Sustainable Remediation Forum (SURF)
SURF 21: December 12 and 13, 2012
Washington, DC

SURF 21 was held at the National Academy of Sciences in Washington, DC on December 12 and 13, 2012. SURF members that participated in the two-day meeting are listed in Attachment 1. Participant contact information is available to members on the SURF website. After logging into the website, select "member resources" then "membership directory."

The meeting marked the 21st time that various stakeholders in remediation—industry, government agencies, environmental groups, consultants, and academia—came together to discuss the use sustainability concepts throughout the remediation life cycle. Previous meeting minutes are available at http://www.sustainableremediation.org/library/ meeting-minutes/.

Day 1

The meeting began with Karin Holland (SURF President) welcoming everyone. She emphasized the international nature of SURF, with participants from five continents—Asia, Europe, South America, Australia, and North America—present. Karin encouraged participants from the SURF affiliates, industry, and regulatory groups to make the meeting as interactive as possible so that everyone could learn from each other.

Mike Rominger (meeting facilitator) 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 the SURF Treasurer at treasurer@sustainableremediation.org.) In addition, Mike thanked BP for contributing additional funding to support SURF student chapters. Official student chapters are active at the following universities:

- ❒ Colorado State University
- ❒ Syracuse University
- ❒ Clarkson University
- ❒ Colorado School of Mines
- ❒ University of Illinois – Chicago
- ❒ Stanford

Mike reviewed the meeting agenda and explained the absence of the invited keynote speakers.

Day 1 presentations and subsequent discussions are summarized in the subsections below. Attachments 2 through 10 contain the presentation slides for Day 1 of the meeting.

Meeting Purpose and White Paper Mission

Karin Holland reviewed the purpose of the meeting and the white paper mission. The objective of SURF 21 was three-fold: to build working relationships among participants, promote mutual learning from the sharing of experiences, and develop an international white paper. The white paper, in turn, is aimed to achieve the following:

- ❒ Advance the science and application of sustainable remediation internationally.
- ❒ Leverage the participation of global remediation industry leaders attending SURF 21.
- ❒ Generate further interest in the importance of sustainable remediation.
- ❒ Further establish SURF's role as a leader in sustainable remediation.

Karin provided a draft outline of the white paper, which includes sections addressing frameworks, guidance documents, and tools for each organization and how each organization balances the triple bottom line of sustainability. Barriers, lessons learned, case studies, and recommended next steps will also be included in the paper. Maile Smith (Meetings and Programs Co-Chair) presented additional detail on Day 2 of the meeting about the next steps to be taken to move the white paper forward (see page 36 of these notes).

At the end of her presentation, Karin asked participants to comment on their initial expectations of an international white paper. Participants seemed to agree that the white paper will provide a current status of sustainable remediation on a global basis and that the sections on lessons learned and next steps will be crucial to advancing the field. Additional participants believed the following should be included in the paper: cultural and regulatory differences, measurements of success (e.g., criteria, partnerships with government), examples of government fostering sustainable remediation, and input from Africa. Presentation slides are provided in Attachment 2.

SuRF-UK Experience: Building a Common Understanding of Sustainable Remediation

Jonathan Smith (SuRF-UK) began his presentation describing the evolution of contaminated site management and the connection between sustainable development and sustainable remediation. Recent legal British cases were highlighted to show that remediation is not sustainable *per se* and certain strategies and/or technologies may cause more damage than they solve.

Following the lead of SURF in the U.S., SuRF-UK was established in 2007 and is a UK-based collaboration group of industry, regulators, academics, and consultants. Unlike its U.S. counterpart, SuRF-UK does not have members. The idea of membership was informally tested, with results showing insufficient appetite and support for the current structure. Jonathan envisions SuRF-UK not as an open-ended organization, but one that will disband at some point in the future when its mission is completed. The group's funding structure supports this belief. SuRF-UK is funded on a task basis by committee members interested in special projects. Contaminated Lands: Applications in Real Environments (CL:AIRE) provides independent coordination and project management for the organization. SuRF-UK has been funded by the U.K. government and industry with in-kind support from representatives of industry and

regulatory groups, among others. Jonathan said that when he is asked how SuRF-UK engages with regulators, he responds "we don't." He explained that regulators are an integral part of SuRF-UK activities and, as such, do not need to be engaged. In fact, the Environment Agency is a founding and continuing member of SuRF-UK, has been fully engaged in the group's work, and is integral to the success of the organization.

Sustainable remediation is…

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

When SuRF-UK was established, the definition of sustainable remediation was developed (see box) and the following goals were identified:

1. Develop a framework for assessing sustainable remediation that is effective, practical, and achieves regulatory acceptance.
2. Develop relevant sustainability indicators.
3. Support the use of sustainability thinking in contaminated site management in the U.K.
4. Organize a series of workshops and training for practitioners.

The group achieved its first major goal in 2010 when it published *A Framework for Assessing the Sustainability of Soil and Groundwater Remediation*. Building on work that the Environment Agency had already undertaken on land and groundwater remediation cost-benefit assessments, the framework establishes the protection of human health and the environment as a prerequisite while identifying the best way to manage risks associated with environmental, social, and economic factors. The holistic framework promotes a tiered approach to assessing sustainability, with possible sustainable remediation indicator categories that represent all three aspects of the triple bottom line. When sustainability is considered early in the project (i.e., during the planning phase), the potential benefits increase. Jonathan stressed the importance of giving people the opportunity to have input in the process because different people bring different perspectives (e.g., a remediation contractor vs. a spatial planner). The acceptance of the document is most clearly visible in the diverse list of signatures (e.g., agency representatives, policy managers, and advisors) contained in the foreword of the report.

SuRF-UK fulfilled its second goal in 2011 with the publication of sustainable remediation indicator categories. The document, *Annex 1: The SuRF-UK Indicator Set for Sustainable Remediation Assessment*, provides expanded guidance and an explanation of the 15 sustainable remediation categories mentioned in the SuRF-UK framework document described above.

In April 2012, the U.K. government revised its contaminated land statutory guidance, helping SuRF-UK achieve its third goal. The revised guidance, *Environmental Protection Act 1990: Part 2A, Contaminated Land Statutory Guidance*, includes sustainable development language and the consideration of net benefits as objectives. In addition, the Environment Agency's revised regulatory guidance on soil and groundwater remediation now recommends the SuRF-UK approach.

Jonathan ended his presentation by describing the lessons that SuRF-UK has learned and the organization's next steps. He stressed the importance of the following:

- ❒ Involving all of the key stakeholders in the development of frameworks and/or guidance in the first place
- ❒ Developing clear definitions and objectives to help consistency and communication
- ❒ Using the simplest approach that produces a reliable management decision

SuRF-UK is currently working on the development of an assessor guide for Tier 1 sustainability assessments and an interactive "SuRF-UK briefcase" designed to help assessors lead Tier 1 qualitative appraisals. The SuRF-UK briefcase is scheduled to be published in mid-2013. Additional activities involve aligning best management practices to the 15 indicator categories and documenting case studies. Presentation slides are provided in Attachment 3.

No discussions occurred after the presentation.

Brazilian Sustainable Remediation Forum

Sander Eskes (SURF Brazil) presented an overview of the organization and activities of the Brazilian Sustainable Remediation Forum, as well as the results of a survey of the relative importance of sustainable remediation aspects in the country. The Brazilian Sustainable Remediation Forum has over 30 members and meets three times a year. With no formal structure, the group is organized around discussion groups, whose members interact and meet more often than the three scheduled organization meetings. The focus of the group is to transfer knowledge to nonmembers through social networks, a blog, and word of mouth. Sander explained that, in Brazil, environmental policy is mostly managed at the state level and that the São Paulo State Environmental Agency (CETESB) is arguably the most influential environmental agency in Latin America. Working with the CETESB, the Brazilian Sustainable Remediation Forum developed and published a white paper describing the main concepts underlying sustainable remediation. In February 2011, sustainability concepts were incorporated into São Paulo state environmental law. In October of the same year, the group organized the first roundtable discussion and workshop on sustainable remediation in Brazil. At the workshop, participants were asked to weigh the relative importance of various sustainable remediation aspects such as water, land, and material reuse; social and economic impacts; health and safety; air emissions; and renewable energy. Survey results showed that social impacts and land reuse were of greatest importance to participants. A graph with survey results is provided in Attachment 4.

Since then, the group has focused on incorporating social considerations into remediation (among other activities). One method attributes monetary values to every aspect of sustainable remediation, including the calculation of risk. Sander reviewed the "bow-tie risk management" approach, which helps people understand the relationship between risks and undesirable events. The center of the bow tie is the undesirable event, while prevention measures are grouped on the left side of the bow tie and mitigation measures are grouped on the right side of the bow tie. Oil and gas industries apply this approach in Brazil, and the best management practices associated with assessing risk are reasonably uniform and universally accepted. Sander explained that one of the advantages of this method is that risks are never compared directly (e.g., a cancer slope factor vs. the risk of having a diver accident).

Sander ended his presentation by explaining how the bow-tie risk management approach can be applied to sustainable remediation and a monetary value can be associated with social and ecological impacts. A bow-tie diagram can be developed for all of the undesirable events associated with a particular remediation alternative. Risk management costs can be calculated as the sum of the installation and maintenance costs of all prevention and mitigation barriers, and the cost can be added to the remediation alternative as a negative monetary value. More information about this approach is provided in Attachment 4.

A lively discussion followed the presentation. A brief summary of the discussion is as follows:

- Case Studies
  The importance of case studies was discussed. Sander said the bow-tie risk management approach was used to evaluate two remedial alternatives at a waste site located near a residential neighborhood. Bow-tie risk analysis results showed that leaving the waste in place and fixing the existing management flaws were more sustainable than excavating the waste and transporting 20,000 truckloads of it through a low-income neighborhood. Management flaws (e.g., cracks in the liner material and gaps in the monitoring network) are being corrected, and a more aesthetically pleasing material is being used as cover.

- Stakeholder Involvement
  Sander emphasized the importance of stakeholder involvement *before* the bow-tie risk analysis is performed. He said that bow-tie analyses integrate the different risk prevention and mitigation measures and, as such, are performed at the end of the stakeholder involvement process.

- Baseline Protection of Human Health and the Environment
  Similar to the U.S. and U.K., the protection of human health and the environment is a baseline expectation during the bow-tie risk analysis. Sander said that the use of this approach avoids comparing different risks that cannot be compared directly (e.g., the risk of having a diver accident vs. the risk of adverse health effects due to the presence of contaminated sediment). Additional discussions focused on worker protection and risk communication. Sander emphasized the use of best management practices to manage risks and stated the reality that “there is no such thing as zero risk.”

- 2011 São Paulo State Environmental Law
  The 2011 São Paulo state environmental law was a revision of a 2009 law that created a state fund for orphan sites needing remediation. In the 2011 revision, companies bidding for work are required to include a sustainability assessment of the approach proposed. While this revision is not a monumental step forward for sustainable remediation, Sander believes it is a good start.

Panel Discussion: Producing Documents

Dave Woodward (AECOM) moderated a panel discussion about the importance and success of producing sustainable remediation documents and the potential success of an International Organization for Standardization (ISO) sustainable remediation standard. Panelists provided

short responses to three questions, and participants asked panelists questions. The names and affiliations of the panelists are provided below.

Panelist Name	Affiliation	Sustainable Remediation Connection
Sander Eskes	AECOM	Brazilian Sustainable Remediation Forum
Stella Karnis	Canadian National Railway Company	SuRF Canada
Paul Nathanail	University of Nottingham	ISO Working Group on Sustainable Remediation
Garry Smith	AECOM	SuRF ANZ (Australia and New Zealand)
Jonathan Smith	Shell Global Solutions (UK) Ltd.	SuRF-UK
Lucy Wiltshire	Honeywell International, Inc.	Network for Industrially Contaminated Land in Europe (NICOLE)

The first question the panelists were asked was as follows: "What priority have you placed on producing documents as part of your organization and why?" Panelists' responses are summarized below.

- Garry Smith
  SuRF ANZ has formed a variety of work groups that are developing documents. A framework document has been developed that provides grounding for those individuals who are unfamiliar with sustainable remediation and serves as a reference for sustainable remediation practitioners. A planning work group intends to produce guidance that emphasizes the importance of including regional planning as a sustainable remediation consideration, and a metrics and tools work group has created a listing of currently available tools to assess the sustainability of a remediation project. A case example work group has developed a template for documenting and communicating sustainable remediation case studies.

- Sander Eskes
  The Brazilian Sustainable Remediation Forum puts a high priority on producing documents because sustainable remediation documents are important in introducing new concepts and providing guidance. When producing documents, the group tries not to "reinvent the wheel," instead using information already developed and customizing it to Brazil.

- Jonathan Smith
  SuRF-UK began by developing a framework that provides documentation to allow remediation practitioners to incorporate sustainable development principles in contaminated site assessment and management processes. Currently, the group is working on materials to help an assessor undertake a sustainability appraisal at the lower levels of complexity (i.e., Tier 1 qualitative appraisal) through an interactive "SuRF-UK briefcase." As part of the dissemination process and to build credibility in SuRF-UK products, articles have been written and submitted to international journals for peer review. Articles will be published either with open access or with SuRF-UK retaining the copyrights so that the documents can be distributed via the SuRF-UK

website. Finally, workshop and training materials are being developed to highlight case studies and enumerate the "how to" of sustainable remediation.

- Lucy Wiltshire
  NICOLE members represent 27 states with 27 different regulatory regimes. With that in mind, the organization developed guidance documents that are easy to read (i.e., in plain English), understand, and implement within the variety of regulatory regimes. Guidance and case studies ultimately inform practitioners and increase the application of sustainable remediation.

- Stella Karnis
  In early 2013, SuRF Canada will publish a document describing the current status of sustainable remediation in Canada and highlighting some of the differences (e.g., inclusion of social considerations) compared to other countries. The group's website serves as an educational tool for those individuals unfamiliar with sustainable remediation. Case studies are being developed and demonstrate a common-sense approach to applying sustainable remediation through the consideration of impacts and benefits.

- Paul Nathanail
  The Concerted Action on Brownfield and Economic Regeneration Network (CABERNET) was created in 2002 with the goal of facilitating new practical solutions for urban brownfields. Because remediation can be a precursor to redevelopment, the World Bank adopted the work of CABERNET[1] and the European Bank of Regional Development incorporated the economic appraisal model of CABERNET into its Joint European Support for Sustainable Investment in City Areas (JESSICA) fund. Paul believes the time has come for a global document that is visible to practitioners and regulators in parts of the world in which SURF does not exist and the ideas of sustainable remediation are not yet known.

Depending on their answer to the first question, panelists were asked one of the following two questions: (1) "If you have produced documents, how have the documents influenced the acceptance of sustainable remediation and methods commonly employed and what level of consensus has been achieved?" or (2) "If you haven't produced documents but intend on doing so, is one of your goals to influence regulations, standard practices, or something else?" Panelists' responses are summarized below.

- Paul Nathanail
  Paul stressed the differences between informing, influencing, and lobbying. He believes SURF has informed the rest of the world about sustainable remediation, and those ideas and concepts are now becoming embedded in regulation. Paul emphasized the importance of developing intellectual frameworks within a legal system and focusing on

[1] World Bank. 2010. *The Management of Brownfield Redevelopment: A Guidance Note*. Sustainable Development Department, World Bank Europe and Central Asia Region. http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2010/06/14/000333037_20100614004032/Rendered/PDF/550090WP0P118011PUBLIC10brownfields.pdf

education and informing rather than training. For example, English and Welsh contaminated land legislation was updated in 2012 to include a "light" form of a sustainability appraisal as part of the risk evaluation for a narrow range of sites.

- Stella Karnis
  Stella agreed and said that SuRF Canada, through its documents, is demonstrating how sustainable remediation can be applied in the various jurisdictions of the country despite varying regulations. SuRF Canada has provided input on a national level to Environment Canada on the proposed incorporation of sustainable remediation into the management of federal sites in Canada.

- Lucy Wiltshire
  The high-level documents developed by NICOLE have been most quickly and easily adopted in areas where SURF is active and where regulatory involvement in sustainable remediation is highly visible. The uptake has been much slower in countries that are less familiar with the concept or have variable regulations (e.g., regulations that differ from the risk-based land management framework adopted in many other countries). To advance the practice of sustainable remediation across Europe, NICOLE and the European regulator forum are planning on developing a joint position paper.

- Jonathan Smith
  Jonathan believes that SuRF-UK has achieved more than it set out to do. Not only has regulation been influenced, but corporate practice as well. His company, Shell Oil, applies sustainable remediation concepts in 90 countries across the world.

- Sander Eskes
  Sander said that the Brazilian Sustainable Remediation Forum is in dire need of successful industry case studies. Currently, industry interest for sustainable remediation is low. In addition, industries in Brazil are not knowledgeable or engaged in sustainable remediation measures. Although state agency representatives are open to the concept of sustainable remediation, their interest varies between and among agency personnel.

