

Sustainable Remediation Forum (SURF)

SURF 18: September 21 and 22, 2011

Seattle, Washington

SURF 18 focused on sustainable remediation in the urban environment and was held in Seattle, Washington on September 21 and 22, 2011. SURF members that participated in the 1½-day meeting are listed in Attachment 1 along with their contact information. The meeting marked the 18th 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 to SURF members at www.sustainableremediation.org.

Meeting Opening

The meeting began with Mike Rominger (meeting facilitator) welcoming participants and thanking AECOM and The Boeing Company for providing a venue for the meeting. Mike discussed meeting logistics, ground rules, nonconfidentiality assumptions, export control laws, and antitrust issues. In addition, he thanked current SURF sponsors for supporting the organization. Members interested in sponsorship opportunities should contact Brandt Butler, SURF Treasurer (see Attachment 1 for contact information).

Opening remarks were provided by Dave Woodward (AECOM) and Nick Garson (The Boeing Company). Dave reviewed the background and history of SURF, told new participants about the white paper and current technical initiatives, and presented the organization's primary objective and mission statement (see Attachment 2 for presentation slides). Nick Garson discussed the logistics of the Everett factory tour planned for the following afternoon, where participants were able to see Boeing's widebody aircraft manufacturing processes, including the new 787 airplane.

Sustainable Remediation in the Urban Environment

By way of his presentation, John Ryan (AECOM) introduced the theme of the meeting: sustainable remediation in the urban environment. He described the economic, environmental, and social aspects that will drive future re-urbanization and demonstrated, through case studies, how sustainable remediation is fundamentally connected to and supports this future state. John presented case studies involving the following: (1) multiple cleanups to create the South Lake Union Neighborhood; (2) cleanup of the Port of Seattle to create an intermodal hub of the future; (3) transformation of a former oil terminal into Seattle Olympic Sculpture Park; and (4) cleanup of Duwamish River sediment to reduce ecological and human health risks. John believes that the common thread among all of these case studies is that the cleanups support building better places to live and work, which attract diverse people who maintain the thriving economy.

John ended his presentation by describing the differences between cleanups in Washington cities vs. other cities across the U.S. and discussing the challenges associated with urban cleanups in general. In the State of Washington, grants are available to public entities for cleanup and most urban areas are permitted to include tribal treaty fishing rights. During remedy selection, a preference exists for treatment or removal of the contamination in order to attain a 10⁻⁶ human health risk and hazard quotient of 1, natural background level, or the appropriate standard. Presentation slides are provided in Attachment 3.

Participants asked questions about the preference for removal vs. containment in Washington and about when sustainable remediation is integrated in the remediation process (i.e., remedy selection vs. remedy implementation). John explained that, in Washington, remediation professionals must conduct a disproportionate cost analysis to demonstrate whether the remedy is permanent to the maximum extent practicable. He also said that sustainable remediation concepts generally are incorporated during remedy implementation rather than upfront in the remediation process during remedy selection. Nevertheless, John told participants that the Washington State Department of Ecology is “phenomenally pragmatic” in balancing the triple bottom line considerations of sustainability.

Panel Discussion: Integrating Sustainability into Site Cleanups

A panel discussion was held and focused on how different organizations integrate sustainable considerations into site cleanup. Nick Garson, Project Manager in the Environment, Health, and Safety Remediation Group at The Boeing Company, moderated the discussion. The following panelists participated in the discussion:

- ❑ **Tanwir Chaudhry**
Tanwir provides technical consulting services to the Naval Facilities Engineering Service Center. He is assisting the Department of the Navy in developing guidance on green and sustainable remediation, conducting green and sustainable remediation case studies, and evaluating and enhancing tools for calculating metrics associated with green and sustainable remediation. His other projects with the Navy include the development and implementation of guidance documents for remedial action optimization.
- ❑ **Carol Dona**
Carol is a chemical engineer at the U.S. Army Corps of Engineers (USACE) Environmental and Munitions Center of Expertise (EM-CX) in Omaha, Nebraska. She is finalizing a decision framework for incorporating sustainable practices throughout the environmental remediation process for USACE projects. She is also working with the Army Office of the Assistant Chief of Staff for Installation Management to incorporate the decision framework into guidance for remediation projects Army-wide.
- ❑ **Stephanie Jones Stebbins**
Stephanie is the Director of Seaport Environmental and Planning Programs at the Port of Seattle. She oversees environmental and planning programs associated with air and water quality, contaminated sediment and upland site cleanups, environmental review and permitting for development projects, and facility and land use planning.
- ❑ **Dan Opalski**
Dan is the Director of the Office of Environmental Cleanup (ECL) in Region 10 of the U.S. Environmental Protection Agency (USEPA). The ECL is responsible for investigating contaminated properties; cleaning up contaminated land, sediment, and water for appropriate uses; emergency response; emergency planning and spill prevention; and Homeland Security and counter terrorism preparedness. Dan’s group works closely with communities and interested

stakeholders, providing funding in some cases to facilitate meaningful engagement in the Superfund process.

❑ Jim Pendowski

At the Washington State Department of Ecology, Jim leads efforts to clean up contaminated sites across the state. He is responsible for cleanup actions under the Model Toxics Control Act and is involved in restoring and protecting properties in and around Puget Sound.

❑ Steven Shestag

Steve is the director of Enterprise Remediation for The Boeing Company. As part of Boeing's Environment, Health and Safety organization, he is responsible for the development and implementation of an integrated strategy for environmental remediation activities.

Nick presented topics to the panelists to spur discussions with the larger group. Panelists briefly gave their perspective on each topic before meeting participants asked questions of the panelists and open discussions began. The panelists' responses and subsequent discussions are summarized in the subsections below.

Discussion Topic 1: Key Policies or Initiatives

Panelists were asked to comment on the key policies and/or initiatives associated with green and sustainable remediation that are in place or are being developed or implemented in their organizations.

❑ Dan Opalski (USEPA Region 10)

Dan focused his response on the common elements between the formalized set of principles developed by the USEPA and the policies being developed by each region. Regardless of the different terminology (e.g., point of departure, touchstone) among regions, he believes that all cleanups can include green elements and stressed the importance of presuming that green concepts will be integrated throughout all remediation project phases. Dan told participants that greener alternative energy and energy usage concepts are becoming more prevalent during remedy implementation in his region, resulting in benefits to the local community as well as reductions in short-term impacts from remediation.

In addition, Dan detailed specific efforts within Region 10 and mentioned potential next steps. Currently, Region 10 is developing a program to purchase and allocate reusable energy. For Superfund projects, the region taps into a renewable energy credit "bank" for cleanups. Dan challenged participants to think about how this approach could be used for non-Superfund cleanups. He also mentioned the opportunity for partnerships and creative thinking in the area of methane emissions. Dan said that his regional administrator is interested in making progress in this area and better utilizing methane emissions from digesters.

❑ Steven Shestag (The Boeing Company)

Steven said that his company is implementing green and sustainable remediation where and when it is appropriate. Boeing has developed guidance for its

contractors to use for sustainable remediation implementation on company-led remediation projects. Steven believes that collaboration is necessary to move the state of practice of sustainable remediation forward and asked participants to think about how collaboration might occur. He also believes that it is necessary to build a business case for green and sustainable remediation so that company leaders can make more informed decisions. He encouraged consultants and industry to work with regulators to better understand how green and sustainable remediation fits within the current regulatory structure.

- ❑ Tanwir Chaudhry (Consultant at Naval Facilities Engineering Service Center)
Tanwir discussed the Department of the Navy's perspective and implementation of the tasks outlined in the 2009 Department of Defense memorandum. The overall goal stated in the memo is to minimize the environmental impact of existing and future remedial systems. The Department of the Navy took the goal one step further by considering green and sustainable practices throughout all phases of remediation—not solely during remedy implementation. Tanwir described new guidance from the Navy that provides a clear and consistent approach for incorporating green and sustainable considerations into the cleanup process. To calculate the footprint of a remedy, the Navy evaluated the tools available and selected SiteWise™. Since 2009, SiteWise™ has been refined and training has been provided to remediation practitioners.
- ❑ Carol Dona (USACE EM-CX)
Carol described a study underway within her organization that focuses on determining the usefulness of quantifying the footprint of a remedy. Study results to date show that the greatest footprint reductions occur when the overall remedy is improved by applying concepts of value engineering. Her organization is comparing the sustainability of various methodologies and developing case studies based on the results as a shortcut for remediation practitioners (vs. quantitative footprint analysis).

Carol also described the USACE interim guidance issued in March 2010. The guidance provides a decision tree with detailed references and information for considering and incorporating green and sustainable practices throughout all phases of remediation.

Discussions were brief and focused two issues: (1) the importance of data in moving the field of sustainable remediation forward and (2) the advantages of using life-cycle assessment (LCA) as a primary tool when assessing remedies and methodologies.

Discussion Topic 2: Current State of Green and Sustainable Cleanups

Jim Pendowski (Washington State Department of Ecology) was asked to comment on the current state of green and sustainable cleanups in his state and whether the use of green and sustainable practices are common or rare or somewhere in between. Jim responded, saying that he believes that the practice of green and sustainable cleanups in Washington is both common and rare—common in that the governor has a clear policy regarding issues such as reducing greenhouse gases and footprints and rare in that sustainability examples are not easily found in his organization. To clarify, Jim explained his interpretation of the terms “green” and “sustainable.”

He views these terms differently, with green remediation focusing more on the site-specific level and sustainable remediation addressing a broader spectrum of parameters (e.g., habitat communities). Although policy directives are in place in his state, Jim is unsure whether these directives will be sufficient to bring the green market into the remediation stream. As a regulator, he trusts the consulting community to work with their clients and bring the best green and sustainable efforts to the table. For his part, he tries to drive his organization to be more receptive to these approaches and, through policy and design, implement these approaches in the field.

Discussion Topic 3: Future of Sustainable Remediation

Carol Dona (USACE EM-CX) was asked to comment on the short- and longer term future of sustainable remediation in her organization. In the short-term, Carol believes that funding would allow researchers and remediation practitioners to demonstrate that green and sustainable remediation is a better than the status quo. Because a green and sustainable remediation evaluation requires a certain level of information (similar to a cost estimate in a feasibility study), Carol believes it would be beneficial to make the information available so that remediation practitioners and key stakeholders can understand the benefits of including green and sustainable concepts in the remediation process. In the longer term, she believes that additional studies addressing green energy could help bring a more broad view to the topic and demonstrate its practicality.

Discussions focused on a question from a participant to Jim Pendowski and Dan Opalski. The participant asked these panelists if they knew of a site where economic or social elements influenced decisions and allowed cleanup to a level less than background.

❑ **Jim Pendowski (Washington State Department of Ecology)**

Jim answered yes to the question and said that 10^{-6} is the human health risk target level in Washington but natural background levels can prevent cleanup to this level. He cited Ecology cleanup laws that include disproportionate cost analysis to allow consideration of cleanup levels that are reasonably achievable with maximum protectiveness. Jim said that much of his organization's time at cleanup sites is spent talking to people living near the site, communicating the issues and realities associated with the site, and working with the community to a reasonable solution.

❑ **Dan Opalski (USEPA Region 10)**

Although economic and social elements are considered during cleanup, Dan said that, fundamentally, threshold criteria are the mandate. He believes that part of his organization's social contract with the community is to meet the mandate. Dan stressed the importance of including all of the key stakeholders in discussions and interactions. He is not aware of a site in Region 10 where the public was amenable to cleanup levels less than the threshold criteria.

Discussion Topic 4: Improving the Likelihood of Sustainable Remediation

Stephanie Jones Stebbins (Port of Seattle) was asked to comment on improving the likelihood of sustainable cleanups. In her response, Stephanie stressed the importance of building trust and quantifying impacts. She believes that stakeholder outreach and metrics will help remediation

practitioners address regulatory limitations. Stephanie also mentioned that explaining the 10^{-6} human health risk mandate and risk in general can be a challenge. She believes that the Port of Seattle experiences a higher level of trust and collaboration with the community compared with other ports around the U.S. that are immersed in an antagonistic, litigious environment. As a result, Stephanie believes that an opportunity exists in her organization (and the northwest in general) to move the field of sustainable remediation forward.

Discussion Topics 5 & 6: Future Plans and Current Successes

Panelists were asked to comment on the future plans of their organizations and/or the green and sustainable programs and initiatives within their organizations that have been successful.

- ❑ Stephanie Jones Stebbins (Port of Seattle)
Stephanie said that her organization is trying to ensure that total cost and triple bottom line metrics are considered during the decision-making process. She believes that her organization has improved in its ability to quantify impacts.
- ❑ Dan Opalski (USEPA Region 10)
Dan said that his organization continues to move forward with the expectation of integrating green concepts into every aspect of work (e.g., grants, work plans). He mentioned the idea of including green remediation in a performance assessment and reflected his disappointment that government entities that prescribed to environmental management systems are not taking up the charge of green and sustainable remediation.
- ❑ Jim Pendowski (Washington State Department of Ecology)
Jim responded by saying that he worries about the “check the box” phenomenon when incorporating green and sustainable concepts into the remediation process. He believes that the green component of remediation will advance when interactions at a site-specific level include the topic and address the issue. Jim is more than willing to host consultants at his office so that productive discussions can occur.
- ❑ Steven Shestag (The Boeing Company)
Steven responded by challenging participants to think about how industry can encourage contractors to consider and integrate green and sustainable concepts in remediation without being too prescriptive. He further encouraged industry and regulators to think beyond the simple cost-benefit equation when considering the merits of implementing sustainable remediation solutions. For instance, other benefits (e.g., reputational, community) may exist that support alternative, more sustainable approaches but may not easily equate to conventional cost-benefit analysis.
- ❑ Tanwir Chaudhry (Consultant at Naval Facilities Engineering Service Center)
Tanwir said that the Department of Navy has a large remediation program, and several regions are more proactive than others in relation to green and sustainable remediation. The Navy’s future plans involve providing remediation program managers with the proper tools and training to implement green and sustainable remediation Navy-wide—throughout the remediation process. The Navy is

currently developing a guidance document, including best management practices, which will help with this effort. The guidance is under final review and is scheduled to be available publicly during the first quarter of 2012 at the green and sustainable remediation portal (<http://www.ert2.org/t2gsrportal>).

Tanwir mentioned the Navy's efforts both to update an existing optimization database to include additional sustainability parameters and to require reporting on the steps taken to implement green and sustainable concepts in remediation projects. Tanwir told participants that the Navy uses SiteWise™, a tool that assesses the environmental footprint of remedial actions using a consistent set of metrics to measure greenhouse gas emissions, energy use, air emissions of criteria pollutants, water consumption, and worker safety.

❑ Carol Dona (USACE EM-CX)

Carol said that, in her organization, some people remain unaware of the concepts of green and sustainable remediation. The word is spreading, but activities remain focused on educating people and assessing practicality. She said that the goal is to make it easy for project managers to implement green and sustainable concepts into all aspects of work by providing tools (e.g., SiteWise™).

Open Discussion with Panelists

Participants were encouraged to ask additional questions of the panelists. The questions related to private partnerships, the business case for sustainable remediation, the role of consultants and the safety of remediation workers. Panelists' responses for each of these topics are summarized below.

❑ Private Partnerships

One participant asked the panelists how often private partnership is occurring when implementing green and sustainable remediation. Tanwir Chaudhry (Consultant at Naval Facilities Engineering Service Center) said that, to his knowledge, no examples of private partnerships on active Navy bases exist because no real incentive exists for the outside partner to make an investment. However, government funding is being used for elements that go beyond the use of the current remediation system at a site (e.g., solar panels, wind turbines). Steven Shestag (The Boeing Company) and Dan Opalski (USEPA Region 10) focused on the potential opportunities for private partnerships when addressing water contamination and resource issues.

❑ Business Case

One participant asked panelists to comment on their progress in making a business case for sustainable remediation.

- Steven Shestag (The Boeing Company) said that when the short-term payoff is obvious, the business case is easy to prove. He believes his company is progressive in terms of environmental stewardship, but admitted making the business case can be a challenge.
- Stephanie Jones Stebbins (Port of Seattle) said that her organization's approach to the business case has changed profoundly over the last five

years. Five years ago, the Port of Seattle complied with the law and fulfilled its corporate responsibility commitments. Although the organization continues to achieve these goals, the business case for green and sustainable remediation has become one of the most important parts of the environmental program. Stephanie said that, across the board, green and sustainable concepts are integrated as part of business strategy.

- Carol Dona (USACE EM-CX) said that the year-to-year funding process in her organization has created challenges when making the business case for green and sustainable remediation due to the difficulty in demonstrating long-term cost recovery.

❑ **Role of Consultants**

One participant asked panelists how consultants can help facilitate the consideration of green and sustainable concepts during remediation decision making. In his response, Jim Pendowski (Washington State Department of Ecology) emphasized the importance of protectiveness, aggressiveness (e.g., not *always* selecting monitored natural attenuation), and the marginalization of remedies (e.g., trading exposure for carbon footprint). Dan Opalski (USEPA Region 10) responded by telling consultants to take care of their reputation so that their good work and thinking serve as the basis for decisions.

❑ **Safety of Remediation Workers**

One participant asked panelists to comment on the idea that remediation worker safety is part of green and sustainable remediation, citing Table 4.3 in the SuRF-UK document *A Framework for Assessing the Sustainability of Soil and Groundwater Remediation*. Dan Opalski (USEPA Region 10) believes that the issue of worker safety is embedded in the nine threshold criteria and told participants that his organization performed a remedy implementation in which worker safety was significantly weighted during remedy selection. Steven Shestag (The Boeing Company) suggested that the concept of remediation worker safety be integrated into SURF's mission statement and believes that it is a key component that fits into remedy selection criteria.

