treatment of persistent contaminants
- Transport
  - Storage and release of contaminants in low permeability zones
  - Use of tracers to resolve NAPL stability
  - Use of CO_2 traps to resolve losses from LNAPL
  - NAPLs as sheens in porous media
- Persistent Contaminants
  - Resolving pathways using quantum mechanics models
  - Novel processes for hydrophobic contaminants in soils
- Groundwater Resources
  - Sustainable development of groundwater resources
  - Subsurface water storage



University Consortium for Field-Focused Groundwater Contamination Research

USA

- CSU
- UC Davis
- UF
- UA

Canada

- UG
- UW
- UBC
- UNB

Current CSU Field Sites

Former Refinery Casper, Wyoming

F.E. Warren AFB Cheyenne, Wyoming

Pueblo Chemical Depot, Colorado

Refinery Commerce City, Colorado

Current Funding Sources

SUNCOR ENERGY

SERDP
Strategic Environmental Research and Development Program

Chevron

ExxonMobil
Taking on the world's toughest energy challenges.

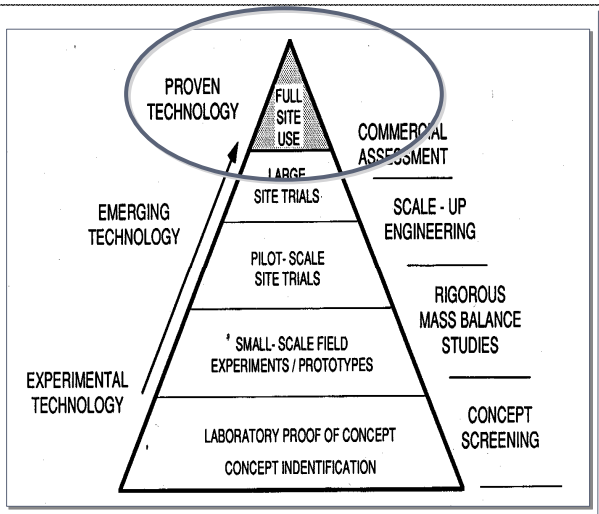
imagination at work

ESTCP

DUPONT

energy API AMERICAN PETROLEUM INSTITUTE

Mission – Education and innovative solutions



Pankow and Cherry 1996

A crisis is a terrible thing to waste…

breakthroughs happen only when conventional wisdom is ignored and cross-fertilization encouraged….

Risk and acceptance of failure are central to innovation ….

-Vinod Kholsa – "Silicon Valley luminary"

Innovation can be defined as: new products, business process, and organic changes that creates wealth or social value – OECD think tank

fresh thinking that creates wealth – Richard Lyons - Goldman Sachs

Novelty of some sort does matter, although it might involve an existing idea from ….

- Economist

Quotes from the Economist, Special Report on Innovation, Oct 13- 19, 2007.

2010 Status

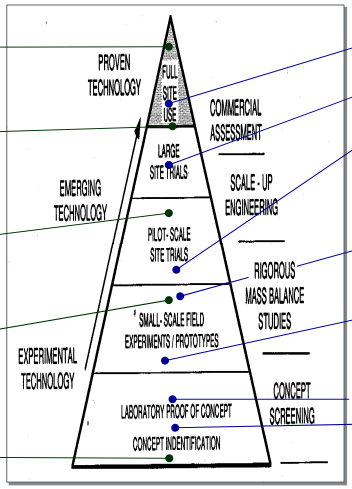
Constraints to partial treatment of sources (1)

Importance of contaminants in low k zones (3)

14 Compartment model for remedy selection

Shrinking and stable LNAPL bodies (1)

Niche for wellhead treatment



ZVI-Clay (4)

Tracers in LNAPL (3)

Computational chemistry for emerging [C] (1)

Electrolytic treatment (2)

CO_2 traps for natural loses of LNAPL

CPS Treatment of cont. in low k zones

Solution for sheens from soils

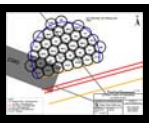
ZVI-Clay sites

DuPont (1996-2004) and Colorado State University (2004 – present)

- Completed projects (9)
- Pending projects (4)
- Pending Lab studies (4)
- Lab studies w/o field application (4)

Implementation Steps

(Photos courtesy of Tetra Tech NUS Inc. and Geo-Solutions Inc.)



1) Clear shallow soils
2) Mix while adding grout
3) Multiple passes at each location
4) Place shallow soils as a surcharge
5) Treatment and settlement

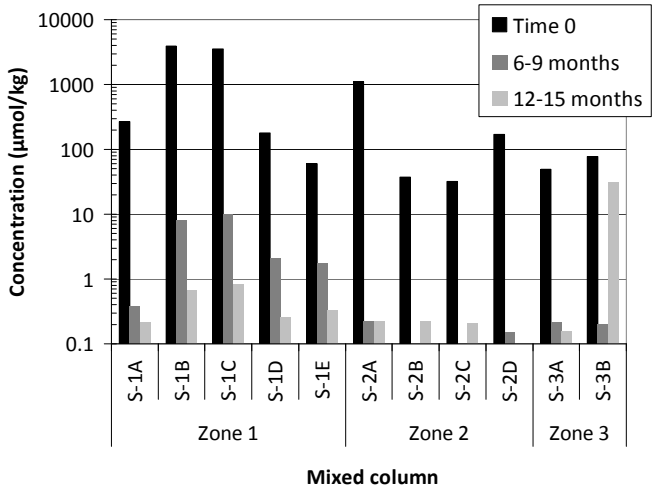
Most recently

In situ admixing of zero valent iron and clay

30,000 cubic yards

Data Courtesy of CH2M HILL

2-3 order of magnitude reduction in [C]