- Garry Smith
  Garry said that the development of SuRF ANZ documents has allowed a more informed international dialog to occur. In Australia, consensus among regional and local representatives is the goal; SuRF ANZ boasts individuals from the Australian government's Cooperative Research Centres (CRC) and the Australasian Land and Groundwater Association. SuRF ANZ plans to contribute significantly to the development of a national remediation document in Australia, which will include contamination guidance and consideration of impacts on land values. The development of this document will allow further discussions about the differences between green and sustainable remediation vs. sustainable remediation.

One participant asked Garry how SuRF ANZ was able to have detailed discussions with regulatory agencies. As background, Garry explained that Australia regulates site assessment (vs. remediation) through a nationally agreed measure, which is essentially a consensus approach (i.e., the state governments retain environmental issues jurisdiction in law). A

nationally acceptable approach to site remediation is currently being developed via a National Remediation Framework, which is being organized by CRC for Contamination Assessment and Remediation of the Environment (CARE). The committee-based approach will bring together representatives from academia, regulatory agencies, and industry; will be health and environmentally risk-driven; and will use consensus to move forward. SuRF ANZ members will likely be included in this process and in the discussion of specific aspects of sustainable remediation with a variety of stakeholders, including regulators. In New Zealand, the regulatory process has largely devolved to the local government level where assessment and remediation occurs in consultation with the national government and with reference (where appropriate) to international regulatory guidance.

Three panelists provided additional comments. Paul cautioned participants about partializing sustainability with a one-dimensional approach (e.g., economic sustainability, social sustainability). Instead, he advocated holistic sustainable development and believes the specialization of sustainable remediation will follow. Garry recommended emphasizing risk-based methodology as a fundamental aspect of sustainable remediation. Lucy recommended developing high-level documents that identify policy and direct users to places where additional detail can be found. She said the best solutions are those that are accepted by stakeholders and embrace a local perspective.

Dave Woodward (moderator) asked panelists to comment on whether documents that have been produced have been successful in modifying regulations. Paul responded that remediation practitioners need to "just get on with it." If practitioners want to claim a remediation project as being sustainable, all three triple bottom line aspects (i.e., environmental, social, economic) must be demonstrated. He believes that regulators are not "the bad guys." Paul encouraged remediation practitioners to approach regulators with intellectual integrity and address the triple bottom line elements ethically rather than presenting an approach that serves the responsible party best.

The third and final question was about a new initiative to produce an ISO standard for sustainable remediation. Specifically, panelists were asked, "Will this effort and associated document ultimately help lead to widespread global standardization of sustainable remediation or will country-specific issues continue to control standard practices more locally?" Panelists' responses are summarized below.

- Garry Smith
  Garry believes that ISO will lead to standardization by way of its content and subject matter and that cultural and local contexts will be applied by users. As an example, he described the different states within Australia that are building different concepts into regulatory requirements.
- Sander Eskes
  Sander believes that Brazil is "quite far away" from accepting an ISO standard for sustainable remediation. He said the main challenge of developing such a standard is the fact that not every human activity can be normalized and amortized. Regardless, he envisions a high-level document in which local concepts can be added as each country or region sees fit.

- Jonathan Smith
  Jonathan believes that an ISO standard would be a helpful piece of documentation in developing a consistent framework for sustainable remediation. He described the challenge of crafting the standard in such a way so that broad principles and approaches are defined while maintaining applicability throughout the world. Jonathan emphasized the importance of stakeholder engagement and believes that it is the key to achieving acceptance of a global framework, particularly in jurisdictions where local policy and cultural norms may vary.
- Lucy Wiltshire
  Lucy said she is wary of an ISO standard for sustainable remediation leading to global standardization.
- Paul Nathanail
  Paul agreed with Lucy because regulatory regimes vary from country to country, but said he will work to make sure this will not be the case. However, the concept of sustainable remediation as presented in literature has little locus for regulators or practitioners and an ISO standard would address this issue.
- Stella Karnis
  Stella believes that an ISO standard for sustainable remediation would complement and lend credibility to the practice. In addition, she believes an ISO standard would provide a common language for stakeholders and remediation practitioners to use, which would help achieve effective communication.

Participants commented on this topic. One participant believes that the power of an ISO standard is that it will mainstream and normalize all of the beneficial aspects of sustainable remediation. Another participant added that an ISO standard will expand the general exposure of the concept of sustainable remediation and lend credibility to the practice.

A general discussion among participants and panelists focused on the current skew of sustainable remediation toward physical sciences vs. social sciences. Everyone seemed to agree that SURF needs to engage social scientists and other stakeholders (e.g., economists) in meetings. One participant suggested that SURF members attend conferences held for these professionals.

Current State of Countermeasures and Remediation Examples in Japan

Ryuzo Tazawa (Shimizu Corporation) provided an overview of the most recent amendment of the Soil Contamination Countermeasures Law and how it has affected the amount of sites undergoing investigation and the technologies selected for remediation in Japan. Enforcement of the law began in 2003. In 2009, the law was amended to include the following:

- Measures to reduce excavation and off-site disposal
- Regulations for contaminated soil disposal
- The ability to perform voluntary investigations

- ❒ Specifications for areas requiring remediation (health impact potential) and areas requiring notification of authorities before development (no health impact potential)
- ❒ Specific remediation measures that must be implemented

Prior to these amendments, relatively few sites slated for investigation were actually being investigated. Instead, discovered soil contamination was not reported and was excavated to avoid registering the land as a contaminated zone. Typically, the contaminated soil and surrounding soil was excavated in areas where groundwater was not used for drinking and disposed of in areas used for tap water sources. As a result of the 2009 changes to the law, the amount of investigations being performed in Japan has increased. The amendments also include language designed to eliminate unnecessary excavation. Ryuzo described three sites that will be remediated to demonstrate some of the new technology that will be used in the country. In addition, he presented another contaminated site that will be remediated and redeveloped as a shopping mall.

Ryuzo ended his presentation by listing his future expectations for soil and groundwater remediation in Japan and presenting information about sustainable remediation. He anticipates the following:

- ❒ On-site treatment measures such as chemical redox and bioremediation will be implemented more frequently.
- ❒ Advancements will be made to the in situ treatment of contaminated clay and silty soil.
- ❒ Reliability improvements will be made when applying in situ technologies in heterogeneous subsurfaces and in locations with nonhomogeneous contaminant dispersion.

Ryuzo presented a matrix demonstrating the sustainable remediation of four sites, including one that was transformed from a gas manufacturing plant to a fish and seafood market. Another matrix showed the environmental, social, and economic considerations that are assessed during a sustainable remediation in Japan. Presentation slides are provided in Attachment 5.

No discussions occurred after the presentation.

Current State of Sustainable Remedies in Japan

Ning Wang (Environment Control Center) reviewed the current state of sustainable remedies in Japan. As background, one of the following events triggers an investigation under the Soil Contamination Countermeasures Law:

- ❒ When a facility that produced, used, or treated hazardous substances is abandoned
- ❒ When the land character of an area larger than 3,000 square meters will be changed
- ❒ When potential human health risks exist

Contaminated sites are designated into two types of areas depending on the human health risk. If investigation results show exceedances of soil leaching standards when groundwater is used

as drinking water or exceedances of soil content standards when the public can access the site, remediation must be performed. Although the law currently does not require sustainable remediation per se, in 2009, concepts similar to sustainable remediation (e.g., designations for contaminated sites to prevent unnecessary excavation) were included. In addition, the Ministry of Environment initiated the development and promotion of cost- and energy-efficient investigation technologies that include environmental protection considerations (e.g., reduction of carbon dioxide).

Wang presented one case study by the Geo-Environmental Protection Center of Japan that involved calculations of carbon dioxide released as a result of remediation activities at four hypothetical sites. The case study evaluated five remediation methods. Results indicated that containment with a sheet pile or a soil mixing wall and asphalt capping resulted in the least amount of released carbon dioxide.

Wang ended his presentation by telling participants that he expects the principles and practices of sustainable remediation to be applied more frequently throughout Japan. Presentation slides are provided in Attachment 6.

In response to a clarification question from a participant, Wang said that the Soil Contamination Countermeasures Law includes the protection of groundwater.

Recent Developments in the Chinese Brownfield Regeneration Market

Mengfang Chen (Institute of Soil Science, Chinese Academy of Sciences) presented the current status of Brownfield sites in China, the problems and challenges associated with these sites, and how human and environmental risk assessment (HERA) software is helping to address some of these challenges. The presence of Brownfield sites in China has intensified because of corporation shutdowns or relocations, leading to numerous pesticide manufacturing sites, mining waste storage sites, and chemical works that are considered high risk. Over 86,000 corporations shut down or relocated from 2001 to 2007; 300,000 industrial corporations continue to operate and about 40% of these operations occur in urban areas. Mengfang described the lack of relevant Chinese guidelines for these sites and the country's effort to catch up with Europe and the U.S. in terms of understanding the threats associated with site contamination. Establishing a risk-based and sustainable contaminated land management framework has been the focus since 2009 when the draft document *Technical Guidelines for Risk Assessment for Contaminated Sites* was issued. In August 2012, remediation practitioners began using HERA software as a risk assessment tool to assess the risks posed by contaminated sites and derive generic and site-specific assessment criteria. Statistical guidance from CL:AIRE and the Chartered Institute of Environmental Health (CIEH) is incorporated in the software to assist in the determination of site risks.

Mengfang highlighted recent activities designed to share knowledge, including two international workshops on site remediation; a workshop on site investigation, assessment, and remediation; and two training courses for soil and groundwater risk assessment. One training course used a risk-based corrective action (RBCA) tool kit and the other used HERA software. A publication on contaminated land management was issued in 2011 and includes the following:

- ❒ Contaminants of concern and adverse environmental impacts for key industries
- ❒ Comparison of U.S., U.K., and Chinese risk assessment guidelines and the implications for China
- ❒ Theory and commonly used models for the derivation of generic soil assessment criteria for contaminated sites
- ❒ Natural attenuation mechanisms and the status of nano-iron technology for the remediation of chlorinated solvents in groundwater

Mengfang ended his presentation by describing plans to establish a SURF China in 2013, hold another site remediation workshop in 2014, and schedule an International Committee on Contaminated Land (ICCL) meeting in 2015. He described the work of the Chinese Soil and Groundwater Remediation Network (CSGR-NET) and highlighted its collaboration with various international groups. Presentation slides are provided in Attachment 7.

Questions after the presentation focused on inputs to the risk assessment model and safe drinking water supplies. The discussion is summarized below.

- ❒ Mengfang said that no standard values exist for risk assessment. In his experience, the maximum concentration is used for groundwater and 95 UCL for soil.
- ❒ Mengfang said that most contaminated sites are located in a region where groundwater is not being used for drinking water. With no guidance for groundwater investigations, groundwater is not the focus at this time. However, Mengfang said that China is beginning to realize the importance of investigating groundwater because of potential exposure pathways.

After the presentation, one participant cautioned the use of statistical guidance without consideration of the legislation that generated the guidance. He emphasized the importance of getting the science right first and foremost.

SuRF Australia and New Zealand (SuRF ANZ)

Garry Smith (AECOM) provided an overview of SuRF ANZ and its activities, discussed the regulatory regimes in these two countries, presented two case studies demonstrating the pragmatic approach to remediation in Australia, provided the group's perspective of the differences between sustainable remediation and green and sustainable remediation, and discussed the benefits of sustainable remediation in developing countries. Presentation slides are provided in Attachment 8.

- ❒ SuRF ANZ
  SuRF ANZ officially launched in March 2012 with a strong focus on website communication and conferencing so that members could share their experiences and the challenges in applying sustainable remediation. Working groups have prepared draft position papers on the planning aspects associated with sustainable remediation, sustainable remediation metrics and case examples, and sustainable remediation conferencing opportunities. The group developed a template for members to document sustainable remediation case studies. These items support a SuRF ANZ draft framework

for sustainable remediation that looks outward to regional level design and urban development and inward on a site-specific level to site and remediation design. The framework, which is being finalized in consultation with members, allows different stakeholders and participants to engage at any stage in the process.

- Regulatory Regimes
  The *New Zealand Environment Act 1986* and Australia's *National Strategy for Ecologically Sustainable Development* are consistent with sustainable remediation based efforts in that they promote a goal "whereby site contamination remediation removes the threat of harm to human health and/or the environment as part of a sustainable (socially and environmentally acceptable and cost-effective) outcome." In addition, the objectives are consistent with the sustainability indicators originally identified by SuRF-UK and included in the SuRF ANZ draft framework.

- Case Studies
  Garry presented two case studies illustrating how Australia and New Zealand adopt human health and ecological risk-based approaches to remediation to determine achievable cleanup endpoints and achieve socially acceptable outcomes. The Lednez site was heavily contaminated with dioxins, which were found in fish and humans. This orphaned site was remediated over a five-year period, and remediation costs were reimbursed after the land was redeveloped with residential apartments. A risk-based approach was used, including differential residual endpoints and consideration of the triple bottom line elements of sustainability. The existing community surrounding the Lednez site was involved throughout the process. The other site, Allied Feeds, was adjacent to the Lednez site but not as heavily contaminated; therefore, it was remediated closer to local background contaminant concentrations.

- Sustainable Remediation vs. Green and Sustainable Remediation
  SuRF ANZ continues to discuss the difference between these two terms with regulators (see box). Garry explained that these definitions are very important when considering the larger issue of urban renewal. Health and ecological protection through remediation are largely nonnegotiable; however, social equity issues and the wider contribution of site cleanups to urban development mean that triple bottom line considerations are more evident in remediation plans, particularly for large urban sites. In Sydney, for example, the majority of sites being remediated are along waterways due to the market-driven nature of waterfront property. At these properties, redevelopment funds commonly are used to pay for remediation, demonstrating that both remediation cost and local community support are important considerations. Through its draft framework, SuRF ANZ recommends consideration of regional-level effects during remediation site planning

Green and sustainable remediation…

"…involves mandated risk-based endpoints for determination of remediation plans." – SuRF ANZ

Sustainable remediation…

"…entails remediation plans that balance environmental, social, and economic endpoints." – SuRF ANZ

and the inclusion of improvements to dedicated transit corridors. In this way, rail and transit infrastructure can be improved and urban sprawl can be minimized.

- ❒ Sustainable Remediation Benefits in Developing Countries
  Garry discussed the use of sustainable remediation to fund remediation in developing countries. He discussed a large slum in Kenya with groundwater contamination and, in light of the urban location of the slum, suggested a potential link between anti-sprawl carbon mitigation benefits and urban slum renewal. If the mitigation of carbon could be measured post-remediation, the carbon credits could pay for the cleanup.

Participants asked questions about potential collaboration with other nongovernmental organizations in developing countries, the Kenya slum, and transportation corridors. Garry confirmed that groups like Engineers without Borders are forming within consulting firms in Australia and New Zealand and that SuRF ANZ is approaching governments and recommending a comprehensive view of remediation. One participant asked why the slum existed. Garry said the residents cannot afford to live anywhere else, and the government currently does not have the resources to improve the quality of life. SuRF ANZ's concept would use a suitable development consortium, including for example the United Nations, to renew the area without displacing the current residents. Then the carbon benefits would be measured and would be transferred back to the funding organization. Another participant pointed out the competing benefit of infilling transportation corridors and reducing lateral distance between workers and residents, potentially bringing pollutant sources closer to the people. Garry acknowledged this consideration; however, he believes that appropriately strong regulatory planning laws (such as those that exist in Australia and other jurisdictions) would help avoid the situation. He noted that sites along transportation corridors typically have separate owners, show residual transit-based pollution, and are frequently undeveloped and underutilized despite their location within the city and their potential contribution to carbon emissions mitigation.

Sustainable Remediation: SuRF Canada

Stella Karnis (Canadian National Railway Company) provided an overview of SuRF Canada and described the sustainable remediation drivers and barriers in Canada.

- ❒ SuRF Canada Beginnings
  In December 2010, government and industry began discussing the idea of establishing a Canadian professional network to discuss and promote sustainable remediation. The first work group meeting was held in May 2011 and included representatives from Environment Canada, provincial and federal governments, industry, and academia. The group defined sustainable remediation (see box); developed a mission and short-, medium-, and long-term objectives; and created a document *What Is SuRF?*

Sustainable remediation...

"...considers the environmental, social, and economic impacts of a project to ensure an optimal outcome, while being protective of human and environmental health, both at a local level and for the larger community." – SuRF Canada

- ❒ Drivers and Barriers
  Stella reviewed the drivers for sustainable remediation and categorized them into the

aspects of the triple bottom line. Although some drivers are similar to those already presented by others, the social drivers for sustainable remediation in Canada include First Nations concerns. Stella said that when stakeholders such as First Nations are brought into discussions early in the process, the most balanced and acceptable approach to remediation is achieved. Barriers were presented in the areas of regulations and policy, procurement, communication and awareness, and financial. Stella emphasized the importance of transparency to avoid these barriers. She said that remediation practitioners need to be transparent when explaining why specific decisions are made.

Stella ended her presentation by describing the status of SuRF Canada today, sharing successful outreach approaches, and listing some of the group's future initiatives. Presentation slides are provided in Attachment 9.

- SuRF Canada Today
  With 100 members, SuRF Canada continues to work with a leadership team and no formal structure but is hoping to formalize its structure as a nonprofit organization soon. Committees have been created for outreach, website, planning, technical initiatives, and group structure. Regular conference calls with the large group as well as committee meetings are held to communicate recent activities and ideas.