Presentations

Presentations and subsequent discussions are summarized in the subsections below. Attachments 4 through 12 contain the presentation slides.

Sustainability Considerations for Sediment Remediation in the Northwest

David Schuchardt (Seattle Public Utilities) presented a sampling of sustainability considerations for sediment remediation, reviewed the primary and secondary factors influencing sediment remediation in the Northwest, described the beneficial use of dredged material at the Pacific Sound Resources Superfund site, and used an example 10-acre site to compare the carbon emissions of various remedies. David presented the following sustainability considerations: environmental (i.e., risk reduction over time, footprint reduction), economic (i.e., cost effectiveness, secondary economic impacts, continued viable waterway use), and social (i.e., public access, cultural fish consumption practices, and stakeholder involvement). In

addition, David presented sediment remediation considerations that are specific to the Northwest region of the U.S., such as nearby landfills that are able to accept wet sediments, the existence of rail infrastructure and transloading facilities, the short construction season, and the land use limitation for hydraulic dredging. David explained that some of these elements (e.g., railroad requirements) can constrain the use of sustainable practices. In contrast, he highlighted an innovative sediment cap design that involved the reuse of over 250,000 cubic yards of dredged material. David ended his presentation by comparing the carbon emissions of various contaminated sediment remedies at an example 10-acre site. He concluded that remedy selection has the greatest effect on carbon dioxide emissions, best management practices have limited effects on carbon dioxide emissions (e.g., 5% to 15% reduction), and the beneficial use of dredged material (vs. aggregate consumption) has limited effects on carbon dioxide emissions (e.g., 5% to 15% reduction). Presentation slides are provided in Attachment 4.

Participants asked questions clarifying the technical aspects of the example case study presented. One participant suggested that the tertiary effects regarding landfill operation could be explored and may provide useful information. A second participant wondered if the largest greenhouse gas component could be attributed to transloading. A third participant noted that best management practices can be of greater significance for other sustainability metrics such as PM10 emissions. David said that transportation to the landfill was the greatest single greenhouse gas component.

USEPA Region 10 Going Clean and Green with Cleanup

Sean Sheldrake (USEPA Region 10) discussed how federal government green policies relate to how the USEPA and, more specifically, Region 10 are making cleanup decisions. An Executive Order in 2009 spawned clean and green policies throughout government, including the mention of sustainable development in the USEPA's Strategic Plan for 2011-2015, the Office of Solid Waste and Emergency Response's Green Remediation Principles, and the Superfund Green Remediation Strategy. For its part, the USEPA Region 10 developed a Clean and Green Policy that is aimed at changing the way remedies are implemented. The policy establishes "points of departure" (e.g., the use of clean diesel through the use of engine retrofits, reused, or recycled materials) that all cleanups must either meet or site-specific reasons for noncompliance must be provided. Sean explained that his region is focusing on transportation use and equipment because these elements often consume the most energy and release the most pollutants (e.g., greenhouse gases, air toxics) during remedial implementation.

Sean also discussed the myths and facts about green cleanup, presented Region 10 success stories related to green remediation, and listed some of the challenges associated with implementing green remediation. By quizzing participants, Sean explained the myths and facts surrounding topics such as tailpipe retrofits, clean diesel engines, and ultra low sulfur diesel. During the quiz, he emphasized the importance of reducing emissions and reminded participants of the harmful effects of particulate matter in diesel exhaust. To address this issue, the USEPA Region 10 has retrofitted emergency response vehicles with diesel multi-stage filters. As flow-through devices, these filters experience less pressure drop than diesel particulate matter filters and can often achieve higher removal efficiencies than diesel oxidation catalysts. Sean ended his presentation by listing green remediation implementation challenges, including overwhelmed project managers who perceive green remediation as "just one more thing to do." He said it is necessary to dispel myths associated with green remediation and help educate staff

about how to identify green remediation opportunities within their projects. Presentation slides are provided in Attachment 5.

Initial discussions focused on tailpipe retrofits. Sean told participants that these retrofits are easy to implement and can cost a couple of thousand dollars for one vehicle. Alternatively, Sean suggested that remediation professionals request appropriate equipment (e.g., Tier 4) when leasing vehicles.

Additional discussions focused on the question of whether green concepts should be a goal (as is currently the case) or a requirement. Sean stressed the need to appreciate the environmental justice aspects of cleanup and the need to clean up more carefully than we have in the past (i.e., considering all aspects of cleanup). He told participants that green remediation could become a requirement but, at the present time, is only required to be considered (i.e., point of departure). One participant responded by encouraging regulatory agencies to continue with green remediation as a goal (vs. requirement), stating the need for regulatory justice that does not force responsible parties to solve health issues such as those resulting from particulate matter. Sean acknowledged this point, but said that the USEPA will be identifying and evaluating potential steps that can be taken to lessen the footprints of cleanup, especially in locations where air quality thresholds are currently exceeded.

Integrating Social Aspects into Sustainable Remediation

Pat Serie (EnviroIssues) and Renee Dagseth (USEPA Region 10) described the key issues of stakeholders involved in the Lower Duwamish Waterway Superfund site in Seattle, as well as the tools and methods being used to address the issues, ways to integrate social aspects into Superfund and Model Toxics Control Act decision making, and lessons learned. Pat coordinates communication and outreach for the Lower Duwamish Waterway Group (i.e., City of Seattle, King County, Port of Seattle, and The Boeing Company), and Renee leads the USEPA's community involvement program for the Lower Duwamish Waterway.

The presenters provided an overview of the site, which is a 5.5-mile stretch of the Duwamish River that flows into Elliott Bay. Two low-income, residential neighborhoods with diverse populations, including many non-English speaking residents, are adjacent to the site, which was listed on the National Priorities List in 2001. Three of the four responsible parties that comprise the Lower Duwamish Waterway Group are public agencies. The presenters' experience on the project shows that the public has more confidence in the remediation process and resulting decisions when the regulatory agencies and responsible parties "stand on the stage" together.

Pat presented the stakeholders' key issues associated with the site, including existing fish consumption advisories, construction impacts to the local community, and off-site disposal impacts to other communities. Through early consultation and outreach at events (e.g., tribal meetings, neighborhood association meetings, community fairs), the USEPA and the Lower Duwamish Waterway Group have worked together to help the community understand the complexities associated with the site and address public concerns. As an example, when public input was desired as part of the feasibility study, the USEPA held and the Lower Duwamish Waterway Group supported two public meetings. One meeting used a standard format, and the other was held in smaller groups at tables with Spanish and English hosts. In these smaller groups, the hosts used Legos[®] to explain the different technologies that might be used at the site.

Food and childcare were provided as encouragement for community members who might not otherwise attend.

Community comments included a request for an environmental justice analysis of the feasibility study; the USEPA is currently responding to this request. The first of its kind in Region 10, the assessment will evaluate short- and long-term impacts of the cleanup alternatives and selected remedy on the adjacent communities and tribes. Community outreach is planned to engage the communities when the draft assessment is complete.

In order to achieve similar progress at other sites, the presenters said that the entire team must be committed to community outreach, including environmental and social justice. In addition, team members at all levels must be involved in the ongoing dialog so that potential issues can be resolved. Pat said that long-term behavior changes are often necessary to control the contamination source and ensure that fish consumption advisories are being followed. As such, the presenters emphasized the importance of continuing community engagement as part of the adaptive management plan. Presentation slides are provided in Attachment 6.

Specific questions from participants and responses are summarized briefly below.

❑ Similarity to Other Sites

The presenters asked participants to comment on whether the activities and experiences presented are similar or different from other sites. One participant commented on his experiences in New Jersey in de-industrialized areas with higher levels of poverty than the Duwamish. In these areas, community members are often angry because of the lack of jobs and voice resentment over a perceived “pave and wave” cleanup strategy by responsible parties. Renee responded that the Duwamish site is part of a thriving community that is supportive of keeping industry on the waterway and providing a healthy place to live.

❑ Funding Source

One participant said he was inspired by the level of creativity in this project and wondered how activities were funded. Renee said that the USEPA provides grants to help fund a citizens’ advisory group, and the Lower Duwamish Waterway Group members sponsor a variety of community events. The parties work together where possible to create the most efficient and effective use of outreach resources.

❑ Communication of Air Emission Issues

One participant asked how the Lower Duwamish Waterway Group communicates air emission issues associated with the cleanup. Renee said that the USEPA and the Lower Duwamish Waterway Group are working with partner agencies such as the Puget Sound Clean Air Agency to answer the range of questions from the community. Although the feasibility study calculates air emissions associated with different cleanup options, the issue has not been a focus of conversation.

❑ Key Points from Community Interactions

One participant asked the presenters to share some of the key points learned from their interactions with the community. The presenters said that the community was concerned about how much fish they could eat safely, worried about the cost of cleanup and how it would affect their jobs, were unsure of the definition of

“carbon footprint” but interested in learning about it, and were focused on their families and children.

Economic Perspectives on Superfund Site Remediation

Dave White (King County Wastewater Treatment Division) presented some economic perspectives on site remediation based on his observations of the Lower Duwamish Waterway Superfund site and his background as an economist. Dave began with an assertion that it is likely that successful cleanups provide a positive net economic benefit in the long term because they make an area a better place to live, work, and invest. However, because of the scarcity of resources, he indicated that it is necessary to seek cost-effective solutions (i.e., the least costly way to achieve a desired outcome).

Dave used the Duwamish site to demonstrate that affected areas can be an important part of the regional and/or local economy and that cleanup should maintain or enhance this regional economic engine. With this in mind, he presented the results of a study that modeled the regional impacts of a 10% change in economic activity in the main economic sectors at the site, including manufacturing, transportation, and warehousing. The results showed that such an impact would be significant to the region, given the overall economic contribution of the affected area (which provides about 100,000 jobs to the local economy) and the ripple effects of changes in the key economic sectors concentrated in the area. Dave said that these results underscored the importance of moving forward expeditiously with a cost-effective cleanup, minimizing contention and delay. Hypothetically, investment in these sectors could be enhanced by the perception that cleanup is proceeding well and that the affected area will remain a good place to work and invest. Conversely, disinvestment could occur if a perception exists that cleanup is not proceeding well or if investors are fearful of inheriting liability. Dave ended his presentation with this summary point: focus on cost-effective, expeditious cleanup that is sensitive to the economic base. Presentation slides are provided in Attachment 7.

Discussions after the presentation were brief and focused on how money can be spent publicly to maximize job potential. Dave referred participants to the summary information provided on the Lower Duwamish Waterway Group’s web site (www.ldwg.org).

Economic Vitality and Environmental Cleanup in Washington State

John Means (Washington State Department of Ecology) presented the results of a 2009 study of the immediate and long-term economic impacts of cleanup at sites receiving funding from remedial action grants. Part of the Model Toxics Control Act, remedial action grants are provided to local governments in Washington State to facilitate the cleanup of publicly owned land contaminated with hazardous substances. Funding for the remedial action grants comes from a tax on certain hazardous substances. John reported that for every grant dollar spent, \$7 was created in ongoing payroll value, \$32 was created in business revenue, and \$6 was created in new local and state tax revenues. He explained that economic improvement is captured in two ways: immediate, one-time capital expenditures (e.g., cleanup, infrastructure and habitat restoration, vertical construction) and long-term economic lifts from increased tax revenues and property values, indirect spending by the revitalized property, and job creation.

To demonstrate the overall results, John presented economic impact assessment results and job creation numbers for three sites: the Thea Foss Waterway in Tacoma, Washington; the City of

Palouse; and the Bellingham Waterfront. Attachment 8 contains presentation slides, as well as the detailed results for all three case studies.

State-Level Sustainable Remediation

Karin Holland (Haley & Aldrich) provided an overview of state programs and interstate efforts in the area of green and sustainable remediation. Specific details of the programs and efforts are summarized below. In her concluding remarks, Karin emphasized the large amount of existing state-specific programs and the different types of organizations providing assistance to advance the field of green and sustainable remediation. She anticipates more widespread adoption of green and sustainable concepts in remediation as a result of state-targeted guidance, a continued push by the regulated community, and federal and regional initiatives. Presentation slides are provided in Attachment 9.

Karin listed some of the states with formal sustainable remediation programs (i.e., Alabama, California, Illinois, Massachusetts, Minnesota, New York, Oregon, and Wisconsin) and discussed two states' efforts in further detail.

- ❑ Oregon
Oregon has a draft policy in place, with future work and activities planned involving guideline development, stakeholder meetings, case study development, web site updates, and the integration of sustainability language in contracts.
- ❑ California
In 2009, the California Department of Toxic Substances Control (DTSC) held a symposium addressing global perspectives on green remediation and issued the *Interim Guidance for Green Remediation*. Currently, the department is performing green remediation pilot-scale studies with PG&E and DuPont.

In addition, Karin reviewed the efforts of the Interstate Technology & Regulatory Council (ITRC) and the Association of State and Territorial Solid Waste Management Officials (ASTSWMO). She told participants that the ITRC published its overview document (*Green and Sustainable Remediation: State of the Science and Practice*) in May 2011. The group plans to publish its technical regulatory document (*Green and Sustainable Remediation: A Regulatory Framework*) by the end of the year. Internet-based training is also planned. Karin also highlighted the work of ASTSWMO, which has published multiple guidance documents and fact sheets. The group recently conducted a survey of state regulators aimed at identifying the barriers of integrating green and sustainable concepts into remediation projects. Survey results indicated that regulators were concerned with the potential higher cost of integrating these concepts into projects and the lack of an explicit regulatory mandate. Regulators also expressed comfort with the status quo when implementing site remediation.

Karin also provided an update on the activities of the ASTM deliverables associated with green and sustainable remediation. The group is working on a standard guide that divides green and sustainable remediation into two tracks: one that addresses the environmental aspects of remediation only (i.e., green remediation) and one that addresses the environmental, societal, and economic aspects of remediation (i.e., sustainable remediation). Because ASTM is a consensus-based organization, the draft document will be submitted to an internal work group, who will perform a quantitative evaluation of the document and vote whether it is approved as is or needs more work.

Karin ended her presentation by summarizing the involvement of SURF members in the aforementioned initiatives and activities, as well as the involvement of regulators in SURF. SURF members regularly attend ITRC and ASTM meetings and continue to actively participate in the development of documents. Similarly, regulators from Washington, Minnesota, Wisconsin, Illinois, Michigan, Ohio, and Florida have attended and made presentations at SURF meetings in the last year alone. Karin invited SURF members to join SURF's Government Outreach initiative, which is working to continue the trend of increased regulatory involvement in SURF.

Discussions focused on formal efforts to get state regulators involved in SURF, details regarding the ITRC's technical regulatory document, and the potential overlap or inconsistencies among all of the different guidance documents.

- ❑ **State Regulator Involvement in SURF**

As leader of SURF's Government Outreach initiative, Dave Woodward (AECOM) discussed state regulator involvement in SURF. Dave said that despite a number of activities aimed at increasing state regulator involvement, economics (i.e., travel dollars) remains one of the primary reasons for lack of state regulator attendance at SURF meetings. A SURF survey of state regulators confirmed this belief. Dave highlighted SURF's efforts to schedule meetings at regulators' offices and invite regulators located near the meeting so as to avoid travel costs. He encouraged state regulators to share their ideas about how they can get more involved in SURF. Although phone participation is available for meetings, Dave believes that participating by phone is not ideal. He welcomes suggestions on how SURF and state regulators can interact more effectively.

- ❑ **ITRC Technical Regulatory Document**

Karin provided more detail about the document, describing it as a guide for practitioners. She said the document consists of about 100 pages and contains an overview, provides a framework, and discusses tools. (After the meeting, the ITRC published the document, which is available at <http://www.itrcweb.org/Documents/GSR-2.pdf>).

- ❑ **Potential Overlap of Guidance Documents**

Karin acknowledged that the plethora of green and sustainable remediation guidance documents in existence can be overwhelming and confusing, but encouraged participants to contact SURF members who are participating in multiple efforts to help them navigate through these documents. She emphasized that SURF members are working to achieve as much consistency among the documents as possible by participating in the various groups and are communicating how SURF's framework can be integrated into the ITRC's framework.

SURF the Globe

Dave Woodward (AECOM) provided an overview of the history, milestones, and key aspects of SURF organizations that have emerged internationally. Based on the evolution and expansion of SURF organizations and green and sustainable remediation, Dave believes that additional SURF organizations are likely to form throughout the world, especially in those areas with a risk-based,

regulatory framework. He anticipates an increasing trend of international collaboration that will advance the science of green and sustainable remediation, fueled primarily by a dramatic increase in case studies and lessons learned. Dave hopes that this evolution will eventually lead to standardized green and sustainable remediation practices. Specific details of the organizations and efforts are provided below; presentation slides are provided in Attachment 10.

As background, Dave provided a timeline of SURF's history and the emergence of green remediation in the regulatory arena. Then he told participants about the emergence of SuRF-UK in 2007 as part of CL:AIRE (Contaminated Land: Applications in Real Environments).

SuRF-UK focuses on holistic sustainability assessments throughout all phases of remediation. Dave described the tiered framework developed by SuRF-UK, which has the support of regulators and is flexible and voluntary. He provided an overview of the organization's current efforts, which include developing and refining indicators, testing the framework, benchmarking assessment tools, and creating a database of case studies.