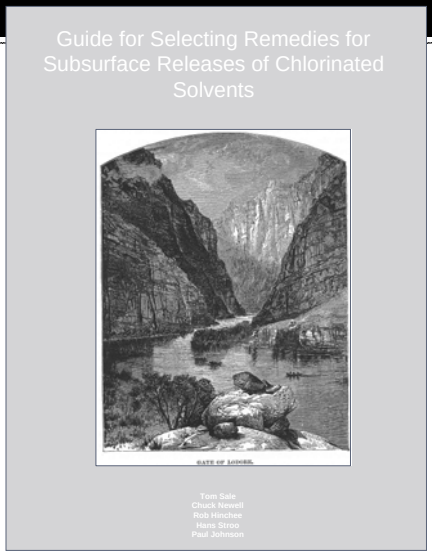
Data Courtesy of CH2M HILL

	Site	*Year*	*Primary CVOC*	*Treated Volume (yd³)*	*Facility*	*Treatment notes*
1	Kinston, VA	1999	TCE	Small (pilot)	Manufacturing	90% removal of TCE (jetting employed as opposed to soil mixing; inefficient mixing)
2	Martinsville, VA	2002	CT	3,800	Lab disposal	99.99% removal of CT in soils over 1 year
3	Camp Lejeune, NC (Site 88)	2005	PCE	7,000	Dry cleaner	up to 99.9% PCE removal in soils
4	Arnold AFB, TN	2005	TCE	2,280	Disposal area	Mixed using Lang tool, performance monitoring ongoing
5	DoD Site, VA	2006	CVOC mixture	1,150	Electronics	99.9% in water – ND in soil – water VOCs < MCLs
6	Lake City, MO	2007	TCE	7,000	Ammunition manufacturing	Mixed in tight clays, uniform delivery of iron demonstrated
7	Florence, SC	2007	CVOC mixture	1,160	Manufacturing	Mixed using Lang tool, performance monitoring ongoing
8	Camp Lejeune, NC (Site 89)	2008	TCE and 1122-TCA	30,000	Disposal area	CVOCs reduced by __% (median) Hydraulic conductivity reduced by 99.5%
9	Skuldelev, Denmark	2008	PCE	260	Industrial	Abiotic reduction apparent – analysis ongoing

- >50,000 cubic yards of contaminated soils treated
- Typical removal rates: 99.9 to 99.99% within 1-2 years of treatment
- **~ 70 tons of chlorinated solvent removed from the environment**

Decision guide for selecting remedies for chlorinated solvent releases (14 Compartment Model)

ESTCP Project (ER-0530)

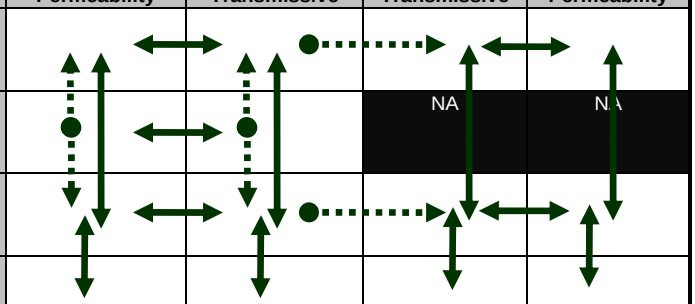


The 14 Compartments Model

(a holistic perspective)

	Source Zone		Plume	
Phase/Zone	Low Permeability	Transmissive	Transmissive	Low Permeability
Vapor				
DNAPL			NA	NA
Aqueous				
Sorbed				

With connecting fluxes

	Source Zone		Plume	
Phase/Zone	Low Permeability	Transmissive	Transmissive	Low Permeability
Vapor				
DNAPL			NA	NA
Aqueous				
Sorbed				

Order of Magnitude (OoM)

Pronunciation Uuuuuum or Ommmmm

Concentrations in GW Equivalents

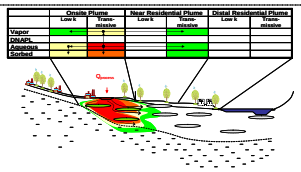
- 0 – Not impacted
- 1 – 1s of ug/L in water
- 2 – 10s of ug/L in water
- 3 – 100s of ug/L in water
- 4 – 1000s of ug/L in water or greater

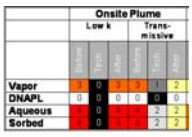
Treatment

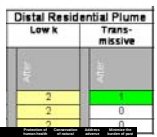
- 3-4 – 99.9% or better
- 2 – 99 %
- 1 – 90%
- 0 – 9% or less

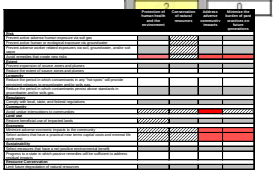
Application of the 14 Compartment Model

- Mapping Distribution of Contaminants
  - Through time
  - As a function of setting
- Mapping the effect of technologies
  - In retrospection
  - *A priori*
- Resolving what remains
- A basis for comparing anticipated results to anticipated outcomes