- Successful Outreach Approaches
  Stella shared two approaches that have allowed SuRF Canada to communicate the basics and benefits of sustainable remediation more easily. The Outreach Committee has designated regional or provincial leads to interact with specific interested groups or stakeholders. These leads have existing professional relationships with the interested group or stakeholder, allowing communications to begin with a level of trust. In addition, SuRF Canada members have partnered with various conference organizers to establish sustainable remediation tracks in conferences. The resulting presentations have allowed practitioners to communicate approaches to sustainable remediation and share learnings.

- Future Initiatives
  In 2013, SuRF Canada plans on developing a paper entitled *Sustainable Remediation in Canada*; performing, documenting, and communicating case studies; and networking and collaborating nationally and internationally with industry, government, and academia.

One participant asked whether Environment Canada had issued sustainable remediation guidance. Stella explained that Canadian provinces generally serve as regulator on contaminated site issues (exceptions may include, but are not limited to, fisheries issues). However, specific areas of Environment Canada and Public Works and Government Services Canada have developed a proposed Federal Contaminated Sites Action Plan (FCSAP) for Sustainable Strategy and Implementation that is pending approval. This document could be used by provinces as a starting point for considering sustainability in remediation.

Development of Green and Sustainable Remediation in Taiwan

Hao-Chun Hung (Taiwan Environmental Protection Administration) presented an overview of the policies for and current state of contamination in Taiwan, reviewed the country's approach to green and sustainable remediation, described two green remediation pilot studies, and discussed the establishment of SuRF-Taiwan and future work. Presentation slides are provided in Attachment 10.

- ❒ Policies for and Current State of Contamination
  In January 2000, the Taiwan Environmental Protection Administration enforced the *Soil and Groundwater Pollution Remediation Act*. The policy provides standards for soil, groundwater, and sediment; classifies sites into control sites or remediation sites; includes a provision for risk-based remediation goals; and establishes a remediation fund. Over 1,900 sites nationwide have been remediated (i.e., about 570 hectares total). The remaining sites are either (1) mega sites and industrial sites that are heavily contaminated, (2) polluted farmland, or (3) illegal dumping sites with no responsible party. These sites account for over 1,150 hectares of contamination.

- ❒ Approach to Green and Sustainable Remediation
  In 2012, the Taiwan Environmental Protection Administration issued its *Framework for Green and Sustainable Remediation.* The framework is designed as a top-down approach that considers all three aspects of the triple bottom line and involves the local government, the Administration, and a responsible party. A draft process for applying green and sustainable remediation is under development and incorporates best management practices into the first three phases of remediation and then evaluates the environmental footprint. Hung emphasized that the process is dynamic, not linear. He reviewed the major considerations of green and sustainable remediation and explained that "human health safety" and "social justice and acceptance" are considered under the social aspects of sustainability. Public meetings, a survey, and a questionnaire are included in the "social justice and acceptance" consideration as a way to understand stakeholders' needs and obtain community perspectives before, during, and after remedial activities. These tools allow community members to express what is most important to them so that triple bottom line considerations can be balanced.

- ❒ Green Remediation Pilot Studies
  Hung described two green remediation pilot studies: one at the Jianshan Power Plant and the other to treat contamination related to an oil storage tank in Pei-pu. At the power plant, solar panels were used to power the remediation, which involved chemical oxidation to treat contaminated soil and surfactant flush and hydraulic control to treat contaminated groundwater. To reduce energy consumption at the site in Pei-pu, a soil vapor extraction system was optimized to treat the source zone and phytoremediation was selected to treat the less contaminated zone.

- ❒ SuRF-Taiwan and Future Work
  SuRF-Taiwan met for the first time in November 2012 and shared experiences and knowledge with nine Asian countries at an international conference. In 2013 and 2014, the Taiwan Environmental Protection Administration plans on developing green and

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Willett, Anna	Interstate Technology & Regulatory Council
Wiltshire, Lucy	Honeywell International Inc.
Woodward, Dave	AECOM

sustainable remediation guidelines and publishing the details of its environmental footprint evaluation and toolkits for best management practices. In addition, the Administration plans on selecting specific field remediation sites to apply some of the lessons that have been learned.

No discussions occurred after the presentation.

Panel: Balancing the Three Legs of Sustainability

Sander Eskes (AECOM and Brazilian Sustainable Remediation Forum) moderated a panel discussion about the barriers of incorporating social aspects into remediation, experiences and lessons learned when balancing the three aspects of the triple bottom line, and whether it is possible to convert all aspects of sustainable remediation into monetary values. Panelists provided short responses to the three questions, and participants asked panelists questions. The names and affiliations of the panelists are provided below.

Panelist Name	Affiliation
Mengfang Chen	Institute of Soil Science, Chinese Academy of Sciences
Dominique Darmendrail	Common Forum on Contaminated Land in the European Union
Stella Karnis	Canadian National Railway Company and SuRF Canada
Ning Wang	Environment Control Center

The first question the panelists were asked was as follows: "What is limiting or preventing you from incorporating social aspects into sustainable remediation in your country?" Panelists' responses are summarized below.

- Ning Wang
  Wang said that sustainability is not included in the laws and regulations governing remediation in Japan and, therefore, the social aspects of sustainable remediation are not a top priority. He believes that the first priority should be improving the public's understanding and awareness of the three principles of sustainable remediation.

- Mengfang Chen
  Mengfang said that contaminated land in China is a significant challenge. He believes that incorporating social and economic considerations will slow down the remediation process because of the educational aspects involved and the anticipated media support needed.

- Stella Karnis
  Stella believes that remediation practitioners continue to struggle with how to measure the social aspects of sustainable remediation. She said that the lack of an agreed upon, common method of measurement may be preventing practitioners from integrating social aspects into their projects. In addition, many social metrics are qualitative vs. quantitative and qualitative metrics can be more subjective. In Canada, consultation processes provide practitioners with the opportunity to consult with different

stakeholders. Stella believes that the social aspects for specific sites could be discussed during this consultation.

- ❒ Dominique Darmendrail
  Because she represents such a large number of states, Dominique did not feel she could answer the question from only one perspective. She challenged the group with two questions.
  - o Assuming that human health risk reduction is a baseline expectation, Dominique questioned how to measure social aspects such as community satisfaction and quality of life. A common weight of measurement would not work because of the local and regional issues associated with particular sites. She believes that the weight of various social aspects can be determined through stakeholder involvement.
  - o Dominique asked participants, "What is the relative scale for social issues?" For remediation, the scale is at the site level, but she believes the context and surroundings must also be measured. In addition, adaptation to local conditions (also called "tropicalization") is necessary.

Participants discussed the topic. Stella began the discussion by saying that remediation practitioners need to do a better job identifying stakeholders and getting them around the table. One participant added that the different definitions of "social considerations" complicate the discussion. Everything impacts society; therefore, all three aspects of the triple bottom line converge as "social." To him, the social aspects of the triple bottom line should focus on community aspects.

Some discussions focused on the qualitative metrics associated with social considerations. One participant encouraged participants to compare using these metrics to the process of making decisions about some of the "softer" aspects of tiered evaluations in U.S. regulations such as the Resource Conservation and Recovery Act (RCRA) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Another participant agreed and said that a qualitative evaluation is sufficient.

One participant described the 13 quantitative indicators associated with equity and social justice in CERCLA and encouraged participants to use existing frameworks to guide remediation projects. He said that at a Superfund site in Seattle, Washington, geographic information system (GIS) methodology was successfully used to assess relevant criteria (e.g., green space) and develop a mitigation strategy.

Additional discussions focused on the need to obtain the perspective of social scientists. One participant suggested defining social objectives with the affected parties. Stella agreed, emphasizing the importance of properly identifying stakeholders and involving them early in the process. One participant said that the field of social science is very much like a laboratory. She noted that no social scientists were participating in the meeting and recommended that SURF reach out to these professionals. She believes that, through the use of transparency and social science, remediation practitioners can gain trust with stakeholders. Hao-Chun Hung (Taiwan Environmental Protection Administration) agreed. He said that a social scientist

developed the survey questions that he discussed in his presentation and Hung believes him to be a very important team member.

The second question the panelists were asked was as follows: "What experiences or lessons does your country have that would be especially valuable to others regarding balancing the economic, environmental, and social aspects of sustainable remediation?" Panelists' responses are summarized below.

- Dominique Darmendrail
  Although many case studies exist, Dominique said that all documentation is in the native language of the original country. When trying to perform critical assessments, the different languages make it difficult to compare and share information.
- Stella Karnis
  To achieve a more balanced decision, Stella recommended engaging stakeholders in the process early and including people who *should* be involved in the process (not just those who *are* involved). She believes that a consistent approach is needed for assessing sustainable remediation indicators and that triple bottom line considerations are balanced through transparency and conversations with stakeholders.
- Mengfang Chen
  Mengfang said that the social aspects of sustainable remediation may be considered in the future. Similar to other countries, ecological aspects have not been systematically considered during the remediation of contaminated land in China. He encouraged participants to get involved in helping to solve the environmental challenges in China, stating that the country has the largest remediation market in the world.
- Ning Wang
  Wang said that it would be premature to share experiences about sustainable remediation in Japan. For a period of time in the past, excavation was used for remediating contamination because it removed contaminants completely and reduced health risks to zero. However, excavation is not only costly and consumes energy resources, but it also transfers the contamination to another area. Because of this phenomenon, Japan's administrative department amended its soil law. Now, if contaminated sites exceed the standard and there is no human health risk, remediation does not need to be performed immediately.

One participant with a background in life-cycle analysis provided his perspective. He recommended that remediation practitioners begin with the broadest system boundaries possible, incorporating urbanization, reduced traffic and utility use, and the burdens of materials used on a remediation site. With these broad initial boundaries, practitioners will gain a holistic view and have the flexibility to draw back on boundaries as needed.

The third question the panelists were asked was as follows: "Do you think it is possible to convert all aspects of sustainable remediation into monetary values? If not, is there another metric that can be used to compare different aspects of sustainable development or should we use other nonquantitative methods?" Panelists' responses are summarized below.

- Ning Wang
  Wang said that it may be possible to convert all aspects of sustainable remediation into monetary values. He said that when projects are evaluated, assessment scores are used even though the contents of the evaluation differ.
- Mengfang Chen
  Mengfang believes that it is possible to convert all sustainable remediation aspects into monetary values.
- Stella Karnis
  Stella believes that if sustainable remediation aspects are monetized, the economic aspects of the triple bottom line are being overly emphasized. She uses a tool that monetizes and weighs each item in the triple bottom line and believes that the most balanced approach is the best, regardless of the scores. In addition, Stella emphasized the importance of a consistent approach and said that the indicators used are more important than the tool.
- Dominique Darmendrail
  Dominique does not believe that converting all triple bottom line aspects into monetary values is necessary or appropriate. She suggested tapping into social science methods and using success factors to help remediation practitioners agree on metrics and weight.

Participants discussed weighting and monetizing, as summarized below.

- One participant suggested using existing weighting factors. For example, LEED (Leadership in Energy and Environmental Design) 2009 takes into consideration the weightings developed by the National Institute of Standards and Technology (NIST), which can be used with the U.S. Environmental Protection Agency's Tools for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI). TRACI represents a common life-cycle analysis impact assessment method used in the U.S. The weightings developed by the NIST compare impact categories with one another and assign a relative weight to each. This participant recommended that remediation professionals use the rationale for weighting used by the NIST as a starting point to assess the relative importance of different impact categories when completing life-cycle analyses.
- A second participant recommended using the simplest approach to obtain a reliable management system. A third participant agreed and emphasized the importance of the conversion rate. If all three dimensions are considered, nonparametric ways of comparing the three dimensions need to be used.
- A fourth participant suggested keeping metrics in natural units and engaging stakeholders to determine the appropriate weight and balance. He cautioned that stakeholders should include more than the local community to obtain a more holistic view.
- A fifth participant reminded others of the issue of time and space, e.g., jobs are important now.

Day 2

At the beginning of Day 2, Marianne Horinko (Horinko Group) provided her reflections of the presentations and discussions held on Day 1. Marianne served as Acting Administrator of the U.S. Environmental Protection Agency from July to November 2003 and was the Assistant Administrator for the Office of Solid Waste and Emergency Response from 2001 to 2004. Marianne summarized her reflections in the following five key points:

1. The sustainable remediation movement is organic. The use of sustainable remediation and the expansion of its concepts geographically are occurring in a flat dimension, with no hierarchy, organization, or bureaucracy. Marianne mentioned the use of social networks in Brazil as an example. She said she greatly respects the institutions of government that bind us together and believes that we need to preserve that history, but also embrace a future that involves organic communication and growth.
2. The fundamental tenets of sustainable remediation are transparency and openness. Based on the discussions on Day 1 of the meeting, success in sustainable remediation is tied to involving the public and sharing information early and often. Marianne believes that sustainable remediation takes traditional science and engineering disciplines and marries them with community planning and land use to achieve the best possible decision.
3. Sustainable remediation metrics demonstrate the economic and social value created for communities. Marianne was impressed with the metrics presented on Day 1 that are being used in China and Japan and believes that these metrics make the case for sustainable remediation. By proving that cleanups can and do improve the quality of life, the sustainable remediation movement will gain followers all over the world.
4. Global cooperation will help grow the sustainable remediation movement. Marianne explained that, in the past, the U.S. and other countries believed that they had cornered the market on innovation. The economic cycle of the last five years has made the U.S. and other countries feel like "we're all in this together." SURF is sharing information and best practices, working with ASTM and now ISO. Marianne believes that it is not outside the realm of possibility that an International Treaty for sustainable remediation could be achieved. Only through global cooperation can SURF break new paths in sustainable remediation.
5. The sustainable remediation movement goes beyond science. Although sound science is the bedrock on which the house is built, it is not the whole answer…only a piece of the answer. Marianne believes SURF needs to go beyond science and focus on other disciplines such as sociology and anthropology. SURF should pull social scientists and economists into the debate to help achieve smarter cleanup decisions.

Marianne ended her reflections by saying that our job is to bring communities back to life and congratulating everyone on the birth and renewal of contaminated sites.

Participants asked the following questions:

- ❒ What is the best path forward to implementing sustainable remediation in the U.S. and world? Marianne said she likes the "bottom-up" approach that she currently sees in SURF. She suggested that SURF continue to innovate and share best practices, celebrate and publicize victories, and develop a great communications strategy.
- ❒ How can the U.S. Brownfields program inform us and guide us? Having watched the Brownfields program grow, Marianne believes that the following makes the program successful:
    - o It is a "listening" program where the regulator listens to the community and the community is considered the customer.
    - o It is nonpartisan, with the general belief that good policy trumps any politics.
    - o A "can do" attitude epitomizes the program.

After hearing Marianne's reflections, Mike Rominger (meeting facilitator) asked participants for their reflections on the first day of the meeting. These reflections are listed in Attachment 11.

The remaining Day 2 presentations and subsequent discussions are briefly summarized below. Attachments 12 through 15 contain the presentation slides for Day 2.

The Road to Sustainable Remediation

Lucy Wiltshire (NICOLE) presented an overview of her organization and the activities of the NICOLE Sustainable Remediation Working Group, case studies and feedback, and next steps. NICOLE is a European network that links contaminated land management professionals from industry, service providers, and academia to develop and promote state-of-the-art solutions for contaminated land management. NICOLE is operated and represented by its members and company member groups, a Steering Group, and thematic working groups. A Sustainable Remediation Working Group was formed in 2008, with the following five subgroups: communication, risk management, economics and tools, indicators, and case studies. Lucy highlighted the group's activities, which are summarized below.

- ❒ In 2009, the group developed a questionnaire for its members to map the use of sustainable remediation concepts in different European Union member states. Questionnaire responses confirmed that sustainable remediation was a new concept and that sustainable remediation principles were referred to and used across Europe in very different ways. In addition, questionnaire results revealed that cost-benefit analysis (or the equivalent) was an accepted tool only in *some* countries and that economic and social impacts were not widely considered in remediation projects.

A sustainable remediation project is…

"…one that represents the best solution when considering environmental, social, and economic factors, as agreed by the stakeholders." – NICOLE

- ❒ In 2010, the group published the *Road Map for Sustainable Remediation* that provides a visual representation of the path toward sustainable remediation. The document is intended to be a guidance document, is generic, and can be applied in different

regulatory frameworks. The road map defines a sustainable remediation project (see box) and, through this definition, emphasizes the importance of building consensus between multiple parties. The framework of a sustainable remediation project is included in the road map. In the framework, sustainable remediation is divided into the two inter-related components of sustainability management and sustainability assessment.

- ❒ In 2012, the group published stand-alone research chapters to supplement the road map document. The three chapters address economics, indicators, and risk assessment.

Lucy said that sustainable remediation case studies are documented on a standard template through an interview process. Findings based on these interviews showed that sustainable remediation projects enjoy open communications, increased transparency, improved regulator engagement, broader consideration of the triple bottom line, and the use of a broad range of tools. Challenges include acceptance by the regulators; potential shifts in balance depending on existing legislation, regulator experience, and level of conservatism; and residual liability management (if applicable). Lucy shared three case studies to demonstrate these findings.