In addition to SuRF-UK, Dave summarized the history, milestones, and planned activities for SURF organizations that are emerging internationally.

❑ SURF Brazil

The first meeting of this organization was held in October 2010. Since that time, five meetings have been held, the organization has an official name (i.e., Brazilian Forum for Sustainable Remediation), sustainability concepts have been incorporated into São Paulo State Environmental Law 13.577, a blog has been created (<http://foresbr.wordpress.com/>), and a white paper is being developed. The group's planned activities include sponsorship of a Latin American network for contaminated land management and creation of a green and sustainable remediation web site on their web page.

❑ SURF Australia

SURF Australia was established in 2009 to promote approaches and practices that achieve better, more balanced outcomes in the remediation and management of contaminated sites. The group encourages a tiered approach to sustainable remediation, which it defines as demonstrating (through environmental, economic, and social indicators) that an acceptable balance exists between the effects of undertaking remediation and the benefits those effects deliver. SURF Australia has established a working group to finalize its framework and plans to focus future efforts on activities such as regulatory agency involvement and research on methods, measurement, and guidance.

❑ SURF Canada

The kickoff meeting for SURF Canada was held in May 2011. Since that time, the group has held a meeting and workshop in association with the Remediation Technologies Symposium in Banff, established a web site (www.surfcanda.org), and developed several draft logos. The group currently acts as an "adhocracy" (i.e., has no formal structure) and is actively seeking participation from interested individuals.

Dave ended his presentation by telling participants that additional SURF organizations are emerging in Japan, China, The Netherlands, and the European Union.

After the presentation, discussions focused on the success of SuRF-UK and the definition of “success.” Dave said he believes success in this case is defined as rapid consensus. He said that SuRF-UK was able to learn from SURF’s experiences and engaged the regulators at the right time. Dave also emphasized that the risk-based regulatory framework present in the United Kingdom is more amenable to the application and adaptation of sustainable remediation. Karin Holland (Haley & Aldrich and a former Brit) agreed, saying the British environmental regulatory system is much less complex than the U.S. system.

SURF’s Nine-Step Process for LCA Put to the Test

Todd Krieger (DuPont) tested SURF’s nine-step process for performing LCAs on a remediation project. In Summer 2011, SURF published guidance on performing footprint analyses and LCA for the remediation industry. The guidance involved the following nine steps: (1) define the study goals and scope, (2) define the functional unit, (3) establish the system boundaries, (4) establish the project metrics, (5) compile the project inventory (i.e., inputs and outputs), (6) assess the impacts, (7) analyze the sensitivity and uncertainty of the impact assessment results, (8) interpret the inventory analysis and impact assessment results, and (9) report the study results. Todd used the guidance when performing a LCA for a former chemical manufacturing facility in California containing tetrachloroethylene (PCE)-contaminated soil. Step-by-step details are provided in the presentation slides (see Attachment 11).

Todd explained that the LCA model was built in such a way so that relative contributions could be observed from each of the different steps. The impact assessment indicated that the key differentiators were diesel fuel use, consumables, and the primary contaminant (i.e., PCE). Todd said that one limitation was the translation of LCA results for toxicity to risk-based evaluations, which are more common in the remediation field. Sensitivity and uncertainty analyses were used to evaluate key input assumptions, including the fate of PCE during remediation (i.e., volatilization during excavation), material use rates, and required transport distances based on whether waste material is deemed hazardous or nonhazardous. Todd explained the results, which showed a trade-off among the cases allowing for reduced PCE air emissions at the expense of increased diesel fuel use. He emphasized that engaging stakeholders or performing a risk-based analysis is required to reach a final conclusion. Todd said that this study showed that the burdens generated from all of the options were small compared to other local emissions not included as part of the evaluation, suggesting that environmental life-cycle results should not drive the remedy selection.

At the end of his presentation, Todd provided his reflections of the process and results. He believes that the nine steps led to a robust, defensible analysis, but acknowledged that regulator feedback is pending. He noted that a significant portion of the work was associated with the reporting step (Step 9) and recommended the development and use of templates to streamline the effort. Todd said that following the process led to improvements and modifications to the individual cases along the way (i.e., using on-site backfill material, pinpointing real landfill distances, adding a second aeration alternative that included PCE emission capture). Presentation slides are provided in Attachment 11.

Discussions were brief, with one participant providing his reflections on balancing impacts and the importance of stakeholder input. He cited the South Lake Union neighborhood as an example. As presented earlier and detailed in Attachment 3, cleanup at this site involved disposal of contaminated soil in a landfill—despite the large footprint associated with this

approach. In this case, the footprint of the remedy was balanced with the stakeholders' need to re-develop the property quickly (vs. continuing land stagnation), demonstrating the importance of site specifics and stakeholder input when implementing SURF's guidance.

Sustainability and the USEPA: National Research Council Report

Mike Kavanagh (Geosyntec Consultants) presented an overview of the National Research Council's (NRC's) report that provides an overall management system framework for sustainability for the USEPA. The USEPA requested this work and asked that the NRC answer the following four questions when developing the framework:

- ☐ What should be the operational framework for sustainability for the USEPA?
- ☐ What scientific and analytical tools are needed to support the framework?
- ☐ How can the USEPA decision-making process (rooted in the risk assessment and risk management paradigm) be integrated into this new sustainability framework?
- ☐ What expertise is needed to support the framework?

The NRC responded by developing a framework with a three-tiered approach that integrates the three aspects of the triple bottom line. The framework was developed based on a prior NRC report entitled *Risk Assessment in the Federal Government* (1983), and scale-up issues were considered so that the USEPA could use the framework when remediating sites. The NRC also developed the Sustainability Assessment and Management (SAM) approach, which is designed to be comprehensive, systems-based, and intergenerational. The SAM process solicits stakeholder involvement and collaboration; is driven by sustainability principles and goals; and involves setting, meeting, and reporting on measurable performance objectives. Through the framework and the SAM approach, sustainability principles and goals are incorporated into USEPA decisions and actions. Mike said that the adoption of the framework and the application of the SAM approach are discretionary. The report is available for free as a PDF from the National Academies Press; presentation slides are provided in Attachment 12.

Participants asked Mike for his insights about the USEPA's perspective of risk communication and sustainable (vs. green) remediation. Mike said that risk communication was discussed with the USEPA, but not at length. During report development, the NRC and USEPA discussed the need to consider sustainability factors when addressing very stringent cleanup goals. Although this issue is not addressed in the resulting report, Mike believes that the stage is set for future discussions and debate. One participant said that the report clearly supports sustainable (vs. green) remediation and states that sustainable remediation is within the jurisdiction of the USEPA.

Committee and Initiative Breakout Sessions

SURF members continue to work on efforts that will further the mission of the organization. At this meeting, breakout sessions were held for the following committees and technical initiatives: Academic Outreach, Integration of Sustainable Remediation and Sustainable Re-Development, Communications and Outreach, Sustainable Remediation Resources Database (formerly known as the "Site of Sites" Initiative), and Sustainable Remediation Site Rating and Professional Certification System. Members can access the latest work and activities of these groups by visiting the Collaboration Area under the Member Resources menu on the web site. Members

interested in joining an initiative or committee should contact the group's leader, which is provided at <http://www.sustainableremediation.org/committees/>.

❑ Academic Outreach

This group met to discuss the SURF Student Paper Competition at Battelle in 2012, student chapters, the academic contact database, sustainable remediation research topics, a proposed SURF academic outreach newsletter, and the possibility of a SURF foundation for research projects.

- SURF Student Paper Competition

At the last meeting, the group discussed the process of the SURF Student Paper Competition at Battelle in 2011 and brainstormed ideas for improvement. At this meeting, the group discussed plans for the competition in 2012, emphasizing that papers should be requested to include elements of sustainable remediation. Mike Miller (CDM), Dave Woodward (AECOM), and Stewart Abrams (Langan Engineering) volunteered to be members of a subcommittee for this event and agreed to investigate the possibility of SURF hosting a student event (e.g., provide food and mingle with SURF members) at the conference.

- Student Chapters

The group told participants that the following student chapters are currently established or being formed: Colorado State University, Syracuse University, Colorado School of Mines, and Clarkson University. The group encouraged participants at the meeting to reach out to former advisors and schools to gauge interest in potential new student chapters. Schools with courses that address sustainable remediation, such as University of California – Berkeley, University of California – Davis, and Harvard University, are good candidates. In addition, the group discussed the concept of a SURF liaison with each student chapter. Ideally, the liaison would be located in proximity to the school, attend student meetings, and help coordinate SURF members' presentations at student chapter meetings.

Students at Colorado School of Mines recently developed a list regarding the benefits of SURF membership and the advantages of student chapters in general (a.k.a., the value proposition). Academic Outreach members will keep the list up to date and communicate these benefits of membership to existing and potential student chapters.

- Academic Contact Database

The group continues to build a database of academic contacts (including professors performing relevant research or teaching courses applicable to sustainable remediation). The group discussed plans to include the contact information in the members-only portion of the web site and perhaps also develop a web-based form for SURF members to add new contacts.

- Sustainable Remediation Research

Since the last meeting, the group sorted SURF members' ideas for future

sustainable remediation research. A subcommittee consisting of Mike Miller (CDM) and Stewart Abrams (Langan Engineering) has been formed and volunteered to find commonalities among the ideas and prioritize the top 10 research topics. The effort may lead to an article or technical note in an academic journal.

- Academic Outreach Newsletter
Pamela Dugan (Carus Corporation) proposed development of a quarterly newsletter that highlights student research and student chapters and encourages networking between SURF members, student chapters, and other schools. The newsletter remains in the proposal stage.
 - SURF Foundation
Ongoing discussion has occurred within the group about the ability to reach the academic community more effectively by providing funding for research projects. Dave Woodward (AECOM) mentioned that previous discussions have occurred within SURF regarding the development of a SURF foundation in the future.
- ❑ Integration of Sustainable Remediation and Sustainable Re-Development
Karin Holland (Haley & Aldrich) introduced this new technical initiative, which has the following objectives:
- Identify the different sustainable remediation and sustainable re-development efforts currently taking place.
 - Develop guidance for practitioners to better integrate sustainability iteratively throughout the remediation and re-development process.
 - Form partnerships with and act as a resource to like-minded programs and organizations.

During the breakout session, the group discussed the scope and schedule for a fact sheet about the topic, with the hope of completing the fact sheet by the next SURF meeting.

- ❑ Communications and Outreach
At the last meeting, this committee solicited feedback from SURF members about how to communicate more effectively within SURF, gain new members, and retain members. At this meeting, the group tried to map the information to their 2011 goals and objectives against which they will base their next steps. In addition, group members informed participants that they have compiled a list of green and sustainable remediation contacts categorized by state as a resource for future outreach efforts.
- ❑ Sustainable Remediation Resources Database
This initiative was formed as an interim measure to the previously proposed creation of a sustainable remediation site database. The goal of this initiative is to develop an internet-based resource that categorizes and provides links to existing sustainable remediation resources (e.g., guidance frameworks, documents, case studies, carbon footprint calculators), describes their unique utility, and objectively rates them to the extent possible. As a first step, the group teamed

with the Illinois Institute of Technology (IIT) to help identify publicly available resources. IIT developed a template to use in evaluating and inventorying resources for reference by sustainable remediation practitioners. IIT also illustrated the application of the template and inventory system by applying the framework and including 32 sustainable remediation resources. While not yet ready for release to the public, the results have been compiled in a document. Currently the group is discussing the possible next steps so that the initiative can continue moving forward.

- ❑ **Sustainable Remediation Site Rating and Professional Certification System**
Ray Lewis (Sunpro) presented this new initiative, which is aimed at determining if an adequate business case exists for developing and applying a site rating and professional certification system for sustainable remediation. The group is taking a phased approach to guide the initiative; the first phase involves researching existing sustainability site rating and professional certification systems. The group plans to develop a white paper discussing these existing systems, as well as presenting the business case (if valid) of establishing and applying such a system to sustainable remediation.

Next Meeting

The next meeting (SURF 19) will be held from January 31-February 2, 2012 at the University of California - San Diego in San Diego, California. Information regarding the details of the meeting is posted on the web site. If you are a SURF member and would like to help plan or host an upcoming meeting, contact Mike Rominger (meeting facilitator) (see Attachment 1 for contact information).

ATTACHMENTS

Attachment 1
SURF 18 Participant Contact Information

SURF 18 Participant Contact Information

Participant	Affiliation
Abrams, Stewart	Langan Engineering & Environmental Services
Accardi, John	AECOM
Adams, Kathy	Writing Unlimited, LLC
Archibald, Craig	HAZCO Environmental Services
Armstead, Robert	Net Zero Development
Barth, Ryan	Not Available
Bealer, Buddy	Shell Oil Products
Blair, Lori	The Boeing Company
Brandt, Jessica	Washington State Department of Ecology
Bussey, Troy	PIONEER Technologies Corporation
Butler, Brandt	URS Corporation
Caron, Greg	Washington State Department of Ecology
Chaudhry, Tanwir	Consultant to Naval Facilities Engineering Service Center
Colligan, Tom	Floyd Snider
Dagseth, Renee	U.S. Environmental Protection Agency
Dona, Carol	U.S. Army Corps of Eng. Env. & Munitions Ctr.
Dugan, Pamela	Carus Corporation
Ellis, Dave	DuPont
Faghin, Nicole	AECOM
Fiorenza, Stephanie	BP
Fitzpatrick, Anne	AECOM
Fleri, Mark	WRScompass
Foster, Ben	ARCADIS
Frasco, Kelly	Carus Corporation
Galvin, Nick	The Boeing Company
Garson, Nick	The Boeing Company
Glenn, Chris	Treadwell and Rollo, A Langan Company
Gray, Tasya	AMEC
Haddad, Elie	Haley & Aldrich
Hadley, Paul	California Dept. of Toxic Substances Control
Hale, Ellen	U.S. Environmental Protection Agency
Hamilton, Lisa	General Electric Company
Hendrickson, Kris	Landau Associates
Holland, Karin	Haley & Aldrich
Houck, Chris	AECOM
James, Andy	University of Washington Center for Urban Waters
Jones Stebbins, Stephanie	Port of Seattle
Kay, William	Haley & Aldrich
Keeley, Karen	U.S. Environmental Protection Agency - Region 10
Kluger, Mark	Dajak, LLC
Krieger, Todd	DuPont
Kuriowa, Roy	Port of Seattle
Larsen-Hallock, Lorraine	TechLaw Inc.
Lewis, Ray	SUNPRO

SURF 18 Participant Contact Information

Participant	Affiliation
Long, Issis	U.S. Department of Navy
Lubrecht, Michael	Directed Technologies Drilling, Inc.
Lynch, Kira	U.S. Environmental Protection Agency
Martin, Todd	Integral Consulting Inc.
McCormack, Tim	Engineering/Remediation Resources Group, Inc.
McGaughey, Larry	AMEC
Means, John	Washington State Department of Ecology
Meyer, Michael	URS Corporation
Miller, Michael	CDM
Moxley, Katie	The Boeing Company
Murawski, Steven	U.S. Environmental Law Counsel
Nichols, Ralph	Savannah River National Laboratories
Opalski, Dan	U.S. Environmental Protection Agency
Payne, Brian	Hart Crowser
Pearson, Erik	ENVIRON International Corporation
Pendowski, Jim	Washington State Department of Ecology
Powers, Martin	CH2MHILL
Ragain, Sean	Geosyntec Consultants
Raymond, Dick	Terra Systems, Inc.
Reackhof, Sharron	Pacific Gas and Electric
Rodin, Jeffry	U.S. Environmental Protection Agency
Roelen, Piper	Landau Associates, Inc.
Rominger, Mike	MCR Facilitation Services
Ryan, John	AECOM
Sanga, Ravi	U.S. Environmental Protection Agency
Schuchardt, Dave	City of Seattle
Seeds, Tena	JBR Environmental Consultants
Serie, Pat	EnvirolIssues
Sheldrake, Beth	U.S. Environmental Protection Agency
Sheldrake, Sean	U.S. Environmental Protection Agency
Shestag, Steve	The Boeing Company
Skance, Olivia	Chevron
Spangler, Brick	Port of Seattle
Spurlin, Matt	ARCADIS
Takasaki, Kym	Port of Seattle
Teter, David	Northgate Environmental Management
Thomson, Angie	EnvirolIssues
Torrens, Jake	AMEC
Truax, Rich	AECOM
Voges, Halah	AECOM
White, David	King County Wastewater Treatment Division
Woodward, Dave	AECOM
Remote Attendees	
Fisher, Angela	GE Global Research

SURF 18 Participant Contact Information

Participant	Affiliation
Kavanaugh, Mike	Geosyntec Consultants
Smith, Maile	Northgate Environmental Management
Wice, Rick	Tetra Tech

Attachment 2
Welcome and Opening Remarks



SURF 18 WELCOME AND OPENING REMARKS

SEATTLE, WASHINGTON

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BACKGROUND/HISTORY

- Formed in 2006 as an adhocacy of interested parties
- Growth and initiatives fueled need for a more formal organization (and money)
- Published white paper as dedicated edition of the Remediation Journal in 2009
- Incorporated as a NJ non-profit Corporation in 2009
- Established Board of Trustees and Officers
- Established website at www.sustainableremediation.org
- Several ongoing technical initiatives and committees

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SURF - PRIMARY OBJECTIVE AND MISSION STATEMENT

SURF's primary objective is:

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

Mission - to maximize the overall environmental, societal, and economic benefits from the site cleanup process by:

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

Attachment 3
Sustainable Remediation in the Urban Environment

Sustainable Remediation In the Urban Environment: Opportunities & Challenges

SURF 18
September 21, 2011



AECOM

Where will another 100 Million people go? Drivers for Re-Urbanization

- Economic
 - Gateway Cities provide the infrastructure & brainpower jobs that support sustainable growth
 - Productivity & job creation increases w/density
- Environmental
 - Footprint reduction opportunities
 - Energy efficiency
- Social
 - Better places to live creates a comparative advantage

"You just can live more efficiently with less environmental impact in infill areas,"



AECOM

Key Aspects of Sustainable Remediation

ECONOMIC
Remedial actions that reduce site risks & provide economic benefits.