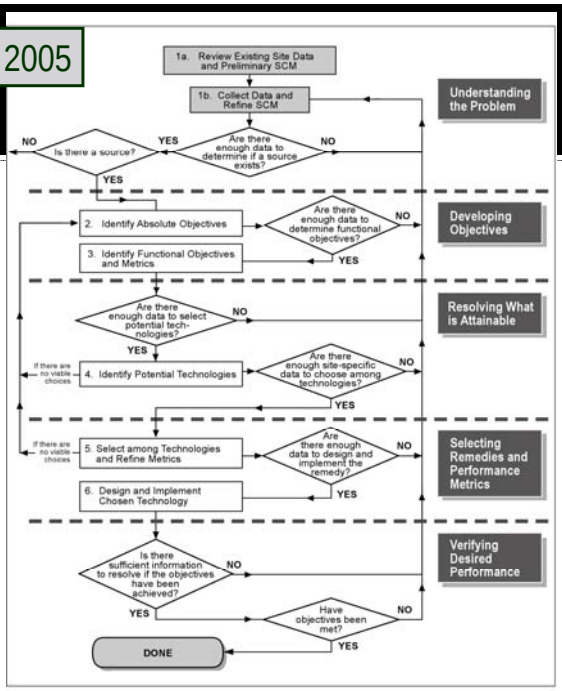


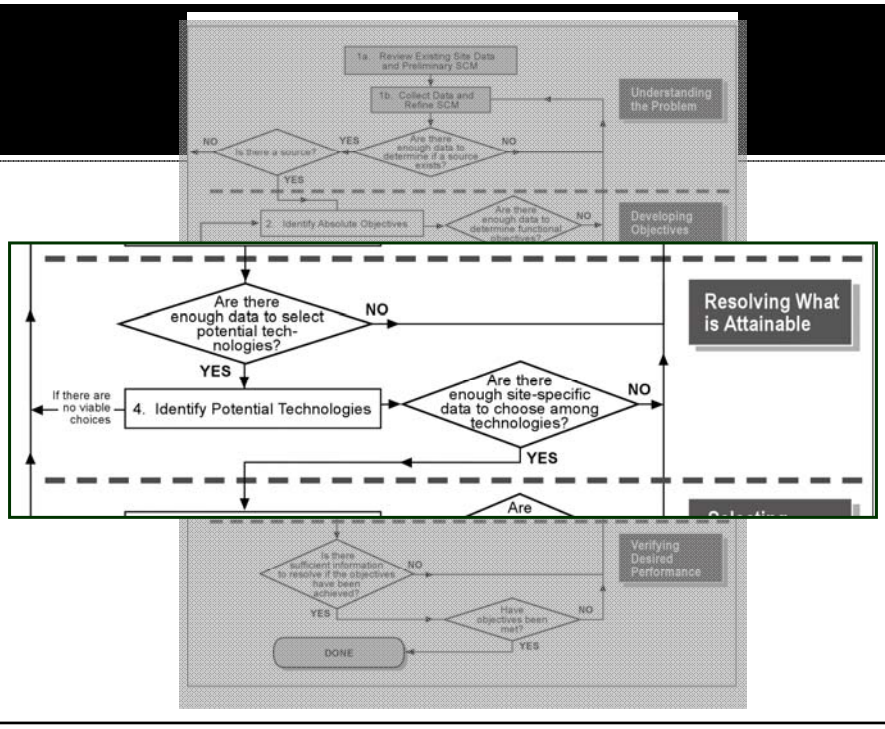






After NRC 2005





A holistic approach

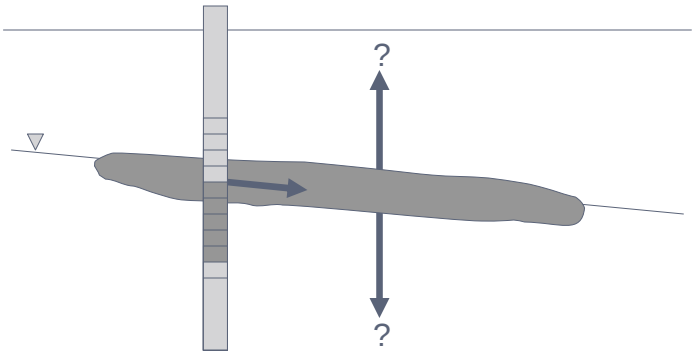
Acknowledgements

- ESTCP
  - Hans Stroo
  - Andrea Leeson
  - Jeff Marqusee
- Collaborators
  - Paul Johnson
  - Rob Hinchee

A Mass Balance Approach to Resolving the Stability of LNAPL Bodies

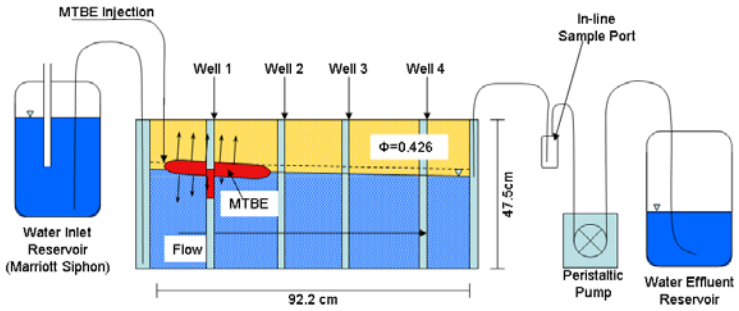
Nicholas Mahler and Tom Sale
Colorado State University