Currently, NICOLE members are preparing a summary paper on the feedback obtained from sustainable remediation case studies and are working on a joint position statement with the Common Forum and other European networks. The next NICOLE meeting will be held in Lisbon, Portugal in June 2013. Presentation slides are provided in Attachment 12.

Participants asked questions about screening case studies for green washing and cross checking the validity of the claims made. Currently, a small group of NICOLE members review the case studies but plans to incorporate a more formal peer review process are being discussed. Lucy acknowledged that case studies are not currently validated and said that she would discuss the rigor of case studies with NICOLE members.

One participant asked Lucy to describe her organization's process of identifying stakeholders. Lucy replied that the NICOLE framework is not prescriptive but acknowledged that identifying stakeholders is clearly an important, pivotal step in the process.

Soil Quality: Guidance on Sustainable Remediation

Paul Nathanail (University of Nottingham) provided his perspective about the importance of an ISO standard for sustainable remediation, offered his vision of the standard, and presented an overview of ISO and the key principles involved in standard development.

- ❒ Importance of ISO Standard for Sustainable Remediation
  Paul mentioned CABERNET's report and its adoption by others (see page 7 of these notes for more detail) as an example of how thinking can be influenced if information is presented simply and communicated clearly. He reminded participants of the legal drivers for remediation and of the need to see remediation as one part of the larger picture of SMART regeneration (see box on next page). The idea of keeping the bigger picture in mind was the inspiration for the idea to develop an ISO sustainable remediation standard. ISO recently issued *Soil Quality – Assessment of Impact from Soil Contaminated with Petroleum Hydrocarbons* (ISO 11504:2012). In the U.K., the

Environment Agency issued guidance on this topic in 2005. The development of the ISO standard highlighted the need for an effective method of communicating approaches and best practices to countries without internal guidance and perhaps without the resources to produce such guidance.

SMART Regeneration...

"The best site-specific solution is remediation that eliminates and/or controls unacceptable risks in an integrated, safe, and timely manner and which maximizes the overall environmental, social, and economic benefits of the regeneration work." – After SuRF-UK

- Vision of the Standard
  Paul believes the proposed standard should be informative (vs. normative) and serve to establish a common baseline of terminology, concepts, and contexts about sustainable remediation. For example, the standard would document the skills and issues to consider when performing a sustainability appraisal of potential remediation strategies. The proposed standard is being developed under the auspices of the ISO Technical Committee on Soil Quality (TC 190), Subcommittee on Soil and Site Assessment (SC 7).
- Overview of ISO and Key Principles of Standard Development
  Paul explained that ISO standards are developed by technical committees whose members are from industry, nongovernmental organizations, governments, and other stakeholder groups. ISO standards respond to a need in the market, are based on global expert opinion and consensus, and are developed through a multi-stakeholder process. Working group members collaborate on informal drafts of the standard before submitting a committee draft for formal circulation, review, and comment. Revisions are made and then a draft international standard is submitted for review and voting before a final international standard is published.

Paul encouraged participants to think about how they want to be engaged in this initiative, either formally or informally. The proposed structure of the standard, which is not binding, was submitted to ISO in Summer 2012. A formal kickoff meeting is planned for January 2013, with bimonthly online meetings to track progress. Presentation slides are provided in Attachment 13.

No discussions occurred after the presentation.

Panel: Improving the Practice

Paul Favara (CH2M HILL) moderated a panel discussion about improving the practice of sustainable remediation. Panelists provided opening remarks and short responses to three questions, and participants asked panelists questions. The names and affiliations of the panelists are provided on the following page.

Panelist Name	Affiliation
Mengfang Chen	Institute of Soil Science, Chinese Academy of Sciences
Sander Eskes	AECOM and Brazilian Sustainable Remediation Forum
Carlos Pachon	U.S. Environmental Protection Agency
Garry Smith	AECOM and SuRF ANZ (Australia and New Zealand)
Ning Wang	Environment Control Center

Panelists provided opening remarks about the state of green and sustainable remediation in their country or region, along with the strengths and areas for improvement as related to its practice.

- Garry Smith
  Australia is comprised of six state jurisdictions that constitutionally retain the overriding powers for environmental protection and management. Environmental protection powers in New Zealand are under national jurisdiction. Both Australia and New Zealand enjoy strong local government environmental protection responsibilities. Active consideration is required as to how the SuRF ANZ sustainable remediation framework will interface with the regulatory requirements. A dialogue with regulators is being established via development of the Australian National Remediation Framework. The practice of sustainable remediation may be used to support development of important emerging cross-disciplinary sustainable development practices in land use planning (i.e., brownfields), urban design (i.e., urban renewal), and transport (i.e., transit-oriented development).

  Garry believes that the adoption of brownfields-based planning policy in developing countries such as Africa would address one of the most important planning goals in developing countries (i.e., economically effective urban development and renewal) while also addressing climate change mitigation.

- Sander Eskes
  In Brazil, contaminated land management is performed at the state level. Some states are not accepting of risk-based management, so the concept of sustainable remediation is a hard sell. Some states are amenable to sustainable remediation concepts, but progress is slow. Sander believes that leveraging learnings and approaches from other countries will help increase the practice of sustainable remediation in Brazil.

- Ning Wang
  Although no requirements for sustainable remediation are included in the soil remediation law in Japan, recent increased communication about sustainable remediation and its concepts is beginning to affect the practice. He believes that sustainable remediation will increase in importance and application in Japan in the next few years.

- Mengfang Chen
  The concepts of green and sustainable remediation and a risk-based framework for

remediation are new ideas in China. Mengfang is hoping to build a national and international platform to discuss these concepts through workshops. He encouraged attendees to contact him if they are interested in participating in this effort.

The first question the panelists were asked was as follows: "What are the focus areas of the green and sustainable remediation practice in your geographic region and why are they considered important?" Panelists' responses are summarized below.

- Garry Smith
  Garry highlighted the following four focus areas of the practice in Australia: (1) developing a national framework that features sustainable remediation; (2) describing the planning requirements for sustainable remediation practice, including the wider urban environment context; (3) identifying and describing appropriate quantitative metrics tools for sustainable remediation; and (4) initiating a dialogue among remediation practitioners, regulators, and industry to discuss case studies in remediation and sustainable remediation. Garry believes that these four areas are important because they affect the bigger picture of remediation in Australia. For example, although dialog about regulations can be complex, it is important to highlight specific regulations that apply to all states within the country and try to clarify and simplify them.

- Carlos Pachon
  In the U.S. Superfund program, remediation program managers are receiving training on green remediation methodology (i.e., tools). These methodologies generate numbers, which helps promote transparency in the process. With this in mind, the U.S. Environmental Protection Agency (along with many others) is collaborating with ASTM to develop a standard for green and sustainable remediation. In planning for the standard, the organization is working across programs at the staff level up to the senior management level to clarify how the standard could be integrated into current programs.

- Sander Eskes
  Sander said that, in Brazil, the focus is on solid waste management and community interaction. The solid waste management industry has a strong political lobby in the country and changing the paradigm of excavation and off-site disposal is a challenge. However, change is beginning to occur through corporations. In November 2012, a delegation from The Netherlands signed a corporation agreement with the regulatory environmental agency of São Paulo State on solid waste management. Community interaction is a priority in Brazil, where the involvement of the judicial system can be a challenge. Remediation practitioners are trying to find better ways to communicate the science of risk to community members.

- Ning Wang
  In Japan, the societal element of sustainable remediation presents a bigger challenge than the economic and environmental elements of the triple bottom line. While communication with local residents about remediation activities is very important, usually the emphasis is on the reduction of human health risks and guarantee of the

resident's normal life (vs. seeking the maximum benefit of economic, environmental, and social aspects of sustainable remediation). The concepts of sustainable remediation need to be recognized by the general public, so future work may need to focus on the social aspects of sustainable remediation.

- Mengfang Chen
  Mengfang said that sustainable remediation is rarely practiced in China but acknowledged that balancing the triple-bottom line considerations is fundamentally important for the country. Like other panelists, he emphasized communication and the challenges associated with explaining both the risks of contamination to human health and water as well as the social and economic benefits of understanding the risks. Because China does not have the resources to address every contamination site, Mengfang believes that a balanced approach to address contaminated land is of paramount importance.

One participant asked a question about the U.S. Brightfield program, which links solar energy to brownfield redevelopment sites. Carlos briefly described the program and a current initiative within the program called RE-Powering America's Land. The initiative focuses on solar energy, wind, and biomass projects that provide local economic benefits in the form of new jobs.

Another participant asked Carlos to identify where the biggest opportunities lie within the remediation process to apply green and sustainable remediation practices. Carlos said that opportunities occur largely in the operations and maintenance phase of the remediation process. His organization has performed over 200 optimizations that have streamlined remedies and forced a hard look at overall remedial strategies.

One participant asked Garry how optimal balance is achieved between environmental and cleanup goals. From the SuRF ANZ perspective, Garry said the concepts of green and sustainable remediation and sustainable remediation are complementary. Green and sustainable remediation focuses on the application of achieving a particular remediation endpoint based on a strong environmental focus. Sustainable remediation has a broader focus – it includes wider endpoint options, including social and economic indicators. The practice of sustainable remediation in Australia and New Zealand depends on the mandatory requirements and the options, which vary.

The second question the panelists were asked was as follows: "What areas of the practice do you see as opportunities for cross-country or regional cooperation?" Panelists' responses are summarized below.

- Mengfang Chen
  Mengfang said he is talking to a number of SURF organizations and is in the process of organizing SuRF-China, which will provide many more opportunities to collaborate. The first SuRF-China meeting will be held next year and he will invite some participants from this meeting to attend. In addition, Mengfang said that the development of the Chinese Soil and Groundwater Remediation Network is in process and he believes that the network will allow practitioners to learn from others' experiences.

- Ning Wang
  Wang emphasized collaboration and a more effective exchange of information related to the definition of sustainable remediation and associated terms and the establishment of sustainable remediation indices. To more effectively share knowledge and learn from each other, the terms associated with sustainable remediation (e.g., definition of economic, environmental, and social aspects) must be defined. In addition, he recommended that groups collaborate to develop sustainable remediation indices (e.g., monetary).

- Sander Eskes
  Sander said that Brazil will continue to learn from experiences abroad. He encouraged participants to learn from the social aspects of local communities in Brazil where there seems to be more of an equal tradeoff of information.

- Carlos Pachon
  Carlos cautioned participants about developing a framework that is a parallel process to others' frameworks. He referred to Marianne Horinko's remarks about the importance of common messaging and leveraging the networks present in this room.

- Garry Smith
  Garry said that a comparison of frameworks among all of the countries represented could shed light on common themes (e.g., common barriers). He suggested a harmonization of frameworks and a template process to condense key issues. By harmonizing all of the approaches and articulating them worldwide, Garry believes sustainable remediation will include the appropriate balance of environment, social, and economic values and will be able to address urgent urban renewal and carbon emissions mitigation needs.

One participant asked how panelists explain sustainable remediation to regulators and problem owners. For problem owners, Sander explains that using a sustainable remediation framework can lead to a more practical solution in an objective way. For regulators, Garry explains that sustainable remediation will provide protection of human health and the environment, but also local protection (e.g., through carbon dioxide emission reductions). In Carlos' experience, problem owners find cost savings and efficiencies when performing green remediation analysis for large, complex remedies.

The third question the panelists were asked was as follows: "As you look forward over the next five years, what areas of the green and sustainable remediation practice do you think will be improved in the geographic region you represent?" Panelists' responses are summarized below.

- Garry Smith
  In five years, Garry believes that practitioners in Australia will be using a national remediation framework that includes community engagement and considers land use and value. Within the same timeframe, Garry believes that New Zealand will have developed a framework or adopted Australia's framework. Regardless, he believes that New Zealand's framework will focus on greenspace, transit, and urban planning issues.

- Carlos Pachon
  Carlos believes that the practice of greener cleanups will be improved within the next five years as more remedies are streamlined. Within the same timeframe, Carlos believes that the concepts applied to greener cleanups will begin to be applied in the broader concept of contaminated sites. He hopes that within the next five years sustainable remediation will become a more integral part of the Superfund program.
- Sander Eskes
  In five years, Sander believes that Brazil will be conducting sustainable remediation on less complex sites and that sustainable remediation approaches will involve water recycling and artificial recharge (vs. hydraulic barriers). In 10 years, he believes that solid waste management guidelines will be established that allow for a higher percentage of solid waste reuse.
- Ning Wang
  Wang believes that societal awareness of sustainable remediation will be the main improvement and development occurring in the next five years. He believes that all parties will consider sustainable remediation when developing a remediation plan, but thinks that the emphasis will be on qualitative aspects. In five years, Wang believes that the definition of sustainable remediation will be familiar to local residents and that the qualitative and quantitative aspects of sustainable remediation will be integrated into relevant guidance documents.
- Mengfang Chen
  In five years, Mengfang believes that awareness about sustainable remediation will have increased in China and a framework will be developed. He hopes that new technologies will be available to address contamination and that risk-based approaches will be consistently applied.

Participants discussed ways to share information about specific sustainable remediation initiatives. The following possible action items were suggested:

- Develop a common case study template, and share case studies internationally to accelerate learnings around the globe.
- Develop documents that articulate the economic and social aspects of sustainable remediation.
- Plan another international gathering addressing how sustainable remediation is applied and focus on a common set of contaminants or technologies for a specific remedy.
- Involve urban planning professionals to provide insight on the temporal and dynamic component to sustainable remediation.
- Address slum improvement needs in third-world countries through sustainable remediation.
- Keep it simple; use social media and the Internet.
- Develop a portal for SURF members all over the world to share information.

Panel: Standardizing Guidance for Sustainable Remediation

Karin Holland (Haley & Aldrich and SURF) moderated a panel discussion about standardizing guidance for sustainable remediation. Panelists provided short responses to five questions, and participants asked panelists questions. The names and affiliations of the panelists are provided below.

Panelist Name	Affiliation
Dominique Darmendrail	Common Forum on Contaminated Land in the European Union
Marianne Horinko	The Horinko Group
Stella Karnis	Canadian National Railway Company and SuRF Canada
Paul Nathanail	University of Nottingham
Carlos Pachon	U.S. Environmental Protection Agency
Lucy Wiltshire	Honeywell International, Inc. and NICOLE

The first question the panelists were asked was as follows: "Are current guidance documents aligned or in conflict?" Panelists seemed to agree that current guidance documents are not in conflict. Paul emphasized the evolution of the sustainable remediation field and how current guidance documents demonstrate the evolution. Each document builds on the last and then is customized to local concerns. Carlos acknowledged the perception of a conflict, but believes that fundamentally there is no conflict. Marianne believes that documents are in various stages of development, but all are going in the same direction. She doesn't believe that guidance documents need to be identical as long as they share a common direction. Stella and Lucy agreed.

Participants and panelists discussed the consideration of worker health and safety in the U.S. and how this consideration fits into the definition of sustainable remediation (i.e., in the environmental or social aspect of the triple bottom line). Representatives from the U.S. Environmental Protection Agency and the U.S. Navy said that worker health and safety is considered as part of the nine evaluation criteria of an investigation and a feasibility study. One participant believed that worker health and safety should be considered under the social aspects of the triple bottom line. Another participant said that he did not regard this issue as a conflict.

The second question the panelists were asked was as follows: "Do you have a preferred guidance document and why?" Lucy said she likes the "big picture" aspect of the NICOLE guidance document. Stella likes the documents produced by SURF in the U.S. and U.K. that emphasize integrating sustainable remediation concepts early in the remediation process. She mentioned a proposal by Environment Canada that explicitly addresses the social elements associated with sustainable remediation.

Participants discussed their preferred guidance documents, which are listed below.

- ❒ *Technical Guidance for Site Investigation and Remediation* (DER-10)—This New York State Department of Environmental Conservation document includes a requirement to consider sustainability during remedy selection.

- ❒ The ITRC document *Technical/Regulatory Guidance: Green and Sustainable Remediation: A Practical Framework*—One participant said this document was easy to use and was developed through a consensus process with state regulators.
- ❒ The *SuRF-UK Indicator Set for Sustainable Remediation Assessment*—This document supports the SuRF-UK framework document and supersedes the initially published indicator set published in March 2011. The document describes 15 categories of indicators involving triple bottom line factors that can be used for a sustainability assessment in support of remediation decision-making.
- ❒ A Boeing internal company document—One participant said this document is used by remediation practitioners within the company and includes items such as success factors and expectations.
- ❒ *Department of the Navy Guidance on Green and Sustainable Remediation*—This document provides Navy remedial project managers and consultants with a clear approach to integrating green and sustainable considerations into the current remediation process.

While endorsing the quality of the work above, Paul Nathanail mentioned that many of the documents are not relevant to practitioners and regulators around the world, which is why a group has been set up to draft a standard under the auspices of ISO.

One participant asked panelists how to balance the risk of remedy when performing large-scale ecological restoration and, more specifically, dredging. Dominique said that the European Sediment Network (SedNet) focuses on sediment management and its regulation (i.e., should sediment be regulated under water, soil, or sediment?). SedNet guidance documents are available at http://www.sednet.org/. Carlos said that dredging is a situation of exception; the common remedies selected to address sediment contamination involve enhanced monitored natural recovery and monitoring.