SOCIAL/COMMUNITY
Adaptive reuse that provides a benefit to the community.

Sustainable Cleanups

ENVIRONMENTAL
Technologies, approaches & designs that reduce the environmental footprint of site cleanup.



Sustainable Remediation Supports Re-urbanization

- Infill & Transportation Oriented Development
- Infrastructure and Job Creation
- Parks & Green Space
- Habitat Protection & Enhancements
- Better Places to Live - A Comparative Advantage



Infill: Multiple cleanups needed for the creation of the South Lake Union Neighborhood

- **Economic**
 - Amazon
 - Biotech
 - \$1.7 Billion invested
- **Environmental**
 - Many dig & hauls due to liability concerns, schedule constraints
- **Social**
 - Live/Work neighborhood



Infrastructure: Port of Seattle Superfund Cleanup creates intermodal hub of the future

- **Economic**
 - Cleanup paid in part with Brownfield funds & integrated into site infrastructure reducing total project costs
- **Environmental**
 - Integrated cap and site infrastructure reduces footprint
 - More efficient transportation infrastructure improves air quality
- **Social**
 - Created 1000 new family wage jobs



Green Space: Former Oil Terminal Transformed into Seattle Olympic Sculpture Park

- Economic
 - Brownfield grants help fund project
- Environmental
 - Reduced footprint through bio treatment, capping & SVE
 - Restoration of Native Habitat/Vegetation
 - Stormwater Management
- Social
 - Provide physical access to water
 - Educational Programs and Partnerships
 - Public Art



Community Engagement: Duwamish sediment cleanup engages broad group of stakeholders

- Economic
 - Significant burden on tax payers & business
 - Stigma effect on investment
- Environmental
 - Cleanup levels based on "Natural Background"
 - Substantial footprint, limited BMPs
 - Stormwater Recontamination
- Social
 - Broad mix of interests
 - Environmental Justice



What's different about cleanups in Washington cities?

- Economic
 - Grants available to public entities for cleanup
- Environmental
 - Human health risk of 10^{-6} and Hazard Quotient =1,
 - or **Natural Background**
 - Preference for treatment or removal in order to attain standards
- Social
 - Tribal Treaty Fishing Rights include most urban areas



Challenges of urban cleanups

- Economic
 - Residual liability creates disincentives for infill and reuse
- Environmental
 - "Big Footprint" cleanups
 - Space & schedule constraints
 - 80/20 rule
 - Limited technology options
- Social
 - Balancing multiple stakeholder expectations
 - Process



Agenda Overview

Day 1

- How are your organizations integrating sustainability into Site Cleanups?
- Unique challenges of cleanups in the NW
- Social Considerations
- Economic Factors
- Update on State, Federal and Global Initiatives

Day 2

- Walking the Talk
- Breakouts



Agenda- Morning, Wednesday, September 21

- | | |
|--------------------|--|
| 9:00 am – 9:30 am | Sustainable Remediation Opportunities and Challenges in the Urban Environment
John Ryan, AECOM |
| 9:30 am – 9:45 am | Break (refreshments) |
| 9:45 am – 12:00 pm | Panel Discussion: How are your organizations integrating sustainability into site cleanups?
Nick Garson, Moderator; Pat Serie, Recorder
Steven Shestak, Boeing
Jim Pendowski, Ecology (tentative)
Dan Opalski, EPA
Stephanie Jones Stebbins, Port of Seattle
Tanwir Chaudhry, Navy
Carol Dona, Army Corps of Engineers |
| 12:00 pm – 1:00 pm | Lunch (on your own) |



Agenda — Afternoon, Wednesday, September 21

- 1:00 pm – 2:00 pm **Unique challenges of sustainable cleanups in the Northwest**
Dave Schuchardt, City of Seattle – Sediment Cleanups
Sean Sheldrake, EPA Region 10 – Implementing EPA's Policy
- 2:00 pm – 2:45 pm **Integrating Social Aspects in SR**
Pat Serie, EnviroIssues; Renee Dagseth, Region 10 EPA – Beyond Outreach: Approaches & Tools That Work
- 2:45 pm – 3:15 pm **Break** (refreshments)
- 3:15 pm – 4:00 pm **Economic Considerations**
Dave White, King County – Economic Impacts on the Regional Economy Related to Site Remediation
John Means, Ecology – Economic Vitality and Environmental Cleanup in Washington State: Qualitative and Quantitative Case Studies
- 4:00 pm – 5:00 pm **Update on State & Global Initiatives**
Karin Holland, Haley & Aldrich – Current Status of State Guidance and Policies
Dave Woodward, AECOM – SURF the Globe: An Update on Global Initiatives
Mike Kavanaugh, Geosyntec – Update on National Academy Report on Sustainability and the EPA
- 6:00 pm – 9:00 pm **Dinner**
McCormick & Schmicks, 1103 First Avenue (at Spring Street)



Agenda — Thursday September 22

- 8:15 am – 8:30 am **Reflections on Day 1**
- 8:30 am – 9:00 am **Walking the Talk: SURF's Nine-Step LCA Process Tested**
Dave Ellis, DuPont
- 9:00 am – 10:15 am **SURF Committee/Initiative Breakouts**
Integration of Sustainable Remediation and Sustainable Redevelopment Initiative
Main Conference Room – 800-725-9556, passcode 7661188
Academic Outreach Initiative
AECOM Conference Room – 877-656-5068, passcode 1999414
- 10:15 am – 10:30 am **Break** (refreshments)
- 10:30 am – 11:00 am **Reports from Committee/Initiative Breakouts**
- 11:00 am – 11:30 am **SURF Business, Updates, and Adjournment**
- 11:30 am – 12:30 pm **Lunch** (on your own)
- 12:30 pm – 4:30 pm **Field Trip to Boeing Everett Plant**
All attendees must be registered in advance. Boeing will provide a tour bus for this trip. The bus will leave from the SURF venue after lunch (12:30 pm sharp) and return to the same location by 4:30 pm.
Please note that footwear must completely cover your feet and have low, wide heels (no sandals or high heels).





Thank you!

John Ryan
360 468 4745
john.ryan@aecom.com

AECOM

Attachment 4
Sustainability Considerations for
Sediment Remediation in the Northwest

Sustainability Considerations for Sediment Remediation in the Northwest

David Schuchardt, P.E.
Seattle Public Utilities

September 21, 2011

SURF 18
Fall 2011 Conference
Seattle, WA

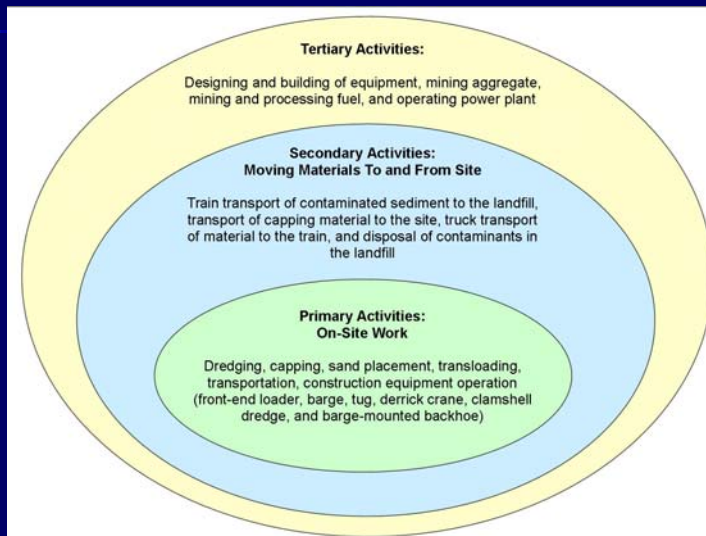


Sediment Clean Up Sustainability Considerations

- Environmental
 - Risk reduction (over time)
 - Footprint reduction (greenhouse gas, waste)
- Economic
 - Cost effectiveness
 - Secondary economic impacts
 - Maintain viable waterway uses
- Social
 - Public access
 - Cultural fish consumption practices
 - Significant stakeholder engagement



Life-Cycle of Remediation



Northwest Factors

- Nearby landfills
 - Ability to accept wet sediments
- Rail infrastructure
- Transloading facilities
- Maintenance dredging of clean sand
- Short construction season
- Land use limits hydraulic dredging
- Nearshore fills unlikely

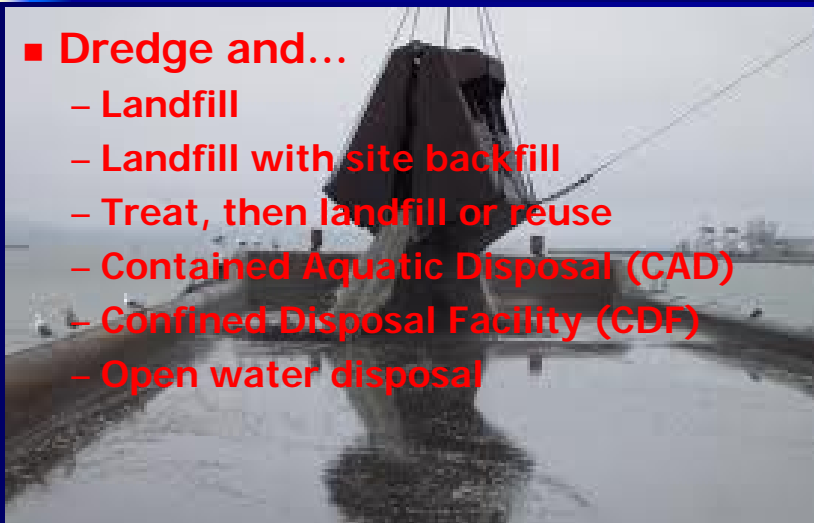
Environmental Metrics

- Gas emissions (CO_2 , NO_x , SO_x , PM_{10})
- Energy Consumption
- Carbon footprint
- Landfill space consumption
- Aggregate consumption
- Habitat impacts
- Others



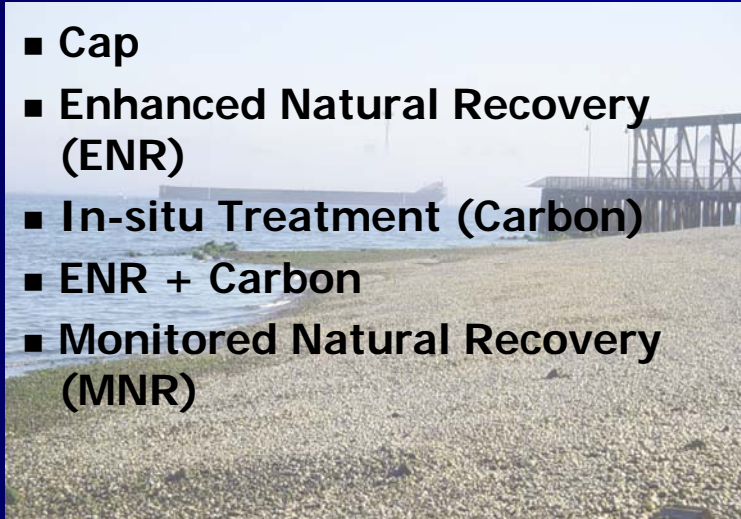
Sediment Remediation Toolbox (Remedy Selection)

- **Dredge and...**
 - Landfill
 - Landfill with site backfill
 - Treat, then landfill or reuse
 - Contained Aquatic Disposal (CAD)
 - Confined Disposal Facility (CDF)
 - Open water disposal



Sediment Remediation Toolbox (Remedy Selection, cont.)

- Cap
- Enhanced Natural Recovery (ENR)
- In-situ Treatment (Carbon)
- ENR + Carbon
- Monitored Natural Recovery (MNR)



BMP Toolbox (RD/RA)

- Limit dredge and cap construction volumes
 - Finer site characterization
 - Finer dredge prisms
 - Smaller contract overdepth/overcap tolerance
 - Residuals management with sand layer
 - Design thinner caps



BMP Toolbox (RD/RA, cont.)



- Fuel-efficient / reduced emissions equipment and operating procedures
- Recycle/reuse debris
- Biofuels, low sulfur fuels, electric
- Optimized transload/transport scheme
- Beneficial use of dredged material

Constraints on BMPs

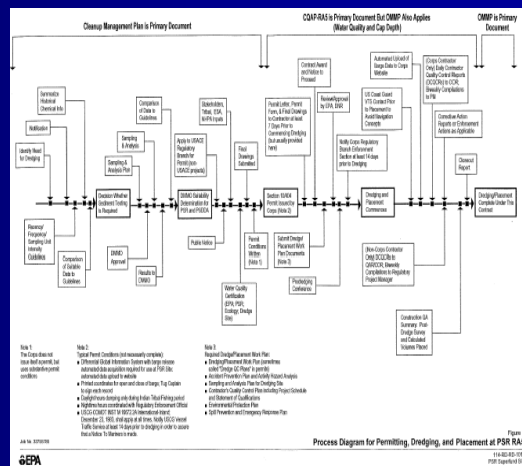
- Cost
- Ability to Bid
- Infrastructure (e.g., for electric dredge)
- Equipment availability
- Railroad requirements
- Regulator acceptance



- **USACE Navigation**
- **Other Proponents**
- **>5MCY
Designated
Suitable in
Northwest 02/03**

Constraints on Beneficial Use

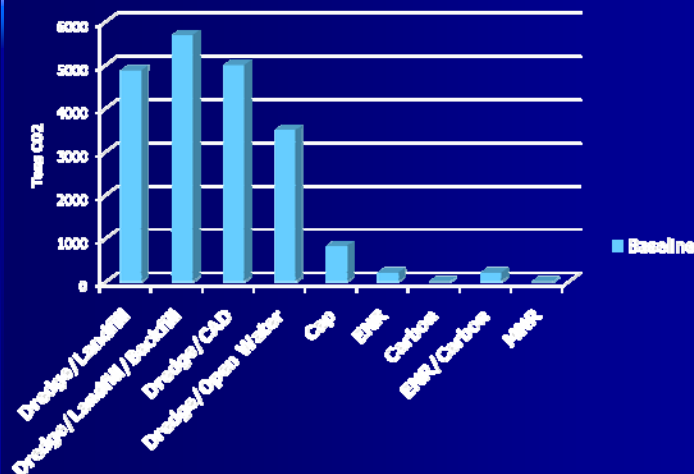
- Timing Unknowns
- Gradation Varies
- Competition
- Administrative process
- Production rate
- Contracting



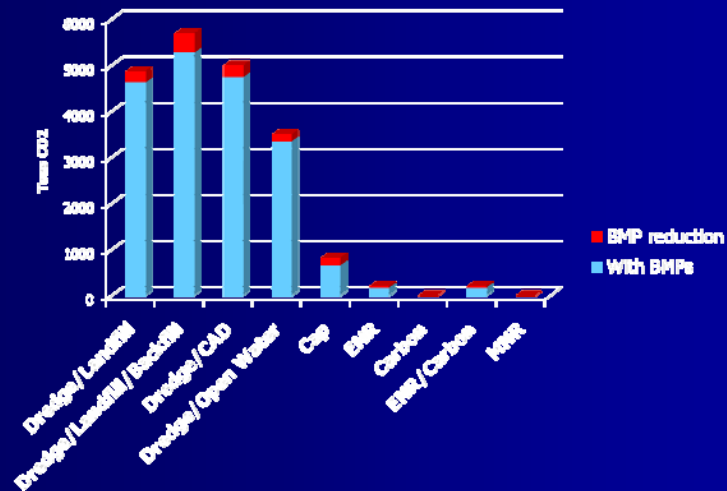
Basis for Comparisons

- 10-ac site
- 5-ft depth of contamination
- 50% volume creep
- Seattle – Roosevelt disposal
- 50% suitable for open water disposal
- BMPs: finer tolerances, maximize rail, biofuels in trucks
- Beneficial use: 50% of import material is dredged sand

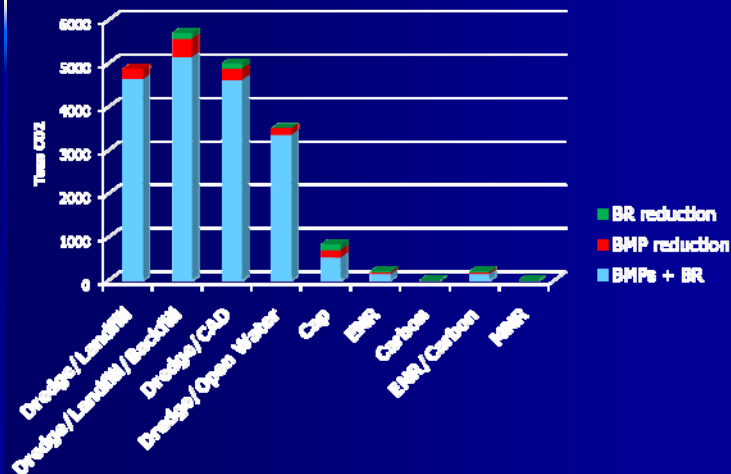
CO₂ Emissions – Effect of Remedy Selection



CO₂ Emissions – Effect of BMPs



CO₂ Emissions – Effect of BMPs and Beneficial Use



Pacific Sound Resources



- Contractor Awarded Duwamish Maintenance Dredge
- Able to Use 49,000 CY in nearshore caps (Clamshell)
- >200,000 CY Used in deepwater cap (Bottom Dump)
- Est. reduction of 818 metric tons CO₂

Conclusions

- Remedy Selection has the greatest effect on sustainability metrics
- Sustainability metrics should be considered in Feasibility Studies and Remedy Selection
- BMPs have limited effects on CO₂ emissions (5-15 percent)
- Beneficial use of dredged material to replace aggregate consumption has limited effects on CO₂ emissions (5-15 percent)



Attachment 5
USEPA Region 10 Going Clean and Green with Cleanup



Region 10 Going Clean and Green with Cleanup

SURF September 21, 2011



Sean Sheldrake
Wayne Elson



WEST COAST COLLABORATIVE
Public-private partnership to reduce diesel emissions

Overview

- Background on Federal Government Green Policies
- EPA and Region 10 Green Policies
- Myths and Facts on “Greening the Cleanup”
- R10 Success Stories



Region 10 Clean and Green Policy

- Goal - Enhance the environmental benefits of federal cleanup programs by promoting technologies and practices that are sustainable
- Establishes “points of departure” that **ALL** cleanups must either meet or provide site specific reasons why not
- Policy does not fundamentally change how and why cleanup decisions are made, but how they are implemented
- Implementation through enforcement agreements, cooperative and interagency agreements, contracts, grants, and promotion in state cleanup programs

4

R10 “Points of Departure”

- 100% use of renewable energy*
- Use of clean fuels, diesel emissions controls and retrofits, and emission reduction strategies
- Water conservation
- Use of reused or recycled materials
- Recycling and reuse of materials from site
- Environmentally preferable purchasing
- Green concrete
- Methane capture from landfills
- Use of EMS practices for all projects

Why Transportation?