Background



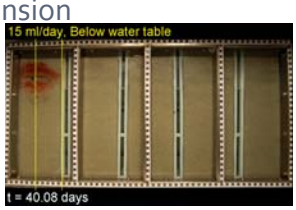
Laboratory Study

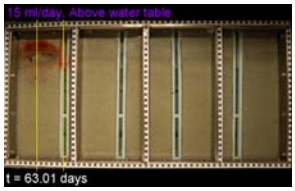
Setup

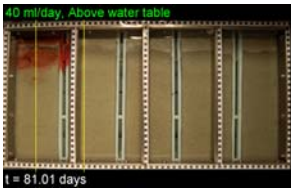


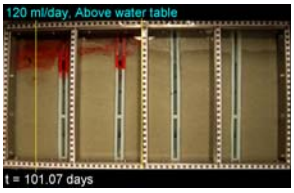
Laboratory Study

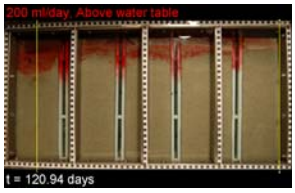
- Injected MTBE at constant rates
  - 9, 15, 40, 120, 200 mL/day
  - Moved injection location
  - Observed expansion



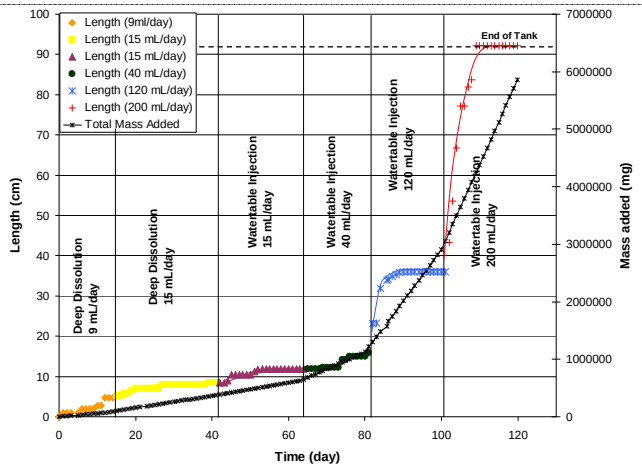






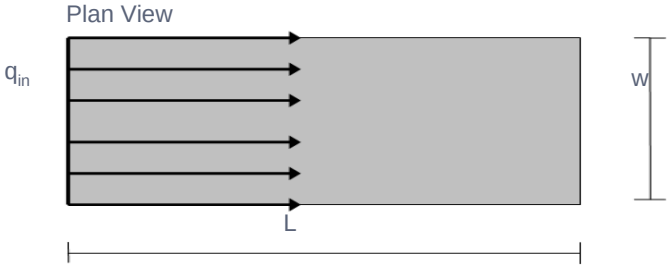


Laboratory Study



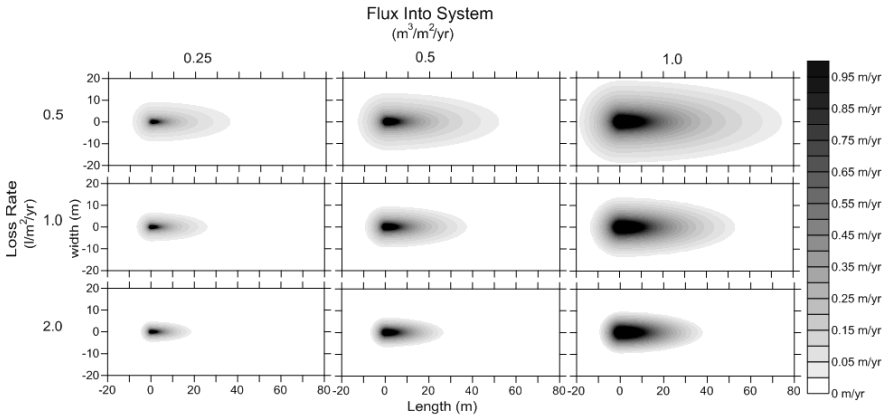
LNAPL Extent

One-dimensional



$$L_{pool} = \frac{q_{in} b}{q_{out}} \left(1 - e^{-\frac{q_{out} t}{S \phi b}} \right)$$

LNAPL Flux



q_{out}?

- Lundegard and Johnson
  - Multiple level sampling and diffusion calcs
  - 1 field site (100s to 1000s gallons /acre/ year)
- Uli Mayer et al.
  - Licor traps
  - 2 field sites
- Colorado State University
  - Integral CO_2 traps at grade
  - 1 field site

Closing

- Thanks for
  - Coming to CSU
  - Advancing SURF
- Post meeting activities
  - Visit to the Engineering Research Center
  - Hike
  - Brewery visit

Attachment 13
Breakout Sessions

Communication and Outreach Committee

SUSTAINABLE REMEDIATION FORUM
COMMUNICATION & OUTREACH COMMITTEE
July 13, 2010

Participants:

Stephanie Fiorenza (co-leader)	Jake Torrens (co-leader)	Ben Foster	Jonathan Pink	Rick Wice
Maile Smith (co-leader and scribe)	Scott Denson	Lisa Hamilton	Curt Stanley	

Note: Contact information is provided in Attachment 1.