The third question the panelists were asked was as follows: "What are the barriers to developing standardized guidance?" One participant cited communication as the primary barrier and gave the example of different organizations using different lexicons for sustainable remediation terms. He believes that developing common definitions for terms relating to sustainable remediation would allow the field to progress. Marianne believes that the group is evolving toward a standardized template or framework and emphasized the importance of the spirit of learning and education in this evolution. She said that standardization of sustainable remediation terms could be a lofty goal and, as such, may not need to be achieved right now.

The fourth question the panelists were asked was as follows: "What should be included in standardized guidance?" Panelists and participants discussed the pros and cons of standardized guidance. Stella said that establishing a common language, terminology, and concepts would be valuable and sufficient. One participant believes that a standardized problem statement or general, holistic objective is needed before developing guidance can be considered. Dominique said one term used by her organization is "common ground."

Additional discussions focused on the appropriateness of a standardized rating system for sustainable remediation projects. Participants seemed to agree that a required rating system was not appropriate, but some type of recognition could be formalized in the long term for problem owners that integrate sustainable remediation at contaminated sites.

The fifth question the panelists were asked was as follows: "What stakeholders should be consulted during the development of guidance?" Carlos said that EPA's defines "stakeholders" as all individuals that will be affected by the decision being made. Lucy emphasized the value of involving regulators and the importance of objectivity when interacting with regulators (e.g., don't assume regulators are adverse to sustainable remediation). Dominique said that her organization needs to convince regulators at different levels that sustainable remediation is the best approach to addressing contaminated land.

Panelists and participants debated the weighting of community member input. One participant said that the person with the "loudest voice" has the most influence and questioned the validity of decisions made in this scenario. Carlos said that the challenge is not fighting the loudest voice, but making sure that all voices are heard. One participant emphasized the importance of informing and educating the community.

In response to the original question, Stella said that the challenge is to develop overarching guidance that can assist remediation practitioners in the day-to-day management of contaminated land. Marianne agreed.

Sustainable Remediation – The London Experience

Paul Favara provided an overview of the transformation of a degraded area in East London. The area was redeveloped to support a sports venue for international competition and future use as a community in East London. The presentation is unavailable for distribution; questions can be directed to Paul directly at Paul.Favara@ch2m.com.

Protecting Human Health and the Environment with a Lower Environmental Footprint

Carlos Pachon (U.S. Environmental Protection Agency) presented an overview of the importance of sustainability in the Superfund program and highlighted the use of green remediation to lower the environmental footprint of site cleanup projects. Although he specifically focused on the Superfund program in his presentation, Carlos emphasized that the use of sustainability and the consideration of all aspects of the triple bottom line is not unique to this program. In Superfund, social aspects are considered via community involvement and economic aspects are included through future land use considerations. With two aspects of the triple bottom line covered, the U.S. Environmental Protection Agency focuses on green

Green remediation is...

"...the practice of considering all environmental effects of remedy implementation and incorporating options to minimize the environmental footprints of cleanup actions."

– U.S. Environmental Protection Agency

remediation (see box) to address the environmental footprint associated with contaminated soil and groundwater remedies. Presentation slides are provided in Attachment 14.

- ❒ Community Involvement
  Community input is required in remedy decisions and implementation at sites in the Superfund program. Paralleled after the International Association for Public Participation, the U.S. Environmental Protection Agency uses the seven core values of public participation to actively seek and facilitate community engagement. Nearly 100 community involvement coordinators are located nationwide throughout the agency's regional offices to provide opportunities for two-way communication throughout the life of a project.

- ❒ Future Land Use
  In Superfund, remedial action objectives factor reasonably anticipated future land use into remedial decision making and future land use information is obtained through local community input. The agency helps return sites to productive use by funding reuse assessments and redevelopment planning; removing reuse barriers (real or perceived); and partnering with local governments, communities, developers, and other interested stakeholders.

- ❒ Green Remediation
  Because large carbon footprints are associated with Superfund remedies, the agency focuses on green remediation to use less energy, emit less carbon dioxide, and use more renewables. Using this approach, over 200 pump-and-treat systems have been optimized and 185 megawatt renewable capacity has been installed on contaminated sites. It is important to note that before green remediation elements are considered and integrated (if appropriate), the remedy is "right-sized" through the development of an accurate conceptual site model, sufficient characterization of source areas and contaminant plumes, sound engineering in design, and streamlined performance monitoring. The agency recommends using best management practices for simple remediation projects and applying the footprint methodology for more complex projects. Best management practices and the *Methodology for Understanding and Reducing a Project's Environmental Footprint* are available at www.cluin.org/greenremediation/.

One participant asked about the value of a risk-based dialog. Carlos believes that a risk-based dialog is valuable, but reminded participants that risk-based assessments identify exposure pathways—not remedies. One participant thanked Carlos for his attendance and participation and others seemed to agree.

Common Forum Activities and Approaches on Contaminated Land Management

Dominique Darmendrail (Common Forum on Contaminated Land in the European Union) presented her organization's mission and activities, reviewed the evolution of contaminated land policies at a national level, and discussed newly developed contaminated land management principles that integrate sustainability. Presentation slides are provided in Attachment 15.

- Mission and Activities

  The Common Forum on Contaminated Land in the European Union is a network of contaminated land policy experts and advisors who exchange knowledge and experiences and discuss policy, research, and the technical and managerial concepts of contaminated land. Forty-five countries participate in the Common Forum and the International Committee on Contaminated Land (ICCL). Recent Common Forum activities include supporting the incorporation of risk-based land management in some European Union countries, an alternative proposal for a Soil Protection Directive, and the proposal of technical guidance documents to aid countries in implementing directives.

- Evolution of Contaminated Land Policies

  In the early 1980s, national contaminated land policies focused on the development of systematic, general approaches and drastic control of contamination sources. In the 1990s, the importance of land use was emphasized during assessments and remedial decision making. Investigation approaches were customized to the specific site and, therefore, were more cost effective than past efforts. Beginning in 2000, spatial planning, water management, and socio-economy considerations needed to be integrated to ensure regeneration of the land while fulfilling different needs for land. The Common Forum believes that new challenges (e.g., energy efficiency, low carbon economy demands) require a shift from risk management to land management for contaminated lands that offer opportunities. In risk assessment, environmental impacts and risks are investigated and understood through a tiered approach. Land management, on the other hand, involves designing and implementing actions to reduce negative consequences and balance benefits. In this way, the Common Forum believes that the next generation of policy needs to use natural resources sustainably, verify the eco-efficiencies of environmental technologies, and integrate life-cycle concepts.

- Contaminated Land Management Principles

  The evolution of contaminated land policies spurred the Common Forum to develop the following four contaminated land management principles:

  - Fitness for Use: Ensures safe use or reuse of contaminated sites by preventing unacceptable risks for citizens and the environment
  - Stand-Still: Ensures no further degradation of natural resources (i.e., soil and groundwater)
  - Sustainable Development: Ensures that benefits are balanced at an appropriate scale and time frame
  - Transparency and Fairness: Establishes well-known assessment and decision criteria that facilitate consensus among involved stakeholders

  With these principles comes the need to address the challenges associated with matching human needs to natural resources and capacities, crossing geographical boundaries and time scales, and promoting synergies and avoiding irreversibility.

Dominique ended her presentation by remarking about future needs and planned ICCL actions. With different legislation and different principles in countries throughout the European Union, the Common Forum recommends acknowledging the efforts to date and finding existing common approaches for managing contaminated soil. To begin to more effectively integrate sustainability in remediation, the Common Forum plans on issuing a joint statement with NICOLE. The ICCL plans to promote best practices, develop a common roadmap or framework for contaminated land management, provide links to existing tools and success stories, and identify gaps to be addressed in the future.

Two questions were asked after the presentation. One participant asked for more detail about the planned joint statement between the Common Forum and NICOLE. Dominique said that the statement is intended to outline the organizations' shared positions on basic principles. Another participant asked about plans to disseminate such new concepts within the authorities' communities. Before dissemination can begin, Dominique said that definitions and ideas need to be clarified. Then, a common roadmap or framework can be developed.

White Paper Next Steps

Maile Smith (Northgate Environmental Management) shared the draft outline of the white paper, along with the names of the chapter facilitators. Over the next several months, chapter facilitators will integrate information from the meeting's invited guests and notes to create the first draft.

Final Reflections

At the end of the meeting, Mike Rominger (meeting facilitator) asked participants for their reflections. One participant said he enjoyed Carlos Pachon's (U.S. Environmental Protection Agency) presentation and realized from it that the agency focuses on green remediation (vs. sustainable remediation) because economic and social considerations are addressed through other agency programs.

Mike noted the diversity of organizations represented in the room and asked participants to suggest additional organizations to invite to future SURF meetings. Participants suggested inviting participants from the following organizations or professions: U.S. Air Force, U.S. Army, U.S. Army Corps of Engineers, American Planning Association, World Bank, Earth Institute at Columbia, Urban Land Institute, United Nations Environment Programme, developers, and remediation subcontractors.

Future Meetings

The next SURF meeting (SURF 22) will focus on SURF's outreach and technical initiative efforts and will be held February 26-27, 2013, at University of California – Berkeley. Information regarding the details of the meeting is posted on the SURF website. If you are a SURF member and would like to help plan or host an upcoming meeting, e-mail Mike Rominger (meeting facilitator) at mike.rominger@sustainableremediation.org.

ATTACHMENTS

Attachment 1
SURF 21 Participant Contact Information

SURF 21 Participant Contact Information

Participant	Affiliation
Aboulafia, Isaac	MECX, LP
Abrams, Stewart	Langan/Treadwell and Rollo
Adams, Kathy	Writing Unlimited, LLC
Akhbari, Daria	Colorado State University
Aragona, Keith	Haley & Aldrich, Inc.
Armstead, Robert	University of South Florida Patel School of Global Sustainability
Bealer, Buddy	Shell
Borgersen, John	Tetra Tech
Butler, Brandt	URS Corporation
Britt, Randy	Parsons
Brown, Kim	NAVFAC Engineering & Expeditionary Warfare Center
Bullens, Geert	Royal Netherlands Embassy
Casunuran, Vergel	Booz Allen Hamilton
Chen, Mengfang	Institute of Soil Science, Chinese Academy of Sciences
Clark, David	BNSF Railway
Crimi, Michelle	Clarkson University
Darmendrail, Dominique	Common Forum on Contaminated Land in Europe
Eskes, Sander	AECOM
Evans, Richard	Groundwater & Environmental Services, Inc.
Favara, Paul	CH2M HILL
Fiorenza, Stephanie	BP
Fisher, Angela	GE Global Research
Gade, Max	Syracuse University
Garson, Nick	The Boeing Company
Glenn, Christopher	Langan/Treadwell and Rollo
Goldblum, Deb	U.S. Environmental Protection Agency
Hadley, Paul	California Department of Toxic Substances Control
Hasegan, Diana	Langan/Treadwell and Rollo
Henderson, James	DuPont
Holland, Karin	Haley & Aldrich, Inc.
Horinko, Marianne	The Horinko Group
Hung, Hao-Chun	Taiwan Environmental Protection Administration
Jayaraman, Venkat	AMEC Environment & Infrastructure, Inc.
Karnis, Stella	CN
Keddington, Patrick	Haley & Aldrich, Inc.
Keller, Joe	Groundwater & Environmental Services, Inc.
Krieger, Todd	DuPont
Leonard, Todd	Rubik Environmental
Levy, Zeno	Syracuse University
Maco, Barbara	U.S. Environmental Protection Agency
Madabhushi, Sriram	Booz Allen Hamilton
Mancini, Kristin	Arcadis
McCann, Brian	Groundwater & Environmental Services, Inc.
McMaster, Michaye	Geosyntec Consultants
McNally, Amanda	AECOM
Means, Bruce	U.S. Environmental Protection Agency
Mikszewski, Alex	Woodard & Curran, Inc.
Monahan, Kyle	Clarkson University
Mouzakis, Katherine	Colorado School of Mines
Nan Wang, Bing	Sinotech Environmental Technology, LTD
Nathanail, Paul	University of Nottingham
Newman, Pixie	CH2M HILL
Odencrantz, Joe	Tri-S Environmental

SURF 21 Participant Contact Information

Participant	Affiliation
Pachon, Carlos	U.S. Environmental Protection Agency
Poole, Scott	URS Corporation
Raymond, Dick	Terra Systems, Inc.
Reackhof, Sharron	Pacific Gas and Electric Company
Rominger, Mike	MCR Facilitation Services
Ryan, John	AECOM
Shea, David	Sanborn, Head & Associates, Inc.
Simon, John	Gnarus Advisors
Sirabian, Russ	Battelle
Smith, Maile	Northgate Environmental Management
Smith, Garry	Smith Environmental
Smith, Jonathan	Shell Global Solutions UK
Stanley, Curt	Shell Global Solutions
Tazawa, Ryuzo	Shimizu Corporation
Tipton, Karina	Brown and Caldwell
Torrens, Jake	AMEC Environment & Infrastructure, Inc.
Vanderkooy, Matthew	Geosyntec Consultants
Venkatasubramanian, Sowmya	Parsons
Wang, Ning	Environmental Control Center Co., Ltd.
Watts, Dan	Arasoc Group
Wenning, Rick	ENVIRON International Corporation
Wice, Rick	Tetra Tech
Willett, Anna	Interstate Technology & Regulatory Council
Wiltshire, Lucy	Honeywell International Inc.
Woodward, Dave	AECOM

Attachment 2
Meeting Purpose and White Paper Mission

SURF 21

- Objectives:
  - Build working relationships
  - Mutual learning
  - Develop an International White Paper

White Paper Mission

- Advance the science and application of sustainable remediation internationally
- Leverage the participation of global remediation-industry leaders attending SURF 21
- Generate further interest and importance of sustainable remediation
- Further establish SURF's role as a leader

White Paper Layout

- Introduction
- Introduction to each organization
- Frameworks, guidance documents, and tools
- How each organization balances the three facets of sustainability
- Barriers or speedbumps
- Improving the practice
- Lessons learned
- Illustrative case studies
- Synthesis, conclusions, and closing thoughts

Initial Expectations?

Attachment 3
SuRF-UK Experience: Building a Common Understanding of Sustainable Remediation

Building a Common Understanding on Sustainable Remediation: the SuRF-UK experience

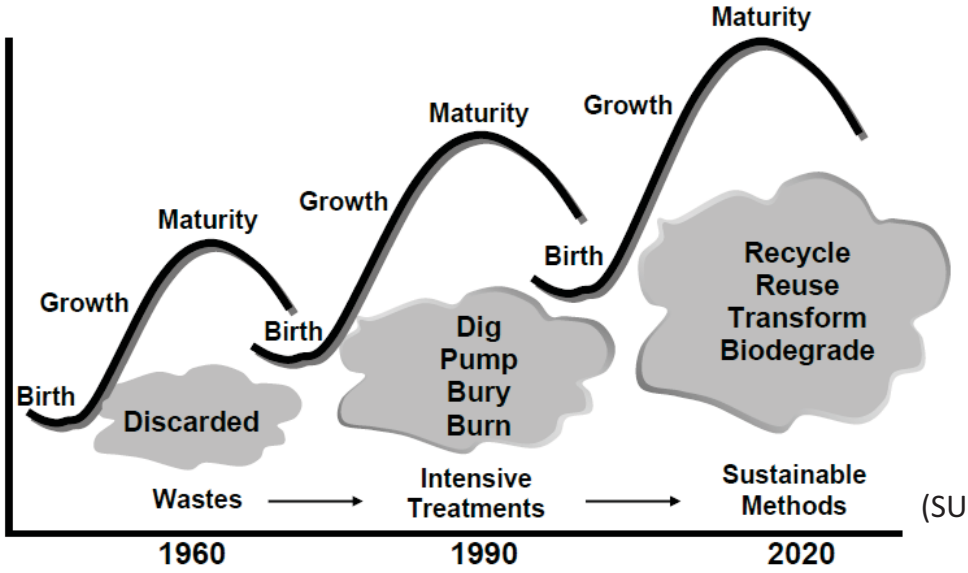
Professor Jonathan Smith
Chair, Sustainable Remediation Forum-UK

Presented to: SURF21, Washington DC, December 2012

Content

- An evolution of contaminated site management
- What is sustainable remediation?
- What is SuRF-UK
- SuRF-UK outputs
- Influence of SuRF-UK
- Lessons learned

Evolution of contaminated site management

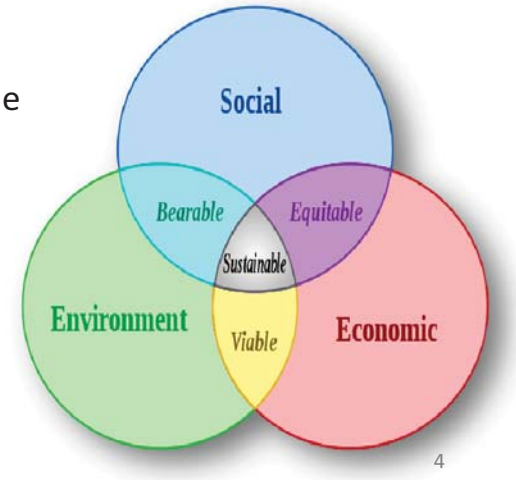


(SURF, 2009)

Knowledge:	Ignorance	Recognition	Increasing understanding (and expectation)	
Response:	Apathy	Outrage	Increasingly objective response	
Remediation:	None	Complete removal	Risk-based	Sustainable & risk-based

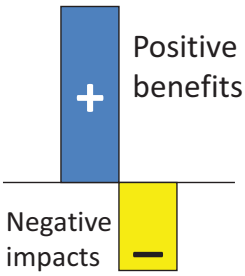
Sustainable Development

- Sustainable development
  - 'Development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (Report of the World Commission on Environment and Development 1987, the Brundtland report)
  - Often applied as a Triple-Bottom Line analysis
- Sustainable remediation
  - Application of the principles of sustainable development to soil and groundwater remediation decisions



Is all remediation beneficial?