- Transportation/heavy duty diesel equipment is often the biggest energy consumer for site response.
- Transportation and other vehicles used can be the biggest polluters for each unit of energy required to do the cleanup at your site, increasing short term risks.



Myth or fact

- Reuse of 85% of demolition materials on site meets EPA Region 10's clean and green goals.

8

Fact

- While 100% reuse or recycling is the target of the Region 10 policy, site specific exigencies may make 85% fully successful.

9

Myth or fact?

- The best way to reduce emissions on diesel vehicles is by using alternative fuels



10

Myth

- Significant additional reductions in (HC?) hydrocarbons, particulates, and other contaminants is possible through tailpipe retrofits.



11

Myth or fact?

- Electric dredges are always the greener way to go



12

Myth

- Electric dredges require electricity which may or may not be from a clean source, e.g. a coal-fired power plant or diesel electric(??) without tailpipe retrofits
 - At certain times of the year and day, up to 20% of the northwest power grid is produced by coal plants. Other parts of the country it is significantly higher



13

Myth or Fact?

- ULSD costs more and can cause problems with my engine.



14

Myth

- ULSD is actually now required for most sectors on and off road.
- Engines will continue to work just as they did without the fuel contaminant sulfur.



15

Myth or fact

- Clean diesel engines simply aren't available according to my contractor.



16

Myth

- Your contractor is partly correct, and this is changing due to demand for cleaner burning engines.
- To ensure use of clean diesel and cleaner burning engines, include *specifications* in the bid package requiring the latest tier vehicle and/or retrofits.

17

Myth or fact

- Rail transportation is “greener” than truck transportation

18

Fact -Avoiding Or Substantially Reducing Emissions

- Rail transportation is roughly 10 times more efficient than truck transportation, resulting in a similar emissions reduction.



Myth or fact

- Idle reduction is bad for my diesel engine

Myth

- Idle reduction does not harm diesel (or gas) engines if implemented properly.
- The guideline for HD diesel is 3 minutes (WCC), while for gas, it is about 30 seconds.



21

Myth or fact

- Money spent on clean diesel and cleaner burning engines, in the end, just makes things more expensive.

22

Myth Why is Reducing Emissions Important?

Costs for Society

- \$Billions in healthcare per year related to particulate exposure
- \$5 million/year spent on health care in California related to diesel emissions

What Are The Benefits?

- Significantly reduces harmful particulate matter and ground-level ozone precursors
- Reduces exposure in communities and sensitive populations nearby Superfund & redevelopment sites
- **\$1 invested in diesel emissions reductions → \$13 in health benefits**
 - Decrease in hospital admissions (Asthma attacks, heart attacks, cardiopulmonary illnesses)
 - Fewer lost work and school days

See: <http://epa.gov/region09/cleanup-clean-air/index.html> for more details



Why is Reducing Emissions Important?

Degrades Air Quality

- Particulate Matter (PM)
- Ozone precursors

Energy and Climate Change

- Over 40% of green house gas emissions from mobile sources
- Over 90% of fuel imported petroleum

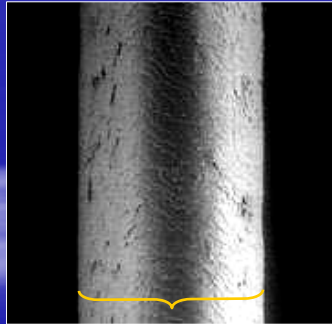
Serious Health Effects

- Diesel exhaust is a “**likely human carcinogen**” and respiratory irritant
- Harmful diesel PM
- Diesel exhaust contains “likely” and “known” (e.g., benzene) human carcinogens, and also have respiratory, neurological, developmental, and immunological health effects.

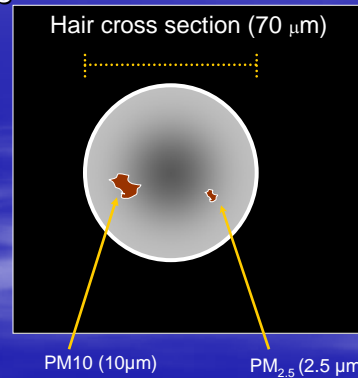


Particulate Matter (PM) In Diesel Exhaust Is The Driver Of Risk

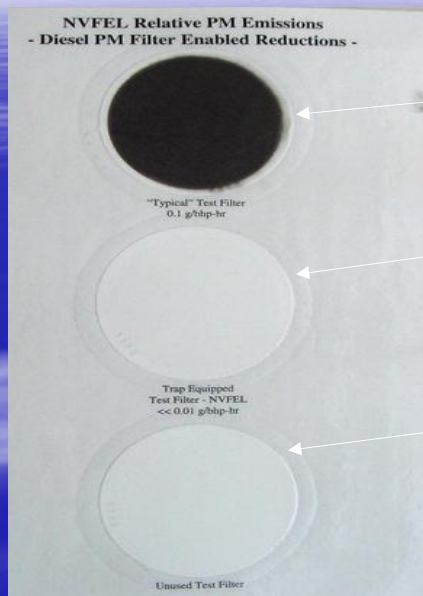
- Mix of particles and liquid droplets
- Considerably smaller in size than human hair
- Penetrates deeply into the lungs



Human Hair (70 μm diameter)



Diesel Particulate Filter Emissions Reductions



Typical test filter – no DPF

Test filter – with DPF

Unused test filter



Region 10 Success Stories

- GR remediation language included in all Superfund contracts and agreements with other agencies (i.e., Corps of Engineers)
- Brownfields program evaluation of solar power for vapor treatment system
- All Superfund grants to States for capacity building include green remediation task
- Site specific GR procurement strategies developed for all construction-related projects
- Use a minimum of biofuels for off-road engines at cleanup sites; biofuels used where available
- Engine filter retrofits on all regional diesel vehicles and use of biofuels for boats
- Well 12A
- Renewable energy credits or renewable energy purchased for all Superfund-financed work starting in January 2012

Divers will Breathe Cleaner Air

40% less carbon monoxide



EPA dive boat in Puget Sound

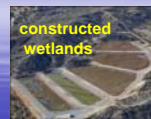
Emergency Response Vehicle Retrofits / Alternative Fuels

- B100 usage where available, average B50 usage reducing SO_x, CO, HC, PM by approximately 50% overall
- DMFs added to trucks to reduce the remaining output of PM by another 50%



National Superfund Program Successes

- ◆ Apache Nitrogen Products, Inc.
- ◆ Aerojet-General Corporation
- ◆ Fort Carson
- ◆ Frontier Fertilizer
- ◆ Massachusetts Military Reservation
- ◆ Operating Industries, Inc., Landfill
- ◆ NASA Jet Propulsion Lab
- ◆ Pemaco
- ◆ Re-Solve, Inc.
- ◆ Upper Arkansas River



GR Implementation Challenges

- Overwhelmed project managers, GR perceived as “just one more thing to do”
- Educating staff and partners on how to identify opportunities for GR within the cleanup process – “dispelling myths”



31

Questions?

Sean Sheldrake – 206-553-1220

Sheldrake.sean@epa.gov

Wayne Elson – 206-553-1463

Elson.wayne@epa.gov

On the Web:

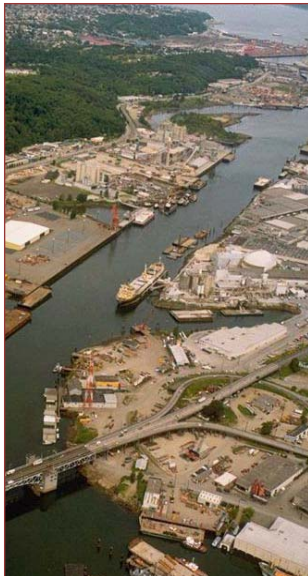
Google “Region 10 EPA Green Cleanups”

<http://yosemite.epa.gov/R10/extaff.nsf/programs/greencleanups>

Also see CLU-IN web page.



Attachment 6
Integrating Social Aspects into Sustainable Remediation



Integrating Social Aspects into Sustainable Remediation

Sustainable Remediation Forum
September 21, 2011

Pat Serie, EnviroIssues

Renee Dagseth, U.S. Environmental
Protection Agency Region 10

Why us? Why together?

Regulatory
Agencies



Lower Duwamish
Waterway Group

Port
of Seattle

City of Seattle

King County

BOEING

- Sampling
- Studies
- Plans
- Analyses

Lower Duwamish as Case Study

- Issues we hear from community, tribes, local government, business
- Tools and methods we are using
- Integrating social aspects into Superfund and MTCA decision making
- Lessons we are learning every day!

Superfund Process Well Under Way



- ## What works to address issues?



- Early consultation and outreach key
- EPA's Citizens Advisory Group, Tribes, Trustees, and waterway businesses active
- Culturally-sensitive tools and messengers
- Assessing environmental justice impacts
- Proactive media outreach

Early consultation and outreach – is it worth it?

- Ten years of investigation and feasibility study options represent ten years of consultation
- EPA owns relationship with Tribes, Trustees, Citizens Advisory Group; LDWG supports
- Highly technical information benefits from detailed discussion
- Broad community outreach at much more general level, but increasingly aware
- Social aspects integrated into technical work (fish consumption scenarios, direct-contact risks)

CAG, Tribes, Trustees, Business – Most Deeply Involved



- EPA has special relationships with CAG, Tribes and Trustee agencies – quarterly meetings, government-to-government relationship with Tribes, other outreach
- Consultation expanded to include waterway businesses once 104(e) requests received
- Opportunities to follow development of Feasibility Study, delve into detail; issues identified for resolution
- No silver bullet – issues remain under discussion – but dialogue is open

Culturally-Sensitive Tools and Messengers Needed for ESJ Communities

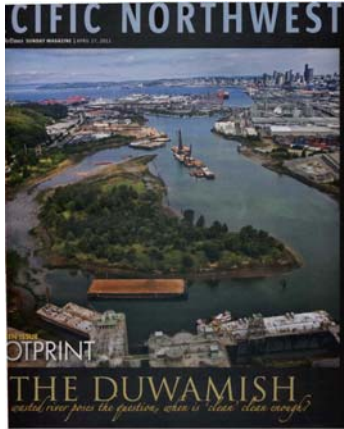


- Traditional outreach reaches traditional community members, but LDW area is rich in cultural and socioeconomic diversity
- Translation of materials is standard; outreach went further
 - Spanish-speaking focused interactive workshop; coordination with CAG for outreach events with food, community translators, children's events
 - Fish consumption surveys by health department and multi-cultural outreach nonprofit
 - Presence at community events – festivals, health fair

Assessing Environmental Justice Impacts

- EPA taking innovative approach to assessing short and long-term impacts of selected remedy on low-income and minority communities, Tribes, based on community requests
- Focuses on implementation of proposed remedy
- Community outreach planned to engage communities in draft assessment

Proactive Media Outreach Supports Balanced Coverage



- Media briefings and tours contribute to balanced national and local coverage
- Challenge to reach media outlets used by immigrant and non-English-speaking communities
- Considering interactive website and potentially other social media

Integrating Social Aspects into Decision Making and Support for Remedy

- Entire team committed to environmental and social justice
- Ongoing dialogue at all levels identifies and attempts to resolve issues
- Clear tradeoffs – goal to balance cleanup benefits with construction impacts in already burdened community
- Also clear -- long-term behavior change needed for source control and fish consumption; investments will support cleanup remedy; continuing community engagement part of adaptive management

Lessons Learned So Far

- High complexity = high need for intensive, continuing dialogue with key stakeholders
- Broad community interests not easily represented through traditional public process; regional issue requires regional awareness
- Superfund process is specific but not isolated from other community issues – need to address broader context
- Focusing on people as well as contamination means decision making can move forward – not just within EPA and Ecology, but with local elected officials and community leadership

Wrap up and Questions

- How is this done in other regions, and how does that work?
- Questions we can answer?

Attachment 7
Economic Perspectives on Superfund Site Remediation

Economic Perspectives on Superfund Site Remediation



Presentation to Sustainable Remediation Forum

Dave White, Strategic Policy and Government Relations
King County Wastewater Treatment Division
Sept. 21, 2011

1

Scope

- A series of observations and perspectives of a (former) economist, new to the subject
- Based on involvement with Lower Duwamish Superfund Site as well as work with King County and the Lower Duwamish Waterway Group:
 - Boeing, King County, Port of Seattle, City of Seattle
- But perspectives are my own

2

Overall assertion: Cleanups Provide a Positive Net Economic Benefit

- REGIONAL ECONOMICS: long term, successful cleanup is good for the local and regional economy
 - Makes an area a better place to live, work, and invest
- NET SOCIAL VALUE: benefits generally worth the costs, but difficult to quantify in dollar terms
 - Some support in studies
- *Rather than “is cleanup worth it”, more appropriate to ask how to implement cleanup cost-effectively, without negatively impacting local and regional economy.*

3

But short term observations

- Resources are scarce; affected areas have other environmental and social needs
 - Need to seek cost-effective solutions
- “Process” costs are high
 - Desire to minimize contention, move expeditiously
 - Supports efficient adaptive management
- No “fund” in Superfund: costs borne locally
 - Will be real impacts on businesses, governments, makes less available for other things (e.g., investment)
 - Need to develop workable financing strategy

4

Lower Duwamish Example

- Demonstrates that affected areas can be an important part of regional/local economy
 - Provides ~100,000 jobs
 - High proportion in manufacturing/industrial sectors
 - Important diversity to regional economy
 - Difficult for these jobs to relocate regionally
 - Relatively high paying, not require substantial education (economic justice)
- Cleanup should maintain/enhance this regional economic engine

5

Some Risks from Process Uncertainty

- Does fear of liability, stigma if process is perceived as not going well affect business investment?
 - Some evidence that impacts residential property values
 - Speculative, but
- Some concern elsewhere: Portland (January 2010, Oregon Business) "Portland Harbor Sinks Underweight Ship"



6

Lower Duwamish

- Potential impacts (stakes) are high
 - Modeled regional impacts of 10% change in economic activity in just main economic sectors
 - Could be positive or negative
- Underscores importance of moving forward expeditiously, minimizing contention and delay

7

Local Economic Impacts of Cleanup (Regional Economic Analysis)

- Long term impacts of cleanup should be positive, what about short term?
- Lower Duwamish modeling:
 - Local stimulus from cleanup activity may not be significant
 - Some jobs occur outside affected area
 - Long timeframe dilutes stimulus impacts
 - Local stimulus effect differs by cleanup technology, e.g. dredging
 - Cleanup funds can come from local sources; resulting negative impacts could offset positive impacts
- However, cleanup offers some opportunity for development of new local industries (source control, monitoring, other?)
- Overall observation: *focus on cost-effective expeditious cleanup that is sensitive to economic base*

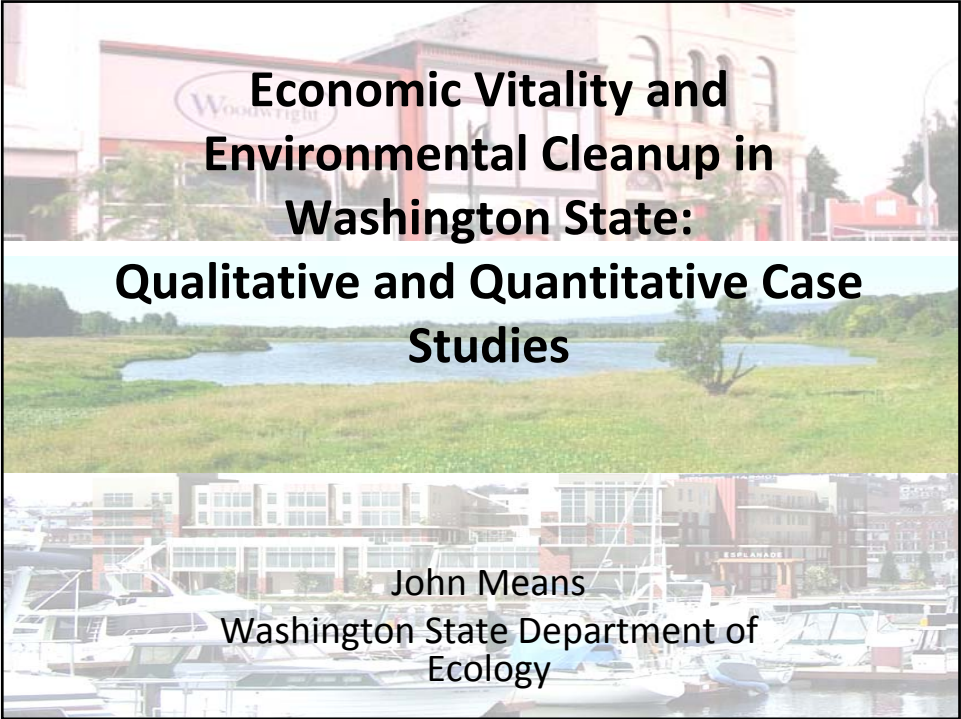
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Summary Observations for Sustainable Remediation

- Successful cleanup should benefit the local and regional economy in the long term
- Affected areas can be very important to the local and regional economy:
 - Maintaining economic activity important to sustainable, successful cleanup
 - Minimize contention, protracted process
- Short term economic impacts critical (now more than ever)
 - Recognize scarcity of resources, other priorities, impacts
 - Not automatically assume cleanup activity is “stimulus”
 - Seek expeditious, cost-effective solutions; implementable financing and implementation strategy

Attachment 8
Economic Vitality and Environmental Cleanup
in Washington State



Economic Vitality and Environmental Cleanup in Washington State:

Qualitative and Quantitative Case Studies

John Means

Washington State Department of
Ecology



Return on Investment: State Cleanup Dollars

- A 2009 Budget Proviso- Study MTCA Funds
We found out that.....