Topics Discussed:

1. **Battelle Outreach Efforts** – Although the group thought that the location of the SURF table at Battelle was less than optimal, they acknowledged that people came by and learned about SURF. Most people visiting the table had heard about SURF through presentations. Ten individuals joined SURF at the conference. The SURF member pins were popular. Feedback from Battelle indicated that the sustainability track went well. The group discussed some disappointment in the panel discussion at the conference in that the panel consisted of the same, usual faces. Some individuals believed that the case for sustainability was not well made in several instances, but also acknowledged that demonstrations of sustainability will continue to improve over time.

2. **Discipline Diversity Initiative** – Creation of this initiative under the Communication and Outreach Committee was discussed at SURF 13. The goal of this initiative is to make a concerted effort to obtain input about sustainable remediation from a variety of disciplines – not just those associated with the environmental aspects of the triple bottom line. Mike Miller is willing to lead this initiative if he can find a replacement chair for the Academic Outreach Initiative.

3. **General SURF Presentation** – The group discussed the status of the draft "Who We Are" presentation. A minor amount of effort is needed to improve the curb appeal and enhance the slide associated with the benefits of membership. Topics to include are as follows: case study clearinghouse, discipline diversity, and SURF's cutting edge approach of developing ideas rather than following boilerplate guidance. The group will remind members that they have access to the presentations through the web site. In addition, the group will make periodic requests to SURF members to let the Communications and Outreach Committee know if/when they make presentations pertaining to SURF. External presentations and outreach efforts will be tracked.

4. **Web Site and Sustainable Remediation Database** – The group discussed the recent updates to the web site and the issue of compatibility of the database with SURF's web site. Specifically, how the web site would be used to serve this database was discussed, with the objective of maintaining a SURF link (i.e., connection, ownership) to the database. In addition, the group briefly discussed the importance of quality control if the proposed sustainable remediation database project moves forward. No action items were identified.

5. **Social Networking Sites** – The group discussed the pros and cons of using social networking sites to promote SURF. Although some members had a negative initial experience with LinkedIn, the group agreed to test a simple page on LinkedIn and Facebook. Each page will consist of a link to the SURF web site and mission statement. The hope is that LinkedIn will help reach professionals in a variety of disciplines and that Facebook will help reach potential student members.

6. **Post-Meeting Survey** – The group briefly discussed the post-meeting satisfaction survey that was developed by the Communications and Outreach Committee to maximize feedback related to SURF meetings, ideas for improvement, and survey participation. Hard copies of the survey were provided to SURF 14 participants.

7. **Newsletter** – The group discussed developing an electronic newsletter that would include routine reminders, photographs, and upcoming events.

8. **Webinars for Future Meetings** – The group discussed conducting short (i.e., one to two hours), "live" webinars. Webinar topics could vary, but the group thought that starting with short case studies might be best because of its benefits to multiple internal SURF efforts. All seemed to agree that webinars are a powerful marketing and branding tool and educational, which links to SURF's mission. The group discussed the various methods of advertising the webinar. One idea was partnering with an entity that has a large mailing list (e.g., RTM), with the

possibility of sharing case studies and swapping presentations. Webinar advertising could also occur through an e-mail list created from Battelle registrations.

9. **SURF Study or Technical Paper** – The group discussed the tool comparison proposed by the LCA Process Initiative. At one point, the Communications and Outreach Committee was considering comparing tools for publication in a technical journal. The group discussed helping the LCA Process group or, at a minimum, providing input about the messaging and representation of SURF. The group also discussed the issue of when it is appropriate for membership to "weigh in" on the "opinions" of the technical initiatives. The discussion verified the importance of defining the purpose, objectives, and endpoint of each initiative and committee. The group believed this to be an urgent message to share with members.

10. **Sustainable Remediation Training Module** – At SURF 13, the Government Employee Outreach Initiative had discussed the development of a sustainable remediation module geared to government employees with the intent to solicit discussion and encourage them to join SURF. At this meeting, the Communications and Outreach Committee discussed the possibility of needing technical analysis and training beyond that covered in the modules for government employees. A short course at a conference was proposed. No action items were identified.

11. **Previous SURF Participants** – All agreed that it was important to contact previous SURF participants that had not yet joined SURF, ask them why they haven't joined, and encourage them to do so.

12. **Mission Statement** – The group finalized the committee's mission statement as follows: to provide a unified and consistent message, internally and externally, for effectively communicating SURF's objectives, activities, and future goals. Specific tasks performed by the committee include the following:

    - Performing content management and maintenance of the SURF web site
    - Distributing information about SURF and committee and initiative activities via the SURF web site, newsletter, external publications, and e-mail communications
    - Encouraging SURF members to write articles for internal and external publications
    - Preparing and updating the "Who Is SURF" presentation
    - Providing a clearinghouse for and links to case studies, technical articles, complementary programs, and other information of interest
    - Recognizing that all communication and outreach activities represent SURF
    - Providing standardization of SURF communications for SURF's membership and outreach activities
    - Acknowledging the importance of volunteering and outreach initiatives
    - Encouraging members to provide feedback and recommendations for improvement

13. **Action Items** – Based on the discussions, the following action items were identified:

    - Combine the Discipline Diversity and Academic Outreach Initiatives, with Mike Miller and Stew Abrams as the co-chairs. Lead: Mike Miller and Stew Abrams
    - Send periodic reminders (through e-mails or newsletter) to members requesting them to let the committee know if/when presentations are made pertaining to SURF. Lead: Maile Smith
    - Create a page for SURF on LinkedIn and Facebook. Lead: Maile Smith (LinkedIn); Jake Torrens (Facebook)
    - Communicate SURF 14 satisfaction survey results to members. Lead: Committee co-chairs with Board of Trustees concurrence
    - Develop first version of the electronic newsletter, and request a volunteer to be the newsletter editor (one-year commitment). Lead: Maile Smith
    - Discuss with the Board of Trustees the idea of developing a distribution list from Battelle registrations for potential webinar advertising (Lead: Maile Smith); if approved, explore possibilities (Lead: Scott Denson)
    - Determine when membership weighs in on the opinions of technical initiatives. Lead: Board of Trustees
    - Divide up names of previous SURF participants who have not yet joined the organization and contact them to gauge interest in joining SURF. Lead: Communications and Outreach Committee members (ongoing through end of membership year)

Academic Outreach Initiative

SUSTAINABLE REMEDIATION FORUM
ACADEMIC OUTREACH INITIATIVE
July 13, 2010

Participants:

Mike Miller (leader)	Aaron Bailey	Steven Murawski	Michelle Thomson
Stewart Abrams (scribe)	Louis Bull	Tom Sale	
Matt Spurlin (scribe)	Jayme Hawthorne	Zachariah Seiden	

Note: Contact information is provided in Attachment 1.

Topics Discussed:

1. **Sustainable Remediation Database** – The group discussed the database proposed by Steven Murawski (see page 5 of the notes). The group agreed that the first steps in determining the feasibility of such a project would be the development of a plan. The remainder of the discussion focused on objectives and obstacles that the plan would need to address.

   After some discussion, the group agreed that the objectives of the database would be to demonstrate the value of sustainable remediation to the regulatory community and provide a quantitative and qualitative technical resource for remediation practitioners. Funding was determined to be an essential next step if the project were to move forward. For this purpose, a proposal including a template for project entry into the database must be developed; this will define the problem and its solution. The group discussed the importance of identifying industry and agency interests and clearly identifying the scope. In addition, the group discussed that funding might be achieved in part through academic partnering through multiple resources and technology and/or long-term residence at universities. The group agreed that, after obtaining funding, building the database and analyzing the data would be next steps. Considerations while building the database were discussed as follows: identifying appropriate data, obtaining and processing information, and determining the platform (e.g., web-based, PDF and optical character recognition).

   Student chapter members expressed interest in the database and thought it would be a way to facilitate the interaction between student chapters and SURF. The use of university-based candidates to oversee the database was discussed to provide consistency.

2. **Mission Statement** – The group developed a draft mission statement, which was refined after the meeting. The mission statement is as follows: to encourage academic participation in SURF as a means to promote the organization, establish linkages, and foster research and innovation.

3. **Student Paper Competition at Battelle** – The group was unable to continue its discussion about the paper competition without Pam Dugan in attendance. All agreed that Mike Miller should contact Pam and obtain the status of the effort. After SURF 14, during July and August, the details of the SURF Battelle student paper competition were finalized through Mike Miller's discussions with the Board of Trustees, using Pam Dugan's first draft as a starting point. Mike also coordinated with the Battelle conference organizers and submitted the announcement of the SURF student paper competition including details for publication by Battelle in the official meeting announcement.

4. **"Letter of Support" for Research** – This idea was conceived during the initiative's breakout session at SURF 13 and was further developed during an initiative conference call before the meeting. The group discussed the draft policy for supporting research proposals that was developed and distributed to the Board of Trustees by Stewart Abrams prior to the meeting. The draft policy provides procedures that allow SURF to provide support for research proposals and initiatives that are consistent with the mission and objectives of SURF. A key mechanism for supporting research proposals is the ability to provide a research proposer with a letter of support. The group discussed the procedures associated with the policy. At the end of SURF 14, members of the Academic Outreach Initiative agreed that Stew Abrams would develop a formal proposal for presentation to the Board of Trustees at an upcoming Board conference call meeting. Special attention would be paid to reservations already voiced by the Board, so that these concerns would already be addressed in the proposal.

5. **Academic Contacts Survey** – An action item at the last meeting was to identify academics whose interests overlap with SURF and who might be interested in joining the organization. A survey was sent to SURF members requesting contact information from their academic network. Katie Lewis (Boeing) has compiled the results of the survey so far, but only a few members have participated. Katie will again remind members of the survey, but each member of the initiative was also charged with interviewing individual members to gather this same information more directly.

6. **Action Items** – Based on the discussions, the following action items were identified:

    - Recommend to the Board of Trustees that a plan be developed to determine the feasibility of SURF developing a sustainable remediation database. Leads: Steve Murawski, Mike Miller, and Tom Sale
    - Provide mission statement to Maile Smith for posting on web site. (Completed)
    - Follow up with Pamela Dugan to determine progress and status of student paper competition at Battelle. Lead: Mike Miller. (Completed)
    - Develop a formal proposal for presentation to the Board of Trustees at an upcoming Board conference call meeting. Lead: Stew Abrams
    - Continue to remind members to complete the Academic Contacts survey. Lead: Katie Lewis (all members of the initiative will quiz SURF members about their academic contacts)

Government Employees Outreach Initiative

SUSTAINABLE REMEDIATION FORUM
GOVERNMENT EMPLOYEES OUTREACH INITIATIVE
July 13, 2010

Participants:

Todd Martin (lead and scribe)	Nick Garson	Natalie Zemen
Paul Deutsch	Dave Woodward	

Note: Contact information is provided in Attachment 1.