- Remediation seeks to reduce risks associated with soil and groundwater contamination, but also;
  - uses energy, natural resources;
  - can generate wastes;
  - introduces health and safety risks.



- ***Key issue***: Remediation is not sustainable *per se*, and certain strategies / technologies may cause more damage than they solve.

Recent British legal cases

- Corby BC found negligent over steelworks remediation, 2009;
  - 16 birth defects allegedly due to exposure to contaminated dust

- Cotswold Geotechnical Holdings guilty of 1st corporate manslaughter charge brought in the UK
  - Geologist died in 2008 when site investigation trench collapsed
  - GCH found guilty, Feb 2011


BBC NEWS

BBC NEWS CHANNEL

Families win birth defect battle

Families who claim their children were born with defects caused by exposure to toxic waste in Northamptonshire have won a legal battle at the High Court.

They sued Corby Borough Council, saying deformities to hands and feet were due to mothers being exposed to a "soup of toxic materials" between 1985 and 1999.

The council was found negligent over work to reclaim a steel plant. It said it was "disappointed" at the ruling.

The judge found in favour of 16 of the 18 claimants.


BBC NEWS GLOUCESTERSHIRE

15 February 2011 Last updated at 18:53

Company guilty of Cheltenham geologist's manslaughter

A Gloucestershire firm has become the first company to be convicted under new corporate manslaughter legislation.

Geologist Alexander Wright, 27, from Cheltenham, died at a development site in Brimscombe Lane, near Stroud, when a trench collapsed on him.

Cotswold Geotechnical Holdings denied killing Mr Wright in the accident which happened in

Sustainable remediation is

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

[SuRF-UK, 2010]

What is SuRF-UK?

- UK-based collaboration of industry, regulators, academics and consultants
- Established in 2007, following the lead of SURF (US)
- Independent co-ordination by CL:AIRE (www.claire.co.uk/surfuk)
- Secretariat has been funded by UK government and industry. In-kind support from industry, regulator, consultants etc.
- **Aims**
  - A framework for assessing sustainable remediation that is effective, practical and achieves regulatory acceptance
  - Develop relevant sustainability indicators
  - Support use of sustainability thinking in contaminated site management in the UK
  - Workshops and self-help

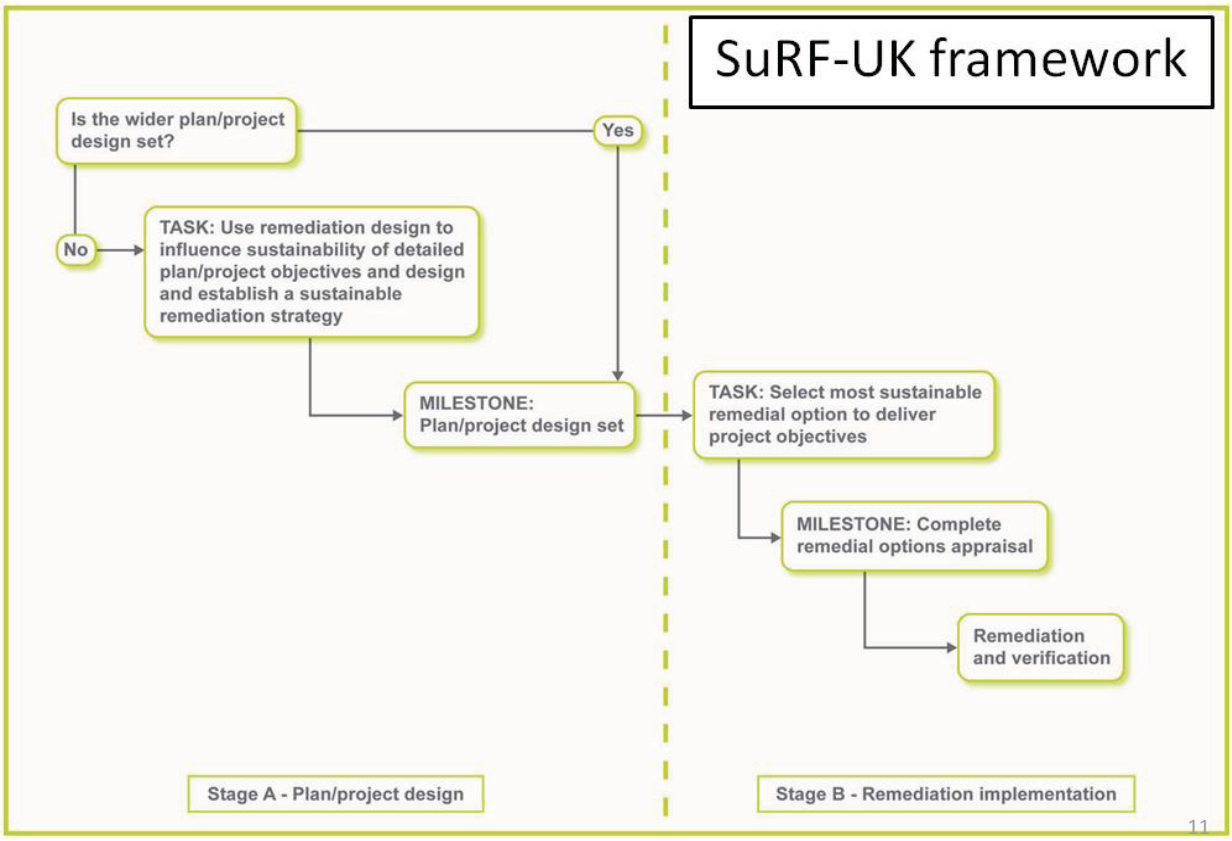
SuRF-UK framework

- SuRF-UK Framework (2010)
  - **Protection of human health and the environment a pre-requisite**
  - Identify best way to manage risks having regard to environmental, social and economic factors
  - Broad scope - holistic
  - Tiered approach to appraisal
  - SR indicator categories

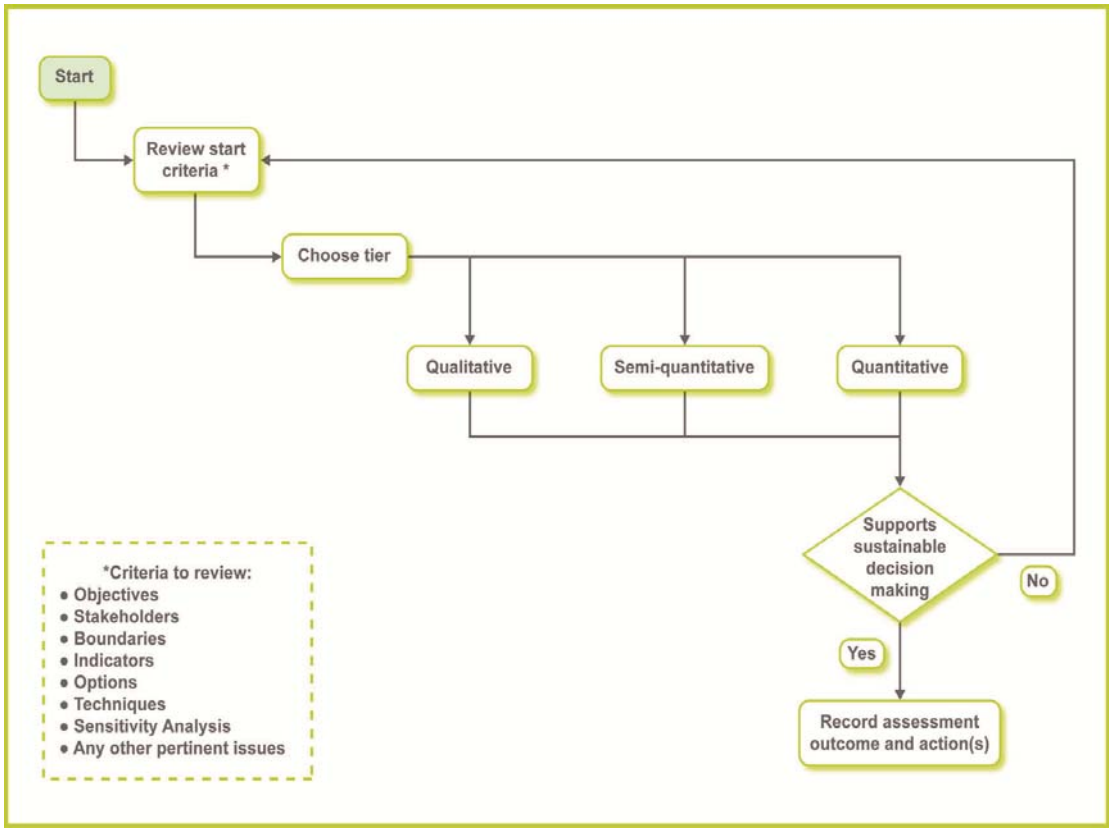
Key Principles

- Protection of human health and the environment
- Safe working practices (for workers & local communities)
- Consistent, clear and reproducible decision-making
- Record keeping and transparent reporting (including assumptions & uncertainties)
- Good governance and stakeholder involvement
- Sound science

SuRF-UK Framework



A Tiered Approach



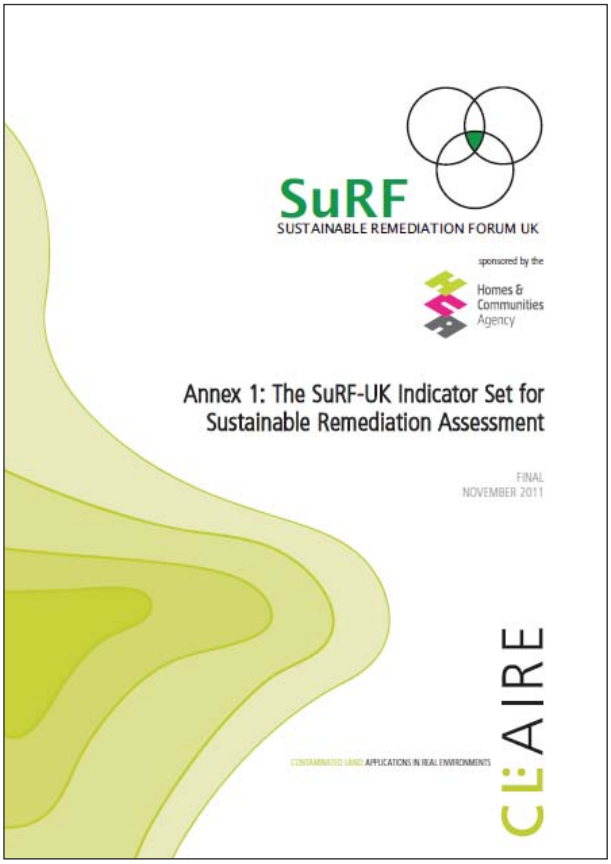
Key factors in appraisal process

- Objectives
  - Project objectives. What decision is the appraisal used for?
- Stakeholders
  - Who affects, or is affected by, the project decision?
- Boundaries
  - Project boundaries – Spatial, Temporal, Lifecycle
- Indicators
  - Which factors are relevant to sustainability?
- Options
  - Remedial options being assessed
- Techniques
  - Sust Rem appraisal techniques – Qual., Semi-quant., Quant
- Sensitivity analysis

Indicator Sets

Environment	Social	Economic
Emissions to Air	Human health & safety	Direct economic costs & benefits
Soil and ground conditions	Ethics & equity	Indirect economic costs & benefits
Groundwater & surface water	Neighbourhoods & locality	Employment & employment capital
Ecology	Communities & community involvement	Induced economic costs & benefits
Natural resources & waste	Uncertainty & evidence	Project lifespan & flexibility

Indicator categories



- SR indicator categories (2011)
- Expanded guidance and explanation of the 15 SuRF-UK categories
  - Definitions;
  - Inclusions and exclusions

Regulatory acceptance?

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

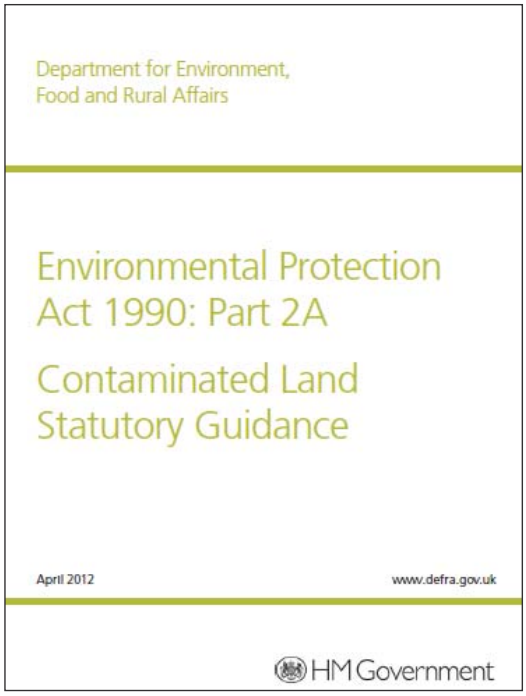
Gareth Hall
Director General, Department for the Economy and Transport
Welsh Assembly

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

UK regulatory update



- Revised Contaminated Land Statutory Guidance (2012)
  - requires regulator assessment of the elements of sustainability;
- "*The overarching objectives of the Government's policy on contaminated land …are: To identify and remove unacceptable risks to human health and the environment….proportionate, manageable and compatible with the principles of sustainable development*."
- "*…should…consider the various benefits and costs of taking action, with a view to ensuring that the regime produces net benefits*"
- SuRF-UK approach recommended in new Environment Agency guidance on soil and groundwater remediation (GP3 Part 5)

Lessons Learned

- **Involve all the key stakeholders in developing your Sustainable Remediation framework and guidance**
- Definitions objectives, scope and meanings must be clear to all parties
- The objective is to *make a site-management decision* using a proportionate, balanced and holistic appraisal
- **Keep it a simple!** Use the simplest approach that produces a reliable management decision.