For Every MTCA Dollar Spent

- \$7 created in ongoing payroll value
- \$32 created in business revenue
- \$6 created in new local and state tax
revenues

Economic Improvement is Captured in Two Ways

- Immediate One-Time Capital Expenditures
 - Cleanup
 - Infrastructure and Habitat restoration
 - Vertical construction
- Long term Economic lift
 - Increased tax revenues and property values
 - Indirect spending by revitalized property
 - Job creation

Thea Foss Waterway- Tacoma

- Once home to thriving industrial activities served by rail and marine transportation infrastructure
- 1.5 miles of waterway on Commencement Bay
- By 1981 area was blighted and full of vacant buildings
- In 1996 the City took lead and created a Development Authority

Thea Foss Waterway: Economic Impact Assessment

- Estimated to generate \$133.7 million over a 20 year period in local and state taxes
- The State will see \$67.3 million in tax revenues
- State MTCA investment of \$30.4 million
- 2:1 ratio in tax revenues to MTCA funds

Palouse

- City of Palouse (population 1,100)
- Less than half acre in size
- Significant part of city's Main Street and adjacent to North Fork of Palouse River
- Commercial activity since 1800s. Most recently bulk fuel storage site
- Cleanup costs forecasted at \$343,000 (at time of study)

Palouse

- Potential future uses include mixed use, limited housing, public access to river
- Estimated to generate \$1.9 million in state and local taxes over 20 years assuming full build-out
- The city itself is estimated to receive \$282,000 in tax generation
- Cleanup estimate \$343,000 (at the time)

Bellingham Waterfront

- Bellingham Waterfront is a multiagency redevelopment effort
- 228 acres in 5 independent cleanup sites
- Port and City entered into interlocal
- agreements for planning, infrastructure and funding
- Over \$100 million for cleanup (half from Ecology grants)

Bellingham Waterfront

- Estimated to generate \$477.3 million in state and local taxes over a 20 year period assuming full build-out
- Port and City will receive \$4.6 million and \$73.1 million, respectively, in tax generation

Quantitative Case Studies: Job Creation

Project	Projected Annual Employment	MTCA Cleanup Projected or Actual	Ongoing Direct Jobs per Year per \$1,000 of MTCA Funds
Palouse	19.6	\$343,000	0.06
Bellingham	6,729	\$50,000,000	0.13
Thea Foss-Tacoma	1,036	\$30,400,000	0.035

More
Information:

John Means
360-407-7188

[john.means@ecy.
wa.gov](mailto:john.means@ecy.wa.gov)



**Model Toxics Control Act
Remedial Action Grants**

Alternative Financing Evaluation

January 2010
Publication no. 10-09-043

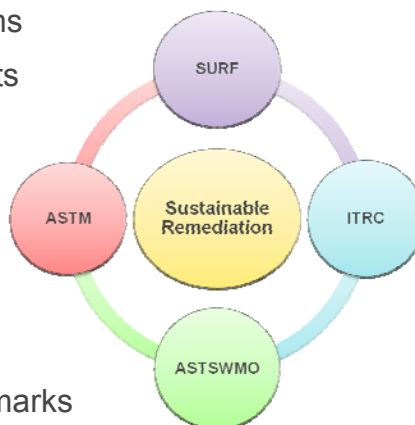
Attachment 9
State-Level Sustainable Remediation

State-Level Sustainable Remediation

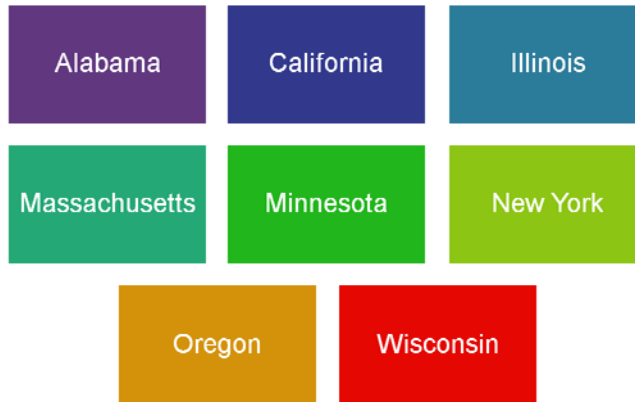
Presented by Karin Holland

Presentation Outline

- States programs
- Interstate efforts
- Concluding remarks



States with Sustainable Remediation Programs



Oregon

- **Draft policy** in place
- **Future work:**
 - Guidelines
 - Stakeholders meetings
 - Case studies
 - Website updates
 - Sustainability language in contracts



California

- Symposium
- Interim Advisory
- Pilots with Industry
 - PG&E
 - DuPont



ITRC

- Guidance for States
- Green and Sustainable Remediation Team



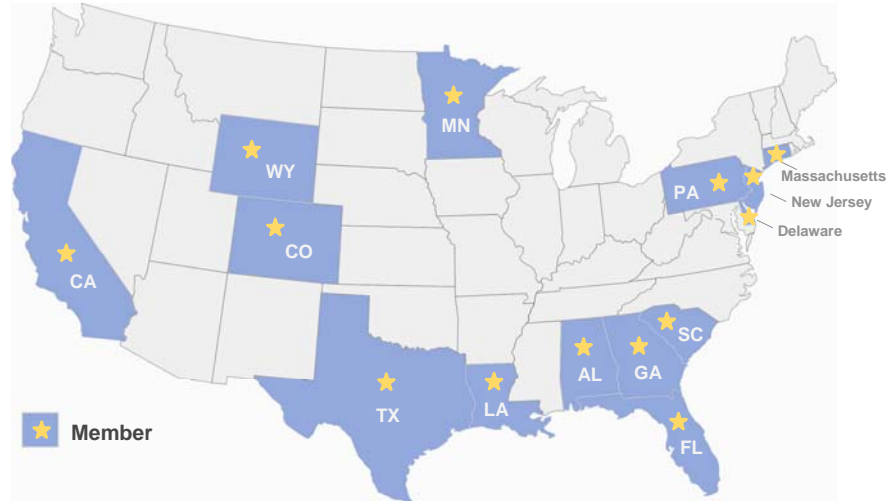
Deliverables:

Overview Document

Technical Regulatory Document

Internet Based Training

ITRC



7

Haley & Aldrich, Inc.

ASTSWMO

Association of State and Territorial
ASTSWMO
Solid Waste Management Officials

- Support to States and Territories
- Greener Cleanup Task Force

Deliverables:

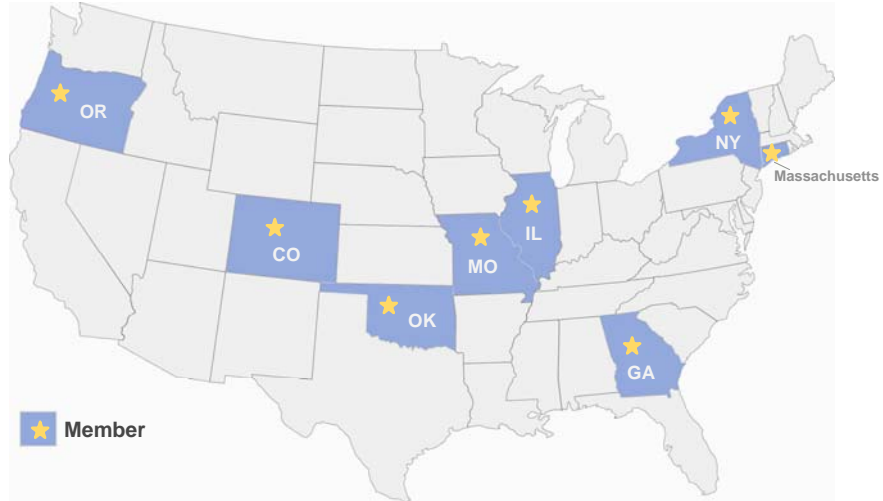
- Multiple guidance documents
- Recent activity → **barriers survey**:
 - Economics
 - Not explicitly included in regulations
 - Acceptance with conventional practices



8

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ASTSWMO



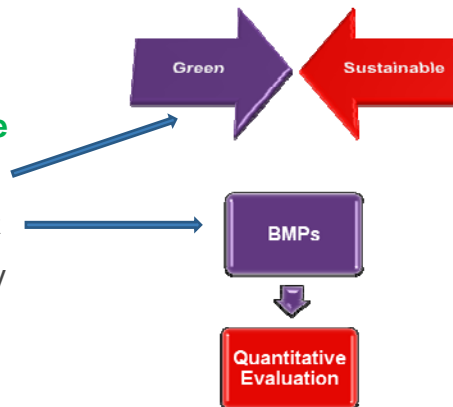
ASTM - Activities



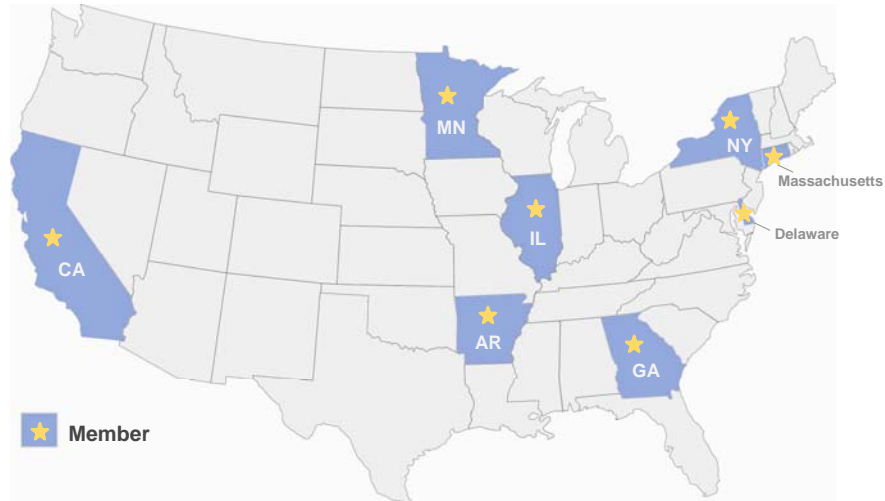
- Develops standards
- Greener and More Sustainable Cleanup Workgroup

Deliverables:

- **Standard Guide**
 - Two tracks
 - Tiered framework
- **Ballot** underway



ASTM



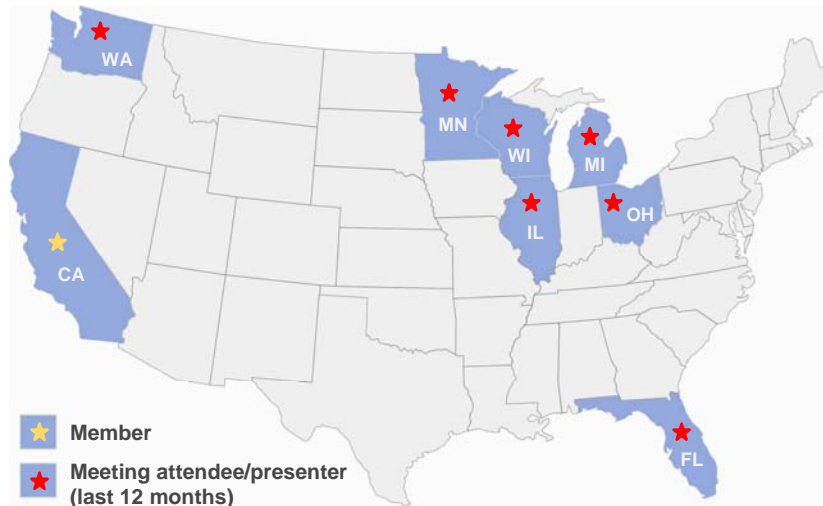
SURF



- Regular Attendance
- State speakers
- Regulatory Initiative



State Participation at SURF



13

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Concluding Remarks

- **Numerous** state-specific programs
- Many organizations **providing assistance**
- **More widespread adoption** anticipated as a result of:
 - State-targeted **guidance**
 - Continued **push** by regulated community
 - **Federal/regional** initiatives



14

Haley & Aldrich, Inc.



Karin Holland
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kholland@haleyaldrich.com

Attachment 10
SURF the Globe

SURF the Globe

*Dave Woodward
AECOM and SURF*



September 21 , 2011

AECOM

Presentation Outline

- Emergence of the Sustainable Remediation Forum
- International SURFs
- Emerging SURFs
- Continued Evolution of SURF and Sustainable Remediation
- Q and A



AECOM



Historical Perspective

2006 - Sustainable Remediation Forum (SURF) formed

2007 - EPA Region III Pilot Projects

- SURF UK established under CL:AIRE
- CA DTSC "Green Team" established
- IEPA Greener Cleanups Program developed

2008 - US EPA launched Green Remediation Website

- WDNR began work on WISC

2009 - SURF White Paper Published

- ASTM GSR Subcommittee established
- ITRC Green Remediation Team established

2010 – EPA Revised Green Remediation Strategy



SURF-UK Initiative

- Established in 2007, following the lead of SURF.
- UK-based collaboration of regulators, industry, academics and consultants. Open forum meetings.
- Independent coordination by CL:AIRE (www.claire.co.uk/surfuk)
- Focus on holistic sustainability assessment of
 - remediation input to high-level land-use planning
 - remediation input to overall site / project design ('Better by design')
 - remedial strategy selection and remediation technology selection
 - remediation implementation and verification
- Goals
 - A framework for assessing sustainable remediation
 - Sustainability indicator review