Topics Discussed:

1. **Implementation** – The group primarily discussed how to best implement a program to reach out to government employees to educate them about SURF and to encourage more active participation by government employees in SURF. The primary obstacles to government involvement with SURF identified include funding/travel restrictions and misperceptions (e.g., greenwashing, "industry group", conflict of interest). The group discussed the need to educate government agencies about SURF and its mission to dispel the misconceptions. It was decided that the best way to achieve this was to develop an education module and host a webinar (or a series of webinars). This was identified as an alternative (or in addition to) the previous meeting discussions about SURF members going to individual agencies and hosting a seminar. The group discussed the following two keys to a successful webinar and their associated approaches:

    - Get the right audience to the webinar
      The group discussed targeting decision makers that help establish the agency direction (e.g., green sustainable remediation leads within state agencies).

    - Generate interest through the webinar topics
      The group discussed developing topics that are effective attention grabbers (e.g., "pitfalls to look for when evaluating green/sustainable remediation"). The idea is to Focus on the government employee perspective of having to review documents that contain sustainability analyses and helping them be better prepared during the review. The group discussed the importance of including case studies that depict integrate green/sustainable remediation from remedy selection through implementation.

2. **Action Items** – Based on the discussions, the following action items were identified:

    - Set up a conference call with a small group of regulators that are SURF members, have participated in past SURF meetings, or that may be interested and/or willing to assist developing the objectives and content of the webinar.
        - Compile a list of SURF government employee members who participated in a previous call hosted by Carol Baker and Todd Martin. Lead: Todd Martin)\
        - Use existing list and add people to compile a list of people to include in the call. Lead: Dave Woodward
        - Draft e-mail invitation for conference call using existing drafted letter and send to initiative members for review. Lead: Todd Martin
        - Send invitation and schedule conference call with a target month of August. Lead: Todd Martin
    - Develop webinar
        - Identify core list of objectives based on outcome of the call and send to initiative members to review. Lead: Todd Martin
        - Pull relevant materials from existing SURF presentation and information; consider recruiting a student from a SURF student chapter to lead effort.
        - Identify a few candidate case studies and select subset to highlight in webinar. (Lead: TBD)
    - Develop distribution list.
        - Use contact list being developed by Interstate Technology and Regulatory Council (ITRC) (available this fall) as base list. (Lead: Dave Woodward)
        - Develop survey for SURF membership; obtain group review; distribute to list developed by Dave Woodward. (Lead: Natalie Zemen)

- Set up bi-weekly conference calls (Fridays) for initiative members to report on progress. Lead: Todd Martin
- Identify presenter for webinar, ideally a SURF member that is an academic or a government employee. To the extent possible, this person should be identified early on, so that he/she may participate in the webinar development and is comfortable with its contents. Lead: Carol Baker or Nick Garson
- Seek an opportunity to present at an Association of State and Territorial Solid Waste Management Officials (ASTSWMO) meeting. Lead: Carol Baker
- Summarize K&L Gates Conflict of Interest memorandum. Lead: Carol Baker

Technical Initiatives Committee

Framework and
Parameters and Metrics Initiatives

SUSTAINABLE REMEDIATION FORUM
FRAMEWORK AND PARAMETERS AND METRICS INITIATIVES
July 13, 2010

Participants:

Brandt Butler (lead, Parameters and Metrics Initiative)			
Karin Holland (lead, Framework Initiative)			

Notes: Contact information is provided in Attachment 1. Additional participant names are not available.

Topics Discussed:

1. **Objective and Scope** – The group discussed its objective in identifying a framework for sustainable remediation and outlined an approach for the resulting framework document. The group agreed that a framework is needed to enable practitioners to evaluate the sustainability of remedial alternatives and operations strategies in a way that allows the generation of easily communicable output, identification of data sources, and comparison to applicable case studies. Sustainable evaluations will be performed using the resulting framework document and will take about four to 20 hours to complete, depending on the complexity of the project. The document will provide assistance with evaluations that are at a basic or moderate level of complexity, with possible references so that users can access advanced analyses. Following the framework, the user will identify what level of analysis is required and the associated requirements. Thus, the document will be segmented so that the user can select the portions that apply to their case.

2. **Sustainability Framework** – The group discussed the draft sustainability framework, which is designed to encompass all phases of the remediation life cycle. A tiered sustainability evaluation, similar to that being devised for the ASTM framework but without the detail, is proposed for the different phases. Following the implementation of the sustainability evaluation, the results may be used to revise the conceptual site model.

3. **Future Land Use Considerations** – The group discussed the importance of future land use considerations as part of the framework. All agreed that future land use should be integral to each phase (i.e., investigation, remedy selection, design and implementation). Specifically, the group recommended the following:

    - Remedial investigation objectives should include evaluation of exposure routes reflecting current and future land use.
    - Remedial (i.e., corrective) action objectives established during remedial design selection should include future land use.
    - Remedial design should build remedies to enable future land use.
    - Remedial implementation should control exposure to enable future land use.

4. **Action Items** – Based on the discussions, the following action items were identified:

    - Distribute the first draft of the Framework document prior to SURF 15 for review.
    - Discuss the Framework document during the breakout session at SURF 15.