Next steps: SuRF-UK Phase 3

- Assessor guide for Tier 1 sustainability appraisal. ‘SuRF-UK briefcase’;
- Best Management Practices aligned to SuRF-UK 15 indicator categories;
- Case studies. 7 and counting.
- Industry workshop
- Webinar
- Training resources

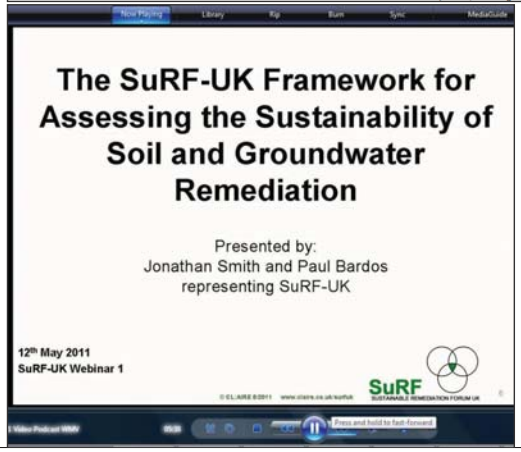
Other SuRF-UK output


REMEDIATION Spring 2011

Applying Sustainable Development Principles to Contaminated Land Management Using the SuRF-UK Framework

Paul Bardos
Brian Bone
Richard Boyle
Dave Ellis
Frank Evans
Nicola D. Harries
Jonathan W. N. Smith

In the past decade, management of historically contaminated land has largely been based on prevention of unacceptable risks to human health and the environment, to ensure a site is "fit for use." More recently, interest has been shown in including sustainability as a decision-making criterion. Sustainability concerns include the environmental, social, and economic consequences of risk management activities themselves, and also the opportunities for wider benefit beyond achievement of risk-reduction goals alone. In the United Kingdom, this interest has led to the formation of a multistakeholder initiative, the UK Sustainable Remediation Forum (SuRF-UK). This article presents a framework for assessing "sustainable remediation"; describes how it links with the relevant regulatory guidance; reviews the factors considered in sustainability; and looks at the appraisal tools that have been applied to evaluate the wider benefits and impacts of land remediation. The article also describes how the framework relates to recent international developments, including emerg-


The SuRF-UK Framework for Assessing the Sustainability of Soil and Groundwater Remediation

Presented by:
Jonathan Smith and Paul Bardos
representing SuRF-UK

12th May 2011
SuRF-UK Webinar 1

- Workshops and discussion
- Peer reviewed paper
- Webinar / podcast
- Case studies

Summary – SuRF-UK

- A framework for assessing the sustainability of remediation is available in the UK
- Supported by all UK environment agencies
- Development and road testing assisted by focussed workshops
- Indicators sets developed and defined
  - But need to be populated (metrics)
- Supports **balanced** decision-making process

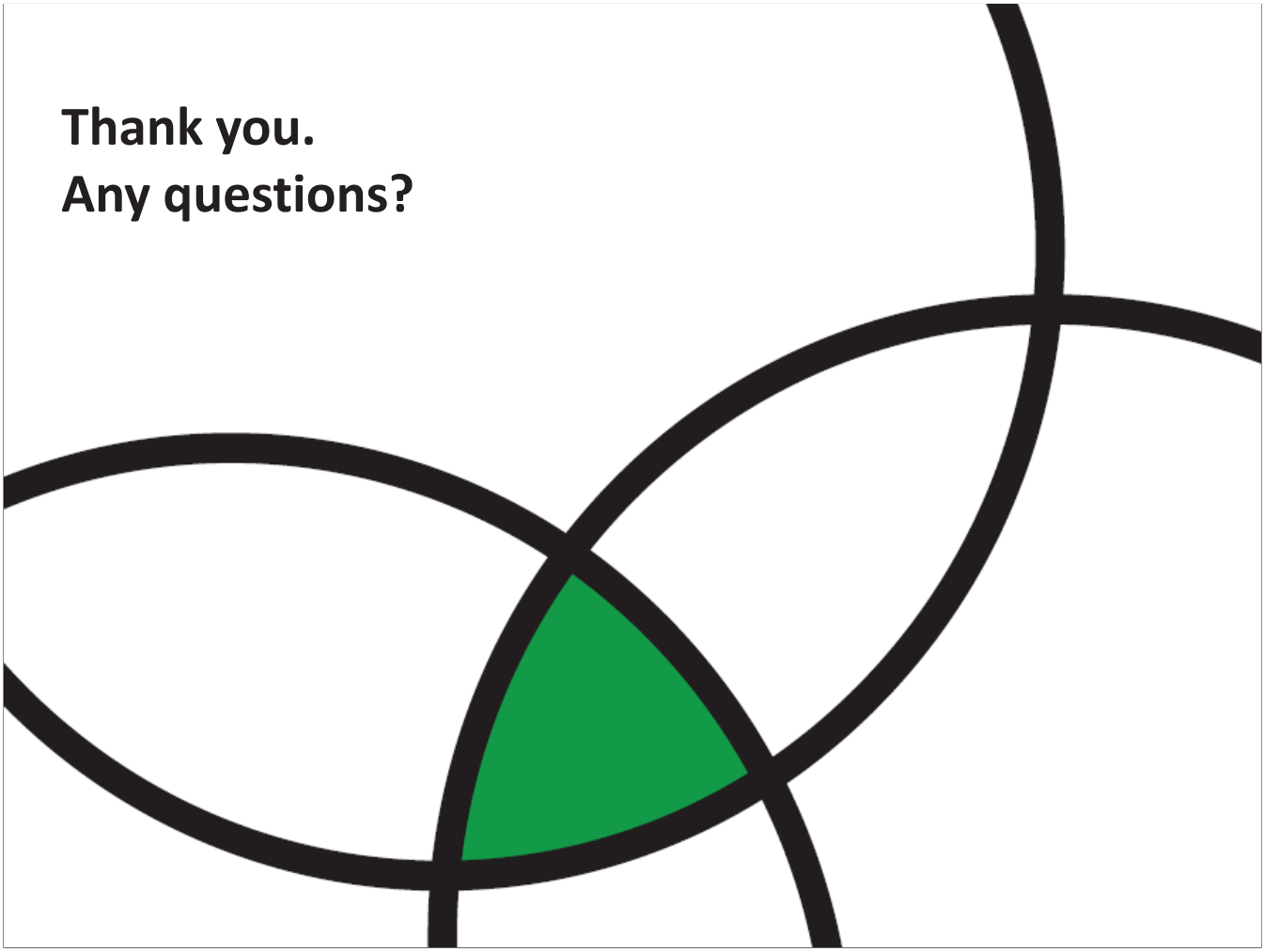
Further reading

- CL:AIRE, 2009. *A review of published sustainability indicator sets: How applicable are they to contaminated land remediation indicator-set development?* SuRF-UK report. SuRF-UK report, May 2009.
- CL:AIRE, 2010. *A framework for assessing the sustainability of soil and groundwater remediation*. SuRF-UK report, March 2010.
- CL:AIRE, 2011. *A framework for assessing the sustainability of soil and groundwater remediation, Annex 1: The SuRF-UK Indicator Set for Sustainable Remediation Assessment.* SuRF-UK report, November 2011.
- SuRF-UK reports and podcast available at: www.claire.co.uk/surfuk

- Bardos RP, Bone BD, Boyle R, Ellis D, Evans F, Harries N, & Smith JWN, 2011. Applying sustainable development principles to contaminated land management using the SuRF-UK framework. *Remediation*, **21(2)**, 77-100.

- SuRF-UK Phase 3 output coming soon:
  - Guidance on SR Best Management Practices; aligned to 15 indicator categories
  - Assessor Pack for Tier 1 (Qualitative) Appraisals

Thank you.
Any questions?



Attachment 4
Brazilian Sustainable Remediation Forum

Brazilian Sustainable Remediation Forum

Fórum Brasileiro de Remediação Sustentável

SURF 21, Washington DC, December 12th, 2012

Brazilian Sustainable Remediation Forum

- First meeting held on October 18, 2010
- Founding members:
  - AECOM
  - BASF
  - CETESB (São Paulo State Environmental Agency)
  - DuPont
  - Shell/Cosan
- President: Sander Eskes (AECOM)

Brazilian Sustainable Remediation Forum (cont'd)

- Organization
  - Based on social networks – interactivity
  - Focus on knowledge transfer to external users (i.e., non-members)
  - Organized around discussion groups (technical, legal, etc.)
  - Meetings are held 3 times per year (discussion groups more often)
  - No formal organizational structure
- Interaction with government agencies and industry
  - Close cooperation with São Paulo State Environmental Agency (CETESB)
  - Limited interaction with industries through branch organizations
- Interaction with the public
  - Mouth-to-mouth advertising (advocacy)
  - Blog (mostly accessed over the weekend)
  - Social networks (Facebook / LinkedIn / Twitter)

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Brazilian Sustainable Remediation Forum (cont'd)

- Policy making (state level)
  - Technical discussion groups
  - Legislative forums
- Key documents
  - White paper
  - Translations and adaptations of CLU-IN guideline documents (*www.**clu**-in.org*)
- Tools
  - AFCEE Sustainable Remediation Tool (SRT™)
  - Various carbon tools
  - Remediation cost estimation tools (RACER™, etc.)
  - Bow-Tie risk analyses tools (THESIS™, etc.)

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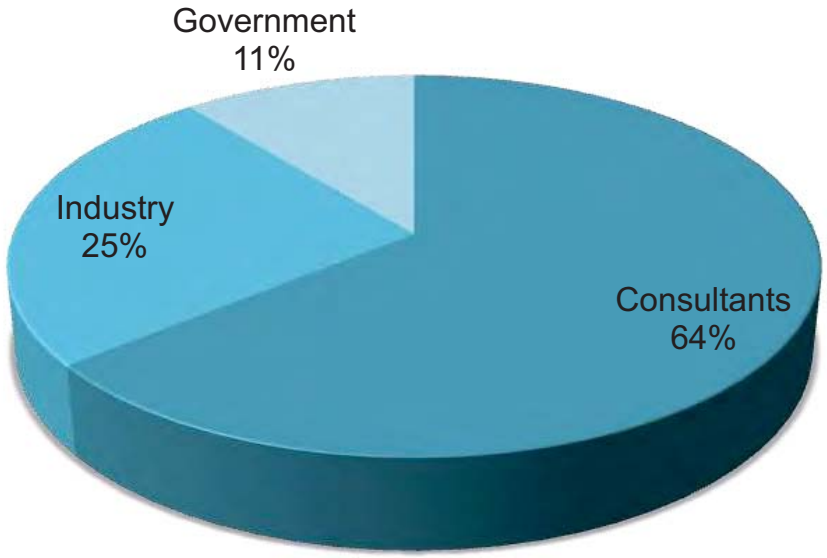
Forum participation



Members on distribution list (September 2012): 34

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Milestones

- Selection of forum name and logo: Fórum Brasileiro de Remediação Sustentável (*Brazilian Sustainable Remediation Forum*) in January 2011
- Incorporation of sustainability concepts in São Paulo State Environmental Law 13.577, February 2011.
- Creation of an official blog in April 2011: http://foresbr.wordpress.com
- Organization of a roundtable discussion and workshop on Sustainable Remediation at the CIMAS II conference in São Paulo, October 2011.
- Application of Bow-Tie technology (ongoing)

Fórum Brasileiro de Remediação Sustentável

II International Congress on SUBSURFACE ENVIRONMENT
October 4 to 6, 2011 - São Paulo - Brazil

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Blog http://foresbr.worldpress.com/

Blog visitors since Jan 2011: 4000

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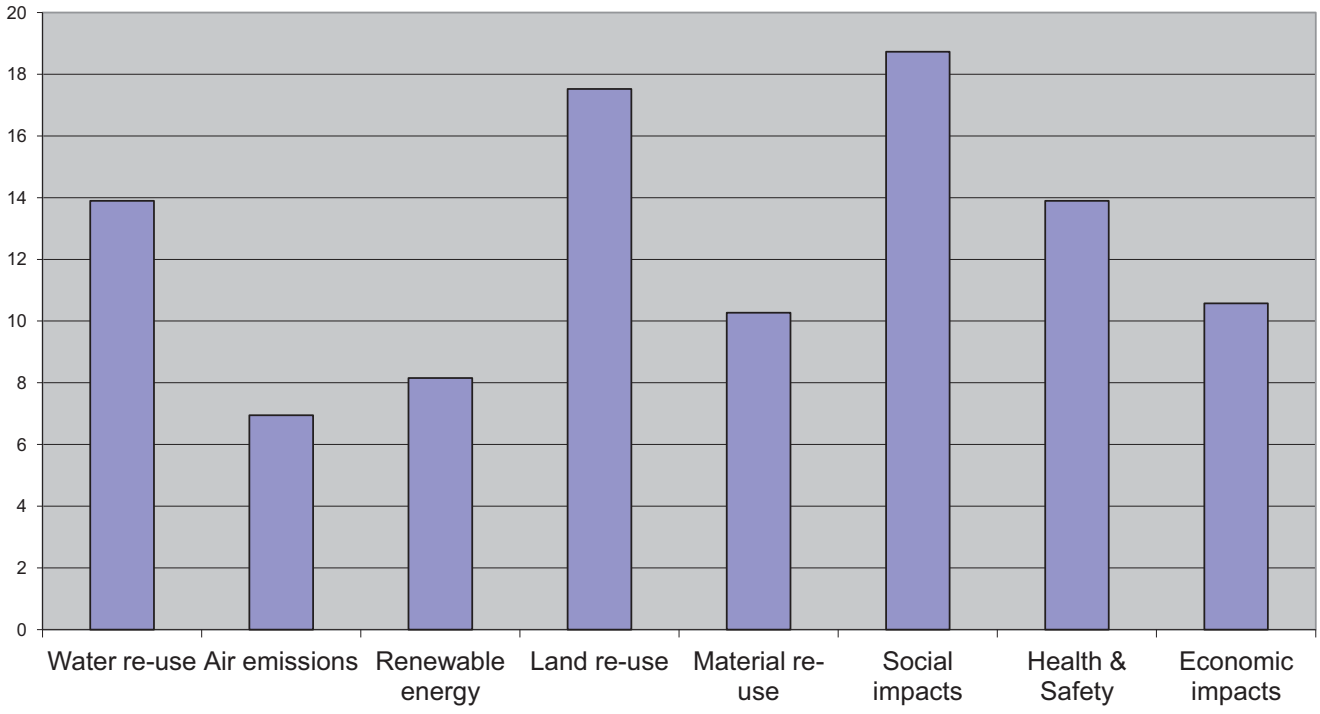
What matters in Brazil?

Relative importance of Sustainable Remediation aspects in Brazil - Poll among 30 participants at a workshop in São Paulo - Nov 2011



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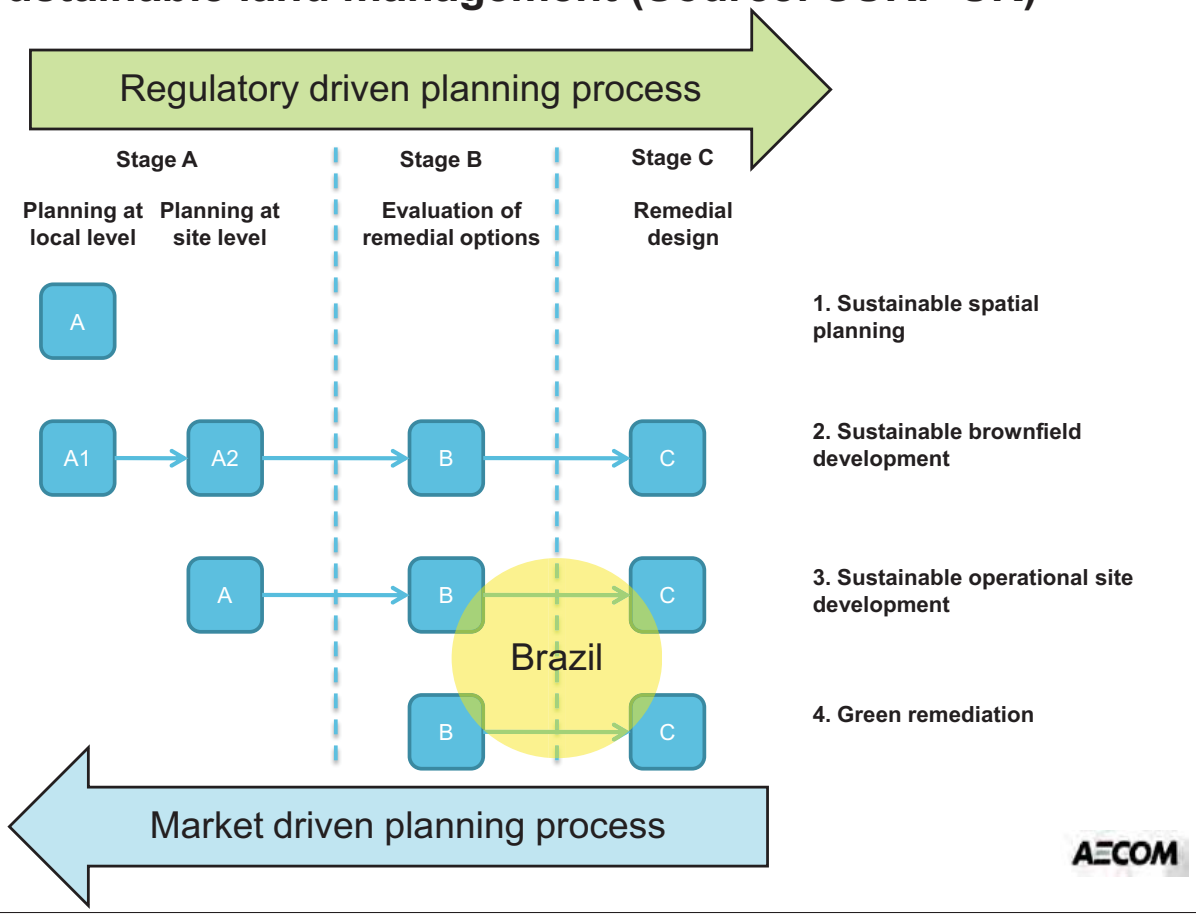
Key issues in Brazil

1. Social aspects
2. Land re-use
3. Water re-use
4. Health & Safety
5. Economic impacts

Sustainable land management (Source: SURF-UK)



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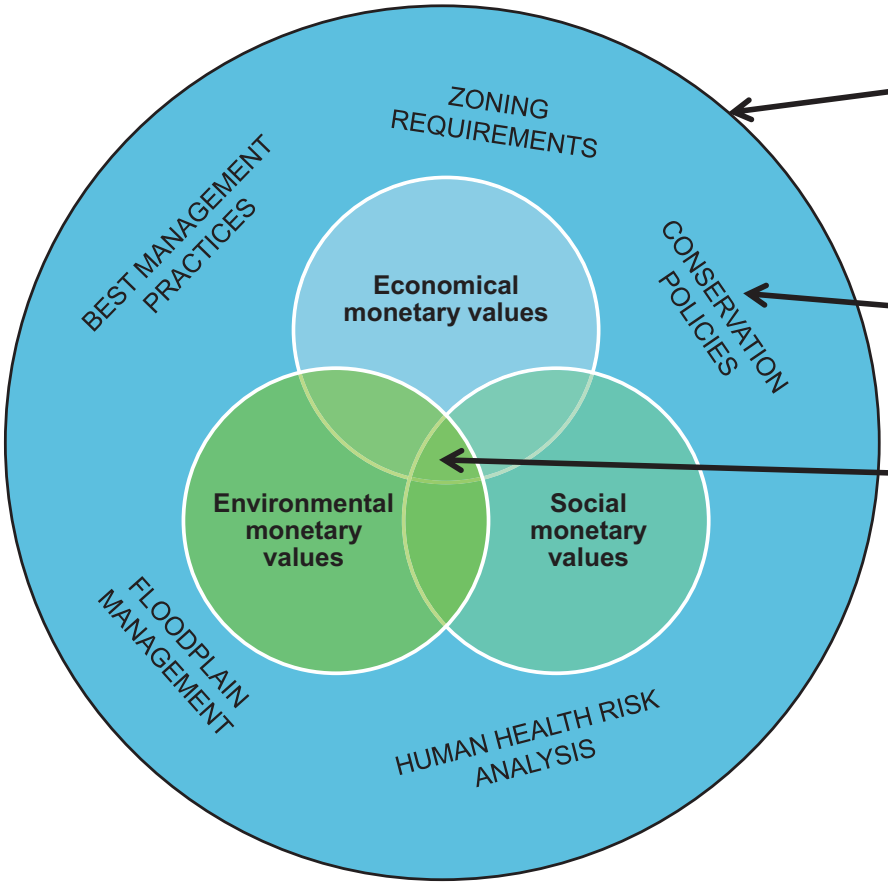
Calculating the Monetary Value of a Remediation Alternative



Information used to define one **Remediation Alternative**

Boundary Conditions are attributed a monetary value of zero.