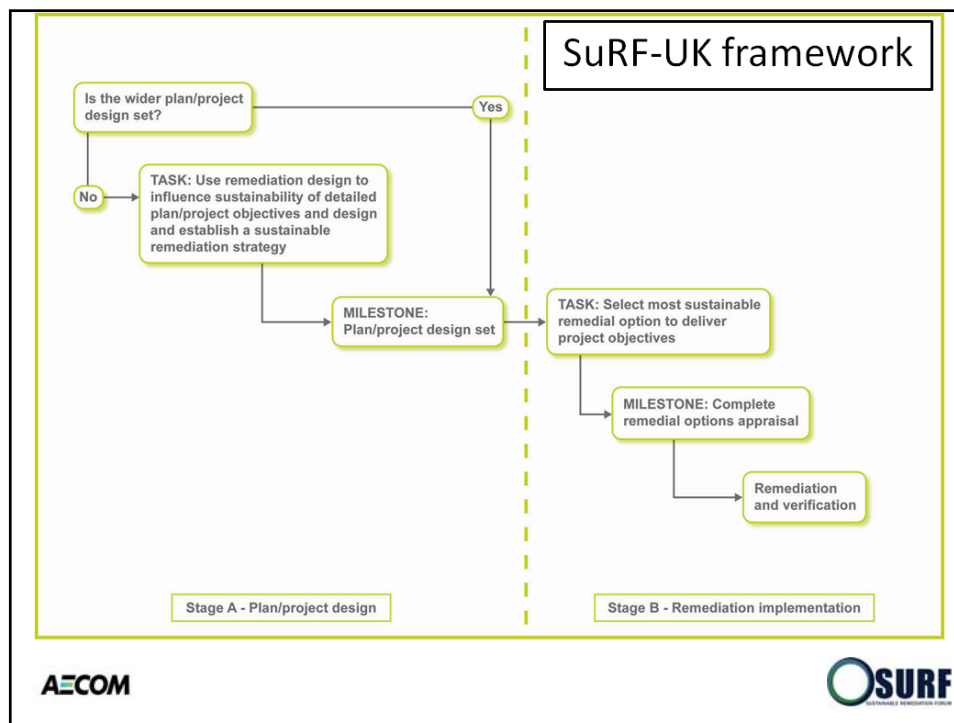


SuRF
SUSTAINABLE REMEDIATION FORUM UK

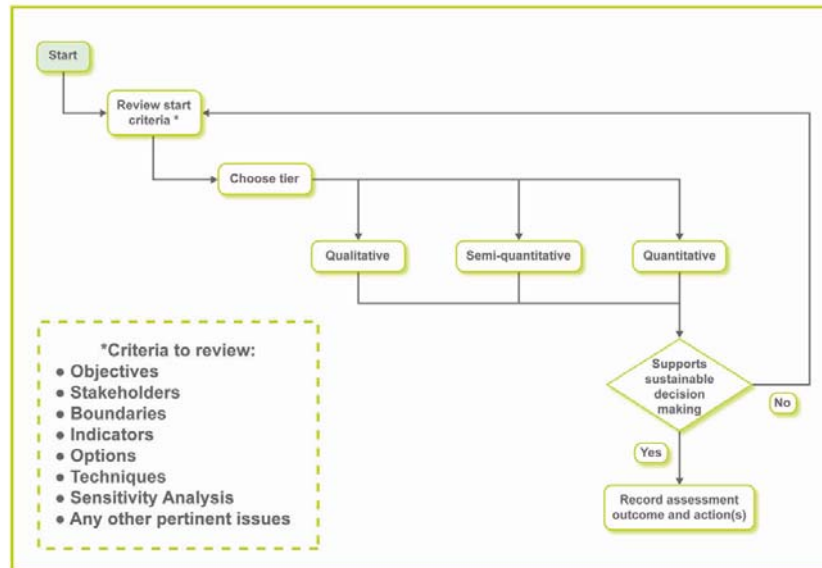


SuRF-UK Definition

- *'the practice of demonstrating, in terms of **environmental**, **economic** and **social** indicators, that the benefit of undertaking remediation is greater than its impact and that the optimum remediation solution is selected through the use of a balanced decision-making process'*
- Optimize risk-management based on consideration of social, environmental and economic factors, but always ensure:
 - Principle 1: Protection of human health and the wider environment
 - Principle 2: Safe working practices
 - Principle 3: Consistent, clear and reproducible evidence-based decision-making
 - Principle 4: Record keeping and transparent reporting.
 - Principle 5: Good governance and stakeholder involvement
 - Principle 6: Sound science



SURF UK - Tiered Assessment



Possible SR Indicator Categories

Environmental	Social	Economic
1. Impacts on air (including climate change); 2. Impacts on soil; 3. Impacts on water; 4. Impacts on ecology; 5. Use of natural resources and generation of wastes; 6. Intrusiveness.	1. Impacts on human health and safety; 2. Ethical and equity considerations; 3. Impacts on neighbourhoods or regions; 4. Community involvement and satisfaction; 5. Compliance with policy objectives and strategies; 6. Uncertainty and evidence.	1. Direct economic costs and benefits; 2. Indirect economic costs and benefits; 3. Employment and capital gain; 4. Gearing; 5. Life-span and 'project risks'; 6. Project flexibility.

Regulatory Acceptance and Consensus

CEAIRE



John Palfalvy
Policy Advisor, Brownfield Land
Department of Communities and Local
Government

Tom Coles
Contaminated Land Policy Team
Department for Environment, Food and
Rural Affairs

Trevor Beattie
Director Strategy, Performance, Policy &
Research
Homes and Communities Agency

Gareth Hall
Director General, Department for the
Economy and Transport
Welsh Assembly

Sheena Engineer
Land Quality Policy
Manager
Environment Agency

Calum MacDonald
Director of Environmental
and Organisational Strategy
Scottish Environmental
Protection Agency

Theresa Kearney
Principal Scientific Officer
Northern Ireland
Environment Agency within
the Department of the
Environment

AECOM



SURF UK - Summary

- SuRF-UK assessment framework published
 - Applies at a range of stages (regional planning, project design / site-specific risk-assessment, remediation options appraisal, implementation)
 - Adopts a tiered structure
 - Is Holistic - Start wide-ranging and narrow down quickly
 - Requires consultation with stakeholders
 - Is flexible and voluntary
- Phase 2 nearly complete
 - Indicator development and refinement
 - Road testing framework
 - Benchmarking assessment tools
- Also developing a database of Case Studies

AECOM





SURF Brazil

- First meeting held on October 18, 2010
- Founding members:
 - AECOM
 - BASF
 - CETESB (São Paulo State Environmental Agency)
 - DuPont
 - Shell/Cosan
- Five meetings have been held, the fifth encounter was held on May 17, 2011.

SURF Brazil Milestones

- Selection of forum name: Fórum Brasileiro de Remediação Sustentável (*Brazilian Forum for Sustainable Remediation*)
- Incorporation of sustainability concepts in São Paulo State Environmental Law 13.577, which became effective early 2011.
- Creation of an official blog: <http://foresbr.wordpress.com/>
- Elaboration of a White Paper on GSR (in Portuguese)



SURF Brazil - Planned activities

- Sponsorship of ReLASC (Rede America Latina de Sitios Contaminados) a Latin American network for contaminated land management
- Creation of a GSR website on the Brazilian page of ReLASC.



- Organization of a roundtable discussion and workshop about GSR at the CIMAS II conference in São Paulo, October 2011.



SURF Australia

- ALGA has been actively promoting sustainable remediation in Australia –conferences and seminars
- CRC CARE took on the organization of SURF Australia - Launched at Cleanup09
- ALGA prepared the draft Framework for Sustainable Remediation and Management - drawn from SURF UK
- CRC CARE formed Steering Committee
- Representatives: CRC CARE (Ravi Naidu as Chair), ALGA, AIP, regulatory agencies (NEPC, SA EPA, Dept Health and Ageing), industries (mining, petroleum, Defence), developer, contractor, consultant
- Continued activity – Steering Committee, ALGA State seminars on sustainable remediation – latest meeting at EcoForum Conference



SURF Australia – Vision and Approach

- Vision - To promote approaches and practices that achieve better, more balanced outcomes in our remediation and management of contaminated sites
- Encourages tiered approach
- Sustainable Remediation - the practice of demonstrating, in terms of environmental, economic and social indicators, that an acceptable balance exists between the effects of undertaking remediation and the benefits they deliver.
- Recent development
 - ALGA lead, CRC Care de-emphasized
 - Outreach for Individual Membership



SURF Australia – Planned Activities

- Further consultation (particularly to involve the regulatory agencies)
- Working group to finalize the Framework
- Other activities:
 - Encourage the application, promotion and evolution of the approach
 - Draw on the efforts and knowledge of others (e.g. international)
 - Encourage research on methods and measurement and guidance



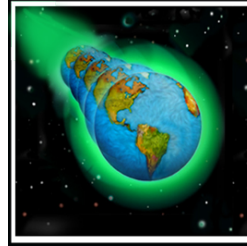
SURF Canada

- Kickoff meeting held May 5, 2011 in Toronto in association with the RPIC Regional Conference
- 10/19/11 Meeting and Workshop in association with the Remtech conference (Banff, Alberta)
- Website established at www.surfcanada.org
- Developing several draft logos including an adaptation of the SURF US logo
- Actively seeking additional participation
- Operating as an adhocacy



Emerging SURFs

- Japan
- China
- Netherlands
- EU through NICOLE



SURF and GSR Evolution and Expansion

- Additional SURF Organizations likely to form throughout the world
- Geographies with risk-based regulatory framework are best suited to embrace Sustainable Remediation
- Increasing International Collaboration and advancement of science of GSR
- Dramatic increase in case studies and lessons learned
- Evolution to the point of Standard Practices
- SURF US Liaison

Questions?



- Contact Information - Dave Woodward

- (717) 790-3405
- dave.Woodward@aecom.com



Attachment 11
SURF's Nine-Step Process for LCA Put to the Test



Walking the Talk: SURF's New Nine Step Process for LCA is put the Test

September 21, 2011

Todd Krieger

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

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

The Nine Steps

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

Remediation Opportunity

- Former chemical mfg facility – Ceased operation in late 90's, Facilities have been demolished
- Re-development opportunity as business park for industrial, commercial, and retail uses in “Jobs Opportunity Zone”
- Identified RCRA Facility
 - DuPont
 - California DTSC
 - EPA Region 9
 - Central Valley Regional Water Quality Control Board
 - Consultants to DuPont



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Remediation Opportunity

- Source Contaminant Remediation
 - Est. 154 kg Tetrachloroethylene (PCE)
 - Concentration - 20 – 1400 mg / kg soil;
 - 520 CY of soil – Multiple locations – 3'-10' bgs.
 - PCE only constituent of concern
 - Vadose zone soil – sandy
 - Linear source zone along trench
- Complete and Significant Exposure Pathway Identified
 - Incidental Ingestion and/or dermal contact with future trespasser / security, current utility / construction worker, future industrial / construction worker



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4

Define the Study Goals / Scope

Project Related Goals

- Corrective Actions Objective - Protect human health and the environment by eliminating unacceptable soil exposures associated with incidental
- Timing for remediation alternative important relative to future use
- Screening level analysis commensurate with level of detail in CMS and cost estimates

Non-Project Related Goals

- Implement SURF Nine Step Process
- Evaluate insight gained from using Life Cycle Methodology / Software for part of the sustainability analysis

Step 1: Define the Study Goals / Scope

- Team originally met in 2010 – Potential Remediation options brainstormed
Reduced to the following cases:

- Case 1: No Action (Does not meet requirements – included as baseline)
- Case 2: Landfill
- Case 3A: Aeration
- Case 3B: GAC – ex-situ aeration and capture on carbon
- Case 4: Phytoremediation
- Case 5: ZVI – In-situ ZVI / Clay chemical reduction
- Understanding Project goal sets purpose and guides sustainability study
- Understand the reasons for the remediation
- Used to set appropriate system boundaries

Steps 2&3 - Functional Unit & System Boundaries.

Functional Unit - Reduction of the concentration and/or mobility of the PCE contaminant in the soil to levels below regulatory limits (10mg/kg) while satisfying all remedial action objectives for the project.

System Boundaries

Look at cases to be evaluated – Identify differences that could affect results – Draw boundaries accordingly

- Include Primary (i.e. contaminant PCE) impacts since different cases treat contaminant differently (degree of destruction / potential emissions)
- Include Secondary impacts – Include off-site impacts due to differences in types of materials / treatments used in the cases
- Screening level analysis
 - Use literature LCI data where available (but evaluate it.)
 - Don't sweat the small stuff (Experience will help identify what is small stuff)

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Step 4 - Establish the project metrics.

Need Stakeholder / team input – not the LCA practitioner alone.
Impact Categories from LCA impact methods mapped to stressors.
Some stressors not tracked through LCA - Use SURF Metrics

Sustainability Parameter or Stressor	Dimension			Metric	Sustainability Matrix	Evaluation Method	Stressor Focus
	Envl	Social	Economic				
Airborne NOx & SOx	✓	✓		NOx and SOx, ton	Terrestrial Acidification Model	Simapro*	Acid rain & photochemical smog due to transportation, on-site construction, remedial technology, power
Greenhouse gas emissions	✓			CO ₂ , equiv ton	Climate Change Potential	Simapro*	Atmospheric warming due to transportation, on-site construction, remedial technology, power. Consider alternatives.
Airborne particulates/toxic vapors	✓	✓		PM10, ton	Particulate Matter Formation Model	Simapro*	General air pollution/toxic air/humidity increase due to transportation, on-site construction, remedial technology, power
				PCE, lb/year, kg 1,4-DCB eq	PCE Air Emissions / Human Toxicity Potential		
Solid waste production	✓	✓		Landfill Volume, cubic yards		Conceptual Scope	Land use/toxicity due to remedial construction and operation
Soil structure disruption	✓	✓		Excavated or Treated Soil, cubic yards		Conceptual Scope	Habitat destruction due to excavation and backfill, soil infertility due to insitu treatment, geochemical changes due to pump and treat
Traffic, Noise/odor/vibration/aesthetics		✓		Number of truck passages		Conceptual Scope, Simapro*	Nuisance & safety due to transportation, remedial activities, visual impairment
				Off-site miles driven			
Land Stagnation			✓	Time to Meet Cleanup Objectives, months		Conceptual Scope	Remediation time; cleanup efficiency; redevelopment
Petroleum use			✓	Gasoline and Diesel Consumed, gal	Energy Model	Simapro*	Consumption
Construction materials				Backfill, Mulch - cubic yards	Energy Model	Conceptual Scope, Simapro*	Consumption/reuse/location of soil and gravel for fill, concrete, plastics, lumber
Construction materials	✓	✓	✓	Iron, clay - tons	Energy Model		
Land & space	✓	✓	✓	Redevelopment, acres		Conceptual Scope, Simapro*	Impoundment/reuse of land or space required for remedial materials, renewable energy, landfills, topsoil

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Step 5 - Compile the project inventory

Inputs - Developed in conjunction with requirements for cost analysis

Identify areas of uncertainty in process inputs for further evaluation – Step 7 & 8

- What will happen to the PCE?
 - Emissions to air during excavation / treatment
 - Amount captured or destroyed
 - What happens to PCE during the no action case?
- Landfill case – % hazardous waste to non-hazardous waste
- GAC use rate – PCE concentration, GAC efficiency
- ZVI use rate
- Are the LCI data sources good enough – ZVI, GAC, Diesel Fuel supply chain?

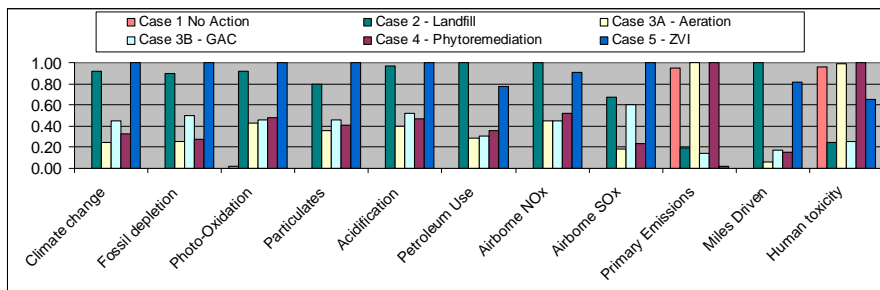
Case 2: Landfill		
Task	Item	Quantities
Mobilization/Setup/Demobilization	Time Staff Equipment	5 Days 1 Supervisor, 1 Operator, 2 Support, 1 DSR 3 PU truck/SUV (100 miles RT)
Remove Clean Soil	Time Staff Materials Equipment	1 day 1 Supervisor, 1 Operator, 1 DSR 281 cy 1 Excavator - 320, 3.5-4gph diesel
Excavate and Load Contaminated Soils	Time Staff Materials Equipment	3 days 2 Operators, 1 Supervisor, 1 dsr 620 cy tri-axle Dump Truck (22 ton cap) - tandem - 6 mpg diesel
Transport Contaminated Soils	Time Staff Materials Equipment	NH Landfill - 15miles, Haz LF - 760 miles 1 Operator/load 60 CY to Haz LF, the rest to Non-Haz LF diesel
Backfill for contaminated soil - On-Site Fill Material	Time Staff Materials Equipment	0.5hr per trip inc fill/dump time, 12CY/truck 2 trucks E&H, 8hrs P&C 3 operators for each part 520 CY On-Site Fill Excavator & 2 Dump (2 x 12 CY) E&H, Dozer & Roller for P&C
Backfill Clean soil	Time Staff Materials Equipment	2 days 1 Operator, 1 Support 281 cy 1 Excavator (same)
Replanting	Time Staff Materials Equipment	2 hr 2 Operators, 1 Supervisor, 1 DSR Seed and straw Pickup truck

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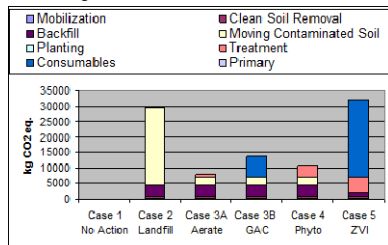
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Step 6 - Assess the impacts.

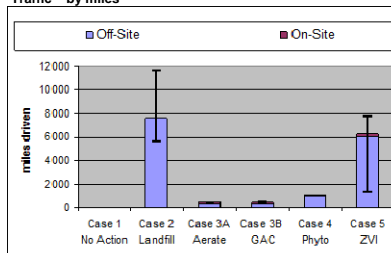


Climate Change Potential



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Traffic – by miles



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Step 6 – Assess The Impacts – Insight Gained

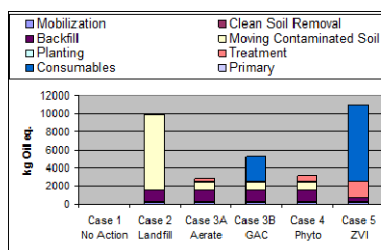
Built LCA model so relative contributions from different steps can be seen

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

- ZVI mfg shown to be important Iterate with multiple LCI models for the iron – LCI Model & assumptions for ZVI further evaluated. More data gathered
- GAC mfg important – Use rate uncertainty due to concentration & efficiency
- Xport for Landfill & ZVI shown to be important – Confirm distances / modes of travel. Perform sensitivity analysis. When GAC added to scope, knew xport would be important – get vendor info on logistics as well as GAC use rate
- Backfill operations shown to be non-negligible. Revised ZVI case to in-situ to see differences in potential burdens
- Electricity source assumption for GAC case evaluated – Wind vs. Grid.