LCA Process Initiative

SUSTAINABLE REMEDIATION FORUM
LCA PROCESS INITIATIVE
July 13, 2010

Participants:

Paul Favara (lead and scribe)	John Claypool	Ray Lewis	Debbie Taege
Ralph Baker	Angela Fisher	Rick Marotte	
Mohit Bhargava	Sonja Koldewyn	Kevin McCoy	
Bob Boughton (phone)	Dustin Krajewski	Dick Raymond	

Note: Contact information is provided in Attachment 1.

Topics Discussed:

1. **Value Proposition** – The group discussed its value proposition in an attempt to determine why a LCA process is needed for sustainable remediation and who would use it. After some discussion, the group seemed to agree that everyone (i.e., regulators and remediation professionals) need to understand the LCA process as it applies to the sustainable remediation and the outputs of sustainability assessments. Regulators will gain confidence in sustainability assessment results with the utilization of a consistent approach (e.g., quality, completeness, use of standards). Remediation professionals will need to understand the definition of LCA and the details involved in the calculations so that they can apply the process to remediation decisions. One of the goals is to increase the transparency associated with the decisions that are made about broader environmental, economic, and social impacts. Then, confidence in the results, for all stakeholders, will be achieved. By providing a baseline of the current state of practice, all stakeholders can better understand the impacts of the green remediation best management practices developed by the EPA.

   After additional discussion, the group agreed that the ultimate goal in identifying a LCA process for sustainable remediation is to impact the remedial decision-making process in a way that protects the environment while considering social and economic impacts. All agreed that in order to succeed, buy-in from regulators is necessary.

2. **End Product** – The group discussed the end product of its efforts as a white paper that makes the abstract numbers associated with a LCA meaningful for stakeholders. The group discussed that the white paper should include an introduction to LCA for those individuals unfamiliar with the process. An executive summary will be included, with more details in the main body of the document. Appendices and references could be hyperlinked and would contain very detailed information if readers wanted to know more. The group discussed including short, boxed case study examples that the text wraps around as a way to demonstrate how LCA can be used in the real world. In the same vein, the group discussed the value of using tables, figures, and checklists to demonstrate points rather than text.

   The group discussed how to roll out the white paper, suggesting conference presentations and a training module at Battelle 2011.

3. **Schedule** – The group developed a schedule for the first draft, which will be completed by the end of August. Interim deadlines are listed below. A draft final will be complete by September for ITRC and ASTM for their review.

   - Week of July 19, 2010: Hold teleconference to discuss Section 4.0
   - August 6, 2010: Forward initial section drafts to Paul Favara
   - August 13, 2010: Review of initial draft by internal team
   - August 20, 2010: Forward all comments to Paul Favara
   - August 27, 2010: Finalize and send to distribution (lead: Paul Favara)

4. **Critical Paths and Milestones** – The group discussed the critical path elements of their efforts and the associated milestones, including interaction with ITRC and ASTM. Action items are listed in #5 and #6 below.

5. **Writing Assignments** – The group discussed the proposed white paper outline and assigned leaders to write each section. The outline is provided below.

    1. Document purpose (i.e., why is this document needed?) (1 page) (Rick Marotte)
    2. Current practices of environmental footprint assessments and limitations (1.25 pages) (Russell Sirabian) (Complete)
        i. Include high level discussion of "typical" approaches
        ii. Identify where some of these approaches can fall short (e.g., data consistency/defensibility, boundaries, functional unit)
    3. LCA overview (1 page) (Dustin Krajewski and Paul Favara)
        i. Define LCA in terms of remediation industry
        ii. Introduce LCA as something that has been around almost 20 years
        iii. Explain LCA based on existing standards, impact assessment methods, use of common databases (e.g., debunk any myths)
        iv. Discuss how existing LCA may challenge remediation industry (e.g., training, investment in software and databases)
    4. LCA for remediation guidance (i.e., main steps impact assessment should evaluate) (Lead: Mohit Bhargava) (Additional Writers: Dick Raymond, John Claypool, Angela Fisher, Mohit Bhargava, Todd Krieger, Bob Boughton)
        i. Define assessment goals and context (0.5 page) (Mohit Bhargava)
        ii. Define the functional unit (0.5 page text with 0.5 page examples in tables) (John Claypool and Mohit Bhargava)
        iii. Establish assessment boundaries
        iv. Establish impact categories (3 pages) (Todd Krieger)
        v. Complete life-cycle inventory (LCI) analysis (2 pages – where to find data) (Todd Krieger)
        vi. Complete life-cycle impact assessment (LCIA) (2 pages) (Paul Favara)
        vii. Assess sensitivity and uncertainty (1 page) (John Claypool and Mohit Bhargava)
        viii. Interpret results (1 page) (Todd Krieger)
        ix. Evaluation (0.5 page) (Angela Fisher and Paul Favara)

6. **Action Items** – Based on the discussions, the following action items were identified:

    - Communicate the following schedule: (Lead: Paul Favara)
        - September 1, 2010: Distribute draft to internal reviewers
        - September 15, 2010: Receive comments from internal reviewers
        - September 30, 2010: Distribute to ASTM
    - Determine a page count per section for the initial draft.
    - Explore the possibility of presenting a training program at Battelle 2011 in Nevada. Lead: Mohit Bhargava
    - Determine if Savannah River National Laboratory is conducting a side-by-side review of two LCA tools. Lead: Paul Favara
    - Identify reviewers and give them a heads up about review schedule. Lead: Paul Favara