- Most impacts shown to follow diesel fuel use (equipment or xport) - Evaluate alternate diesel fuel LCI model - Comparison revealed update needed for some emissions during crude oil production in US LCI model

Fossil Fuel Depletion Potential



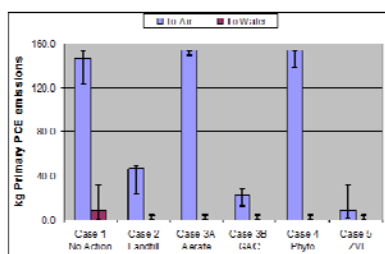
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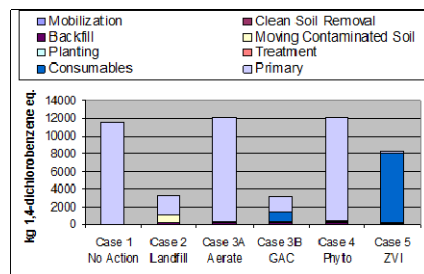
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Step 6 - Assess the impacts – Toxic Air Emissions

PCE Emissions



Human Toxicity Potential – by Process step



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

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

- More work required here to find common ground or compatibility with LCA impact methods and risk-based assessments

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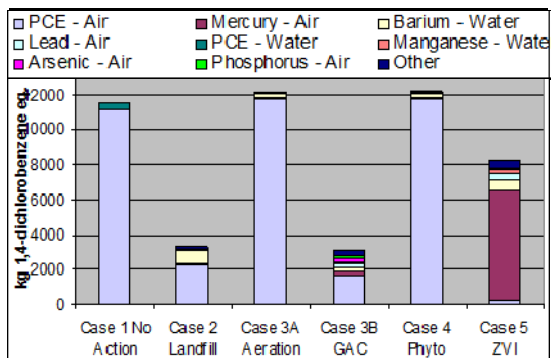
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Step 6 – Assess The Impacts – More Insight Gained

- Use HTP as screen for key contributors – chemicals / processes
- Emissions from PCE clearly important – but not only contributor to HTP -

- Crude oil production,
- diesel fuel refining,
- diesel fuel combustion,
- electricity generation,
- ZVI & GAC mfg lead to emissions of lead, barium, mercury, among others

Human Toxicity Potential by Emission



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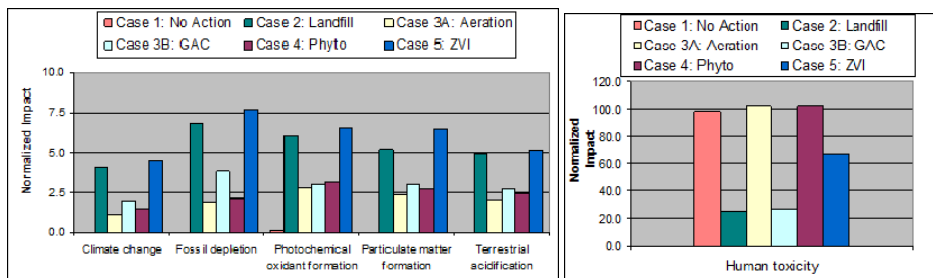
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Step 6 – Assess The Impacts – Even More Insight Gained

- Emissions for all cases are small relative to other concurrently active remediation projects (2-3 orders of magnitude smaller)
- Normalized results suggest most burdens equivalent to < 8 person equivalents (HTP is higher but uncertainty is much higher)

Impact eq. per person = world impacts / world population



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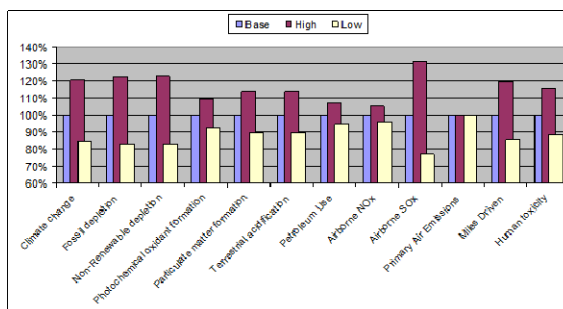
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Step 7 – Sensitivity and Uncertainty Analysis

- This was a screening analysis – So need to check validity of assumptions, modeling selections, uncertainty in inputs before drawing conclusions
- Identified area of uncertainty during step 5
- Identified significant areas of impact / areas where you expected impact but did not see any during step 6

Case 3B: GAC – Sensitivity to GAC Use rate

- All cases – PCE emissions / degree of destruction / capture
- Landfill – Non-Haz / Haz split
- GAC – Use rate, Electricity source for blower
- ZVI – Use Rate and Mode / distance for xport



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Step 8 – Interpret Results

- Results of this study are based on a relative approach. They indicate potential environmental effects, and they do not predict actual impacts on category endpoints, the exceeding of thresholds, or safety margins or risks. Further, the results are specific to the assumptions made in this study and do not necessarily represent the expected results of these different technologies at other locations or with other contaminants or at different contaminant concentrations.
- Key Differentiators

Step 8 – Interpret Results

- **Key Differentiators**

- Diesel Fuel Use
- Consumables
- Primary Contaminant

- **Limitations**

Step 8 – Interpret Results

- **Key Differentiators**

- Diesel Fuel Use
- Consumables
- Primary Contaminant

- **Limitations**

- Sensitivity & Uncertainty Analysis
 - Xport assumptions in Landfill, ZVI
 - PCE Emissions
 - Stability of trends with changes in assumptions
- Trade-offs
 - Diesel Fuel Use
 - PCE Emissions
- Magnitude of impacts

Step 8 – Interpret Results

- **Key Differentiators**

- Diesel Fuel Use
- Consumables
- Primary Contaminant

- **Limitations**

- Sensitivity & Uncertainty Analysis
- Trade-offs
- Magnitude of impacts

- **Ranking & Rating**

Step 8 – Interpret Results / Step 9 Reporting

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

Step 8 – Interpret Results / Step 9 Reporting

Sustainability Parameter or Stressor	Units	Case 1 No Action	Case 2 Landfill	Case 3A Aeration	Case 3B Aeration with GAC	Case 4 Phyto	Case 5 In-Situ ZVI
Overall Rating		0	3	3	3	3	3
Airborne NOx & SOx	kg-SO2-eq	Does not meet threshold criteria	189	79	103	91	196
Greenhouse gas emissions	kg-CO2-eq	Does not meet threshold criteria	28,500	7,700	13,900	10,200	31,000
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Soil structure disruption	Cubic Yards	Does not meet threshold criteria	800	800	800	800	800
Traffic, Noise/odor/vibration/aesthetics	Trips	Does not meet threshold criteria	43	0	3	2	3
	Miles	Does not meet threshold criteria	4700 - 13600	500	1100 - 1600	1,100	1500 - 6300
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Construction materials	Tons	Does not meet threshold criteria	0	0	1	0	60
Land & space	Acres	Does not meet threshold criteria	0.06	0.06	0.06	0.06	0.06
Color Code		Definition					
		Lowest impact where there is a difference of significance among options					
		No significant difference - or in between the highest and lowest impact options					
		Highest impact where there is a significant difference among options.					

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Step 8 – Interpret Results / Step 9 Reporting

• Design team insight

- Appreciation for primary contaminant emissions during excavation / treatment
- Risk assessment vs LCA impact method outputs – Local vs. global impacts – Concern for HTP results being taken out of context
- Only minor additional inputs required vs. cost analysis (transport distances)
- Understanding uncertainty in assumptions on more impacts than sustainability analysis
- Cases altered based on preliminary findings (ZVI case shifted to in-situ, GAC case added)

• LCA practitioner insight

- Evaluation of HTP – use more as screen for chemical emissions and sources. Could extend to risk assessment comparison if scope warranted – accounting for local impacts of various emissions from different processes
- Full analysis is not trivial – 40 page report; ~1/3 figures & tables, 4 Exec summary, 8p for sensitivity.

Step 8 – Interpret Results / Step 9 Reporting

- **Pathforward - Project**

- Communicate results to Regulators – What do they have to say about process?
- Address key areas of impact of selected remedy

- **Pathforward – Sustainability Analysis**

- Become more a part of the CMS
- Explore how to better use / communicate HTP
- Evaluate less intensive reviews – Can we get to similar conclusions?

- **Reflections**

- Much of the work was actually in reporting – Templates will be important
- Nine steps led to robust, defensible analysis – missing regulators feedback
- Conclusion that all impacts were limited discounted value in making final selection – but still robust analysis makes this conclusion valid.

Questions?



The miracles of science™

Attachment 12
Sustainability and the USEPA:
National Research Council Report



SUSTAINABILITY
at The National Academies

THE NATIONAL
ACADEMIES

“ Sustainability and the U.S. Environmental Protection Agency”

**National Research Council Report
September 15, 2011**

**Overview of Report by
Mike Kavanaugh
Geosyntec Consultants**

**SuRF Meeting
22 September 2011**



SUSTAINABILITY
at The National Academies

THE NATIONAL
ACADEMIES

Sustainability and the U.S. Environmental Protection Agency

- A committee under the Science and Technology for Sustainability Program, National Research Council, conducted a study at the request of the U.S. Environmental Protection Agency's (EPA's) Office of Research and Development to help define efforts to incorporate sustainability concepts into agency programs
- This study builds on existing sustainability efforts in EPA by strengthening the analytic and scientific basis for sustainability as it applies to human health and environmental protection within the agency's decision-making process



SUSTAINABILITY at The National Academies

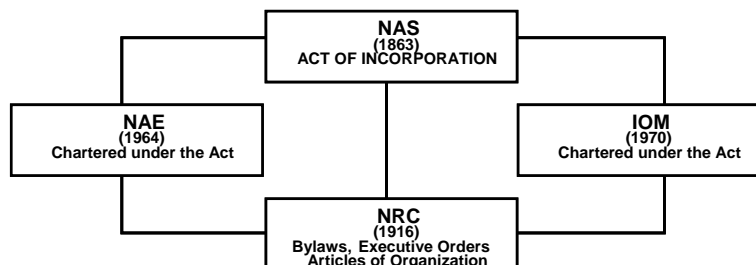
THE NATIONAL
ACADEMIES



SUSTAINABILITY at The National Academies

THE NATIONAL
ACADEMIES

THE NAS, NAE, IOM & NRC





Sustainability and the U.S. Environmental Protection Agency

The consensus report will answer the following questions:

- What should be the operational framework for sustainability for EPA?
- What scientific and analytical tools are needed to support the framework?
- How can the EPA decision making process rooted in the risk assessment/risk management (RA/RM) paradigm be integrated into this new sustainability framework?
- What expertise is needed to support the framework?



Sustainability and the USEPA Committee Members

- **Bernard Goldstein (IOM) (Chair)** - University of Pittsburgh
- **Leslie Carothers** – Environmental Law Institute
- **Terry Davies** – Resources for the Future
- **John Dernbach** – Widener University School of Law
- **Paul Gilman** – Covanta Energy Corporation
- **Neil Hawkins** – The Dow Chemical Company
- **Michael Kavanaugh (NAE)** – Geosyntec Consultants
- **Steve Polasky (NAS)** – University of Minnesota
- **Kenneth Ruffing** – Organisation for Economic Co-operation and Development
- **Ted Russell** – Georgia Tech
- **Susanna Sutherland** – City of Knoxville
- **Lauren Zeise** – California Environmental Protection Agency



Sustainability and the U.S. Environmental Protection Agency

- Develop a framework for EPA to solve complex environmental challenges through a more integrated, systems approach
- Similar to the 1983 NRC report *Risk Assessment in the Federal Government*
- Recommended framework will be scaled up under the broader NRC study, *Sustainability Linkages in the Federal Government*, that will begin in September 2011

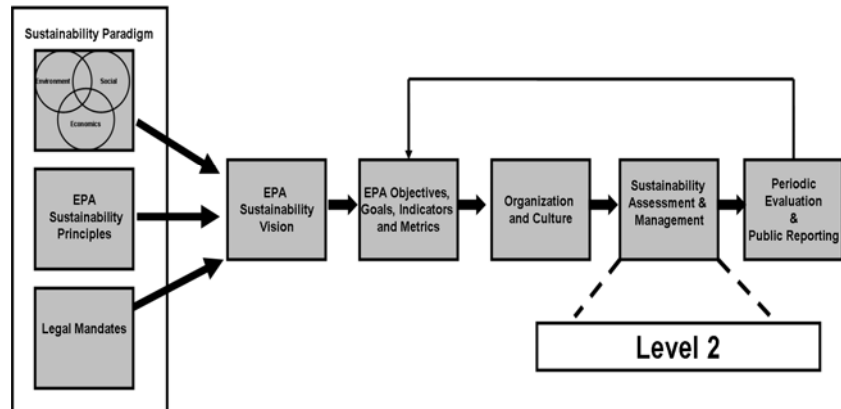


Sustainability Framework

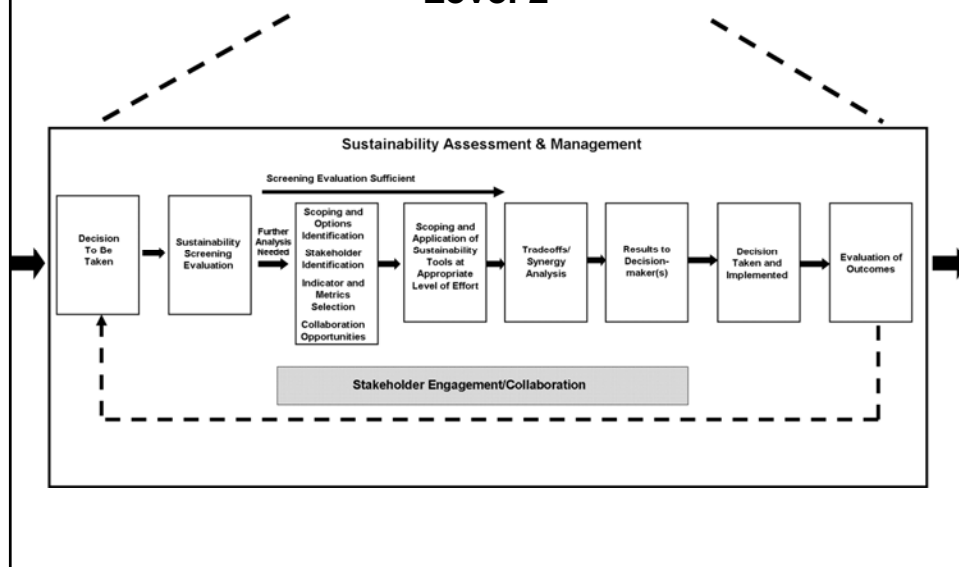
The committee developed the Sustainability Framework and the Sustainability Assessment and Management (SAM) approach to provide guidance to EPA on incorporating sustainability into decision making

The Sustainability Assessment and Management process is intended to be equally applicable to human health, ecological risks and other challenges

Sustainability Framework Level 1



Sustainability Framework Level 2





What should be the operational framework for sustainability for EPA?

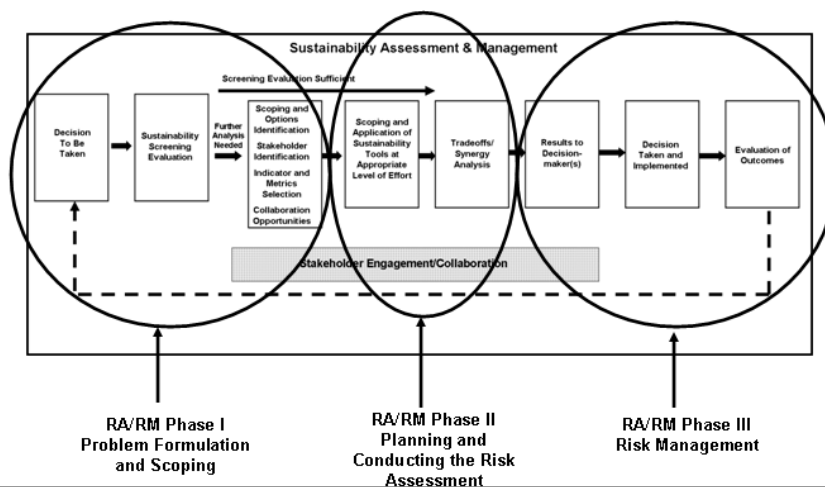
The proposed Sustainability Framework requires a comprehensive approach including specific processes for incorporating sustainability into decisions and actions

EPA should incorporate into its decision making upfront consideration of sustainability options and analyses that cover the three sustainability domains (social, environmental, and economic), as well as trade-off considerations

The framework was developed with the intent that EPA could apply it to any decision to which a need arose
(Recommendation 3.1)



Interface between Risk and Sustainability





Summary

- Overall management system framework for sustainability for the U.S. Environmental Protection Agency
- Approach driven by sustainability principles and goals and involves setting, meeting and reporting on measurable performance objectives
- Sustainability Assessment and Management (SAM) component incorporates sustainability into individual EPA decisions and actions



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Link for Report and other info on Study

[http://sites.nationalacademies.org/PGA/sustainability/index.
htm](http://sites.nationalacademies.org/PGA/sustainability/index.htm)