The monetary value of a remediation alternative is the sum of negative and positive monetary values of all three **Sustainability Legs**

Not all monetary values can be calculated directly…

- **Economic values**

  -Negative(CAPEX, O&M, NPV, etc.) ► Calculate $

  +Positive (e.g., return on investment) ► Calculate $

- **Environmental values**

  -Negative
  - Water & energy costs ► Calculate $
  - Ecological impacts ► Determine risk levels

  +Positive
  - Carbon credits ► Calculate $
  - Return from materials re-use ► Calculate $

- **Social values**

  -Negative (community impacts, H&S risks) ► Determine risk levels

  +Positive (local benefits, benefits to society) ► Calculate $

How to compare dollar values and risk levels ?

Proposed solution:

1. Determine the net monetary value of those aspects that can be calculated directly
2. For all other aspects, perform a Bow-Tie Risk Analysis and calculate the cost of managing the risk.

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How is risk quantified?

- Statistically, the level of risk can be calculated as the product of a) the probability that harm occurs; and b) the severity of that harm.

SEVERITY	CONSEQUENCES				LIKELIHOOD				
	People	Asset	Environment	Reputation	1	2	3	4	5
					Very Unlikely	Unlikely	Possible	Likely	Very Likely
1	No/ Slight Injury	No/ Slight damage	No/ Slight effect	No/ Slight Impact	Low	Low	Low	Low	Low
2	Minor Injury	Minor damage	Minor effect	Limited Impact	Low	Low	Low	Medium	Medium
3	Major Injury	Local damage	Local effect	Major Impact	Low	Low	Medium	Medium	High
4	Fatality	Major damage	Major effect	Nat. Impact	Low	Medium	Medium	High	High
5	Multiple fatalities	Extensive damage	Massive effect	Internat. Impact	Medium	Medium	High	High	High

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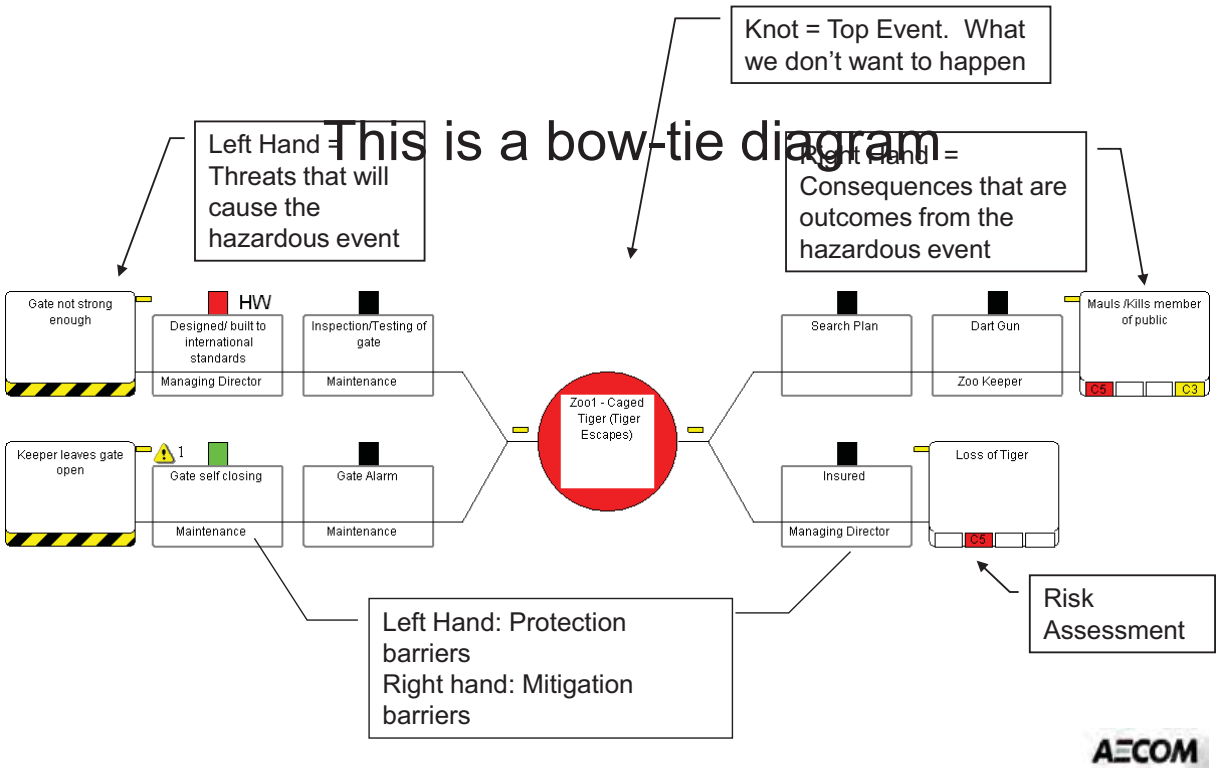
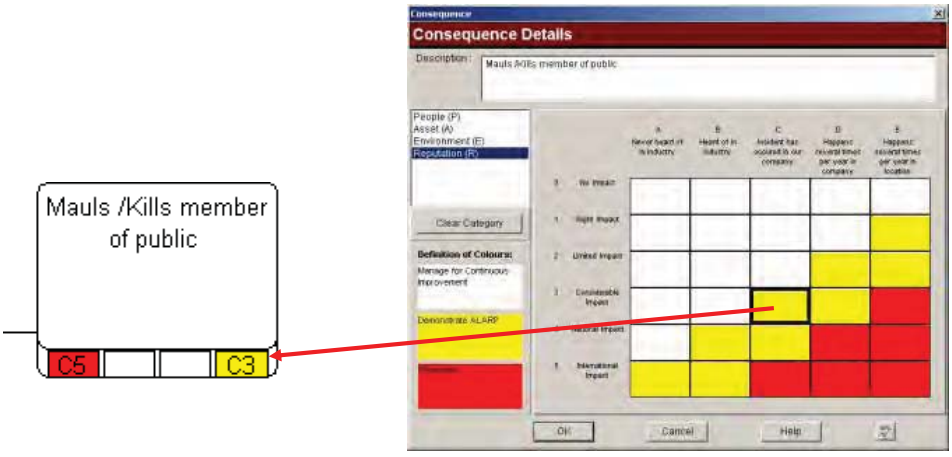
What is a bow-tie diagram?



Assessing the Risk

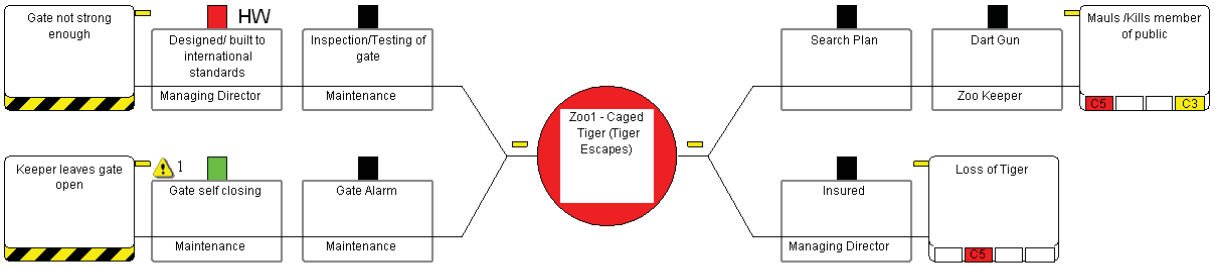
- The risk can be assessed by selecting a category from a risk matrix



- Risk matrices are surprisingly uniform throughout the world, when following Best Management Practices (BMP)

Creating a bow-tie diagram

- A bow-tie diagram shows how a “top event” will be prevented and mitigated.



How to apply this to Sustainable Remediation:

1. We can calculate a bow-tie diagram for all the top events associated with a particular remediation alternative
2. The risk management costs are calculated as the sum of the installation and maintenance costs of all prevention and mitigation barriers
3. This cost is added to the remediation alternative as a negative monetary value

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Using Bow-Tie, we can now associate a monetary value with social and ecological impacts (defined as the cost for prevention and mitigation)

•Economic values
- \- Negative(CAPEX, O&M, NPV, etc.) ► Calculate $
- \+ Positive (e.g., return on investment) ► Calculate $

•Environmental values
- \- Negative
  - ○ Water & energy costs ► Calculate $
  - ○ Ecological impacts ► Bow-Tie ► Calculate $
- \+ Positive
  - ○ Carbon credits ► Calculate $
  - ○ Return from materials re-use ► Calculate $

•Social values
- \- Negative (social impacts, H&S risks) ► Bow-Tie ► Calculate $
- \+ Positive (local benefits, benefits to society) ► Calculate $

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Advantages of proposed methodology

- Methodology avoids subjectivity, or having to make political choices
- Risks assessments and the associated costs of implementing and maintaining the risk barriers can be based on BMPs that are widely accepted
- Besides social impacts, it's possible to incorporate ecological risks, H&S risks, etc.
- We do not have to make questionable choices between risks, in other words, we never have to compare risks directly (e.g., a "cancer slope factor" versus "the risk of having a diver accident")

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Thank you!

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Attachment 5
Current State of Countermeasures and Remediation Examples in Japan

Current State of Countermeasures & Examples of Remediation in Japan

Dec. 2012

Shimizu Corporation
Ryuzo TAZAWA

Contents

1. Scope of Countermeasures

- Amendment of The Soil Law 2009
- State before and after Amendment of the Soil Law

Environmental Risk and Standards for Soil Contamination

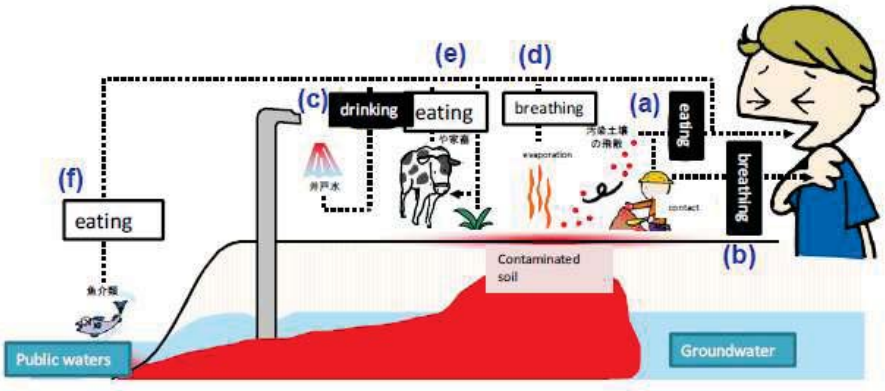


Figure 1: Environmental Risk related to Soil and Groundwater contamination

Note:

(a) Direct ingestion of contaminated soil (including soil particulate)

(b) Dermal absorption

(c) Ingestion of groundwater contaminated by hazardous substances eluted from contaminated soil

(d) Inhalation of hazardous substances emitted from contaminated soil to atmosphere

(e) Discharge of soil containing hazardous substances to municipal waterways → accumulation in aquatic ecology → ingestion by human beings

(f) Accumulation of hazardous substances in crops and livestock raised on contaminated land → ingestion by human beings ⇒Agricultural Land Soil Pollution Prevention Act

Hazardous substances (25 items) in the Soil Law

Category 1	Category 2	Category 3
(VOC)	(Heavy metals etc.)	(Agrichemicals, PCB..)
• carbon tetrachloride • 1,2 - dichloroethane • 1,1-dichloroethylene • cis-1,2-dichloroethylene • 1,3-dichloropropene • dichloromethane • tetrachloroethylene • 1,1,1-trichloroethane • 1,1,2-trichloroethane • trichloroethylene • benzene	• cadmium and compounds • hexavalent chromium and compounds • cyanide and compounds • total mercury and compounds • selenium and compounds • lead and compounds • arsenic and compounds • fluorine and compounds • boron and compounds	• simazine • thiram • thiobencarb • PCB • organic phosphorus compounds
	Risk for direct ingestion (9 items)	Risk for ingestion through groundwater etc. (25 items)

5

State of Countermeasures

- Reduce potential to human health impacts
  - Prevention of exposure
  - Block of human exposure pathway
  - Removal of contaminants
- Status of countermeasures

Selling and purchasing land, Redevelop.

↓ at present

Removal of contaminants

⇒ Conforming soil standard

↓ near future

Appropriate measures for land use

6

Amendment of the Soil Law 2009

--- Important points ---

(1) Prevention of removal excavation and proper management of contaminated soil taken out

(2) Expansion of investigation opportunities, Including voluntarily investigation

(3) Clarify of zones and necessary countermeasures for managing found soil contamination properly

※ Soil Contamination Countermeasures Law has enforced since 2003; for last decade

State of Designated Zones in Soil Law

Designated Zone : 719 zones source: MOEJ on Sep. 1 2012

(1) Requiring Countermeasure : 83 zones

(2) Requiring Notification for changing land characteristics : 636 zones

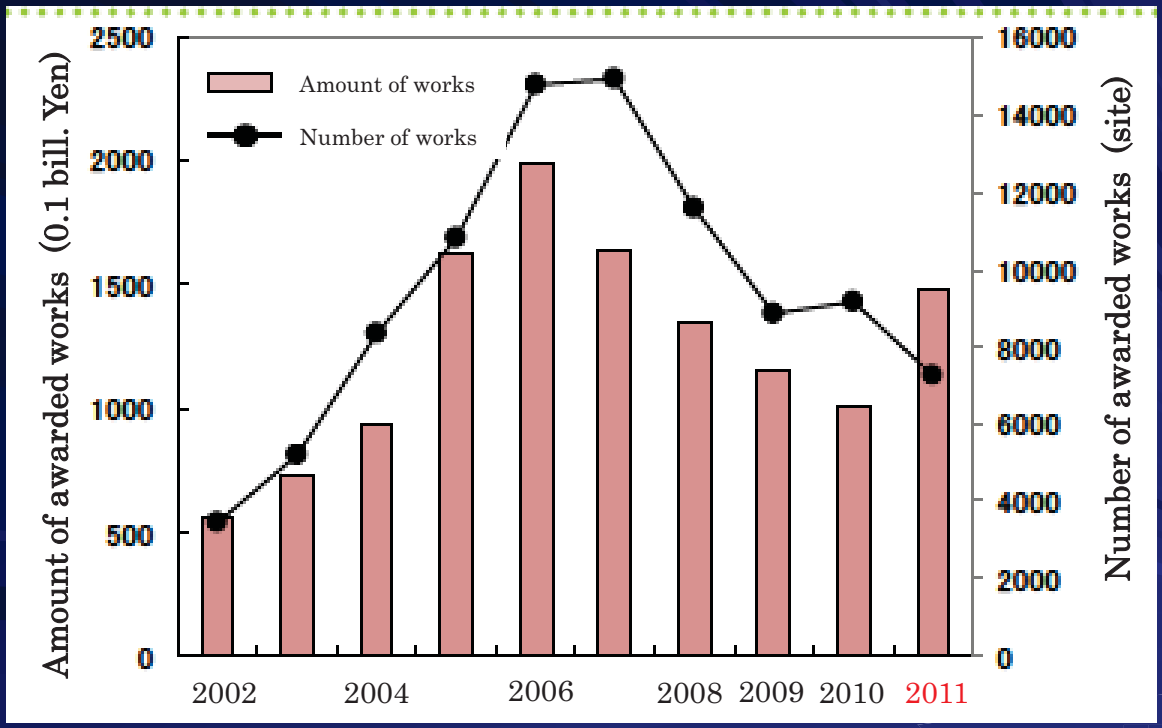
Investigation opportunity	Number of Zones/ sites	Content of Article
Article.3	: 298	→ Closing down specified facilities
Article.4	: 151	→ Changing land over 3,000m2
Article.5	: 3	
Article.14	: 250	→ Requesting voluntarily to be designated
Article.4&14	: 17	

2. Investigation and Countermeasures

According to the Survey of GEPC (2002-2010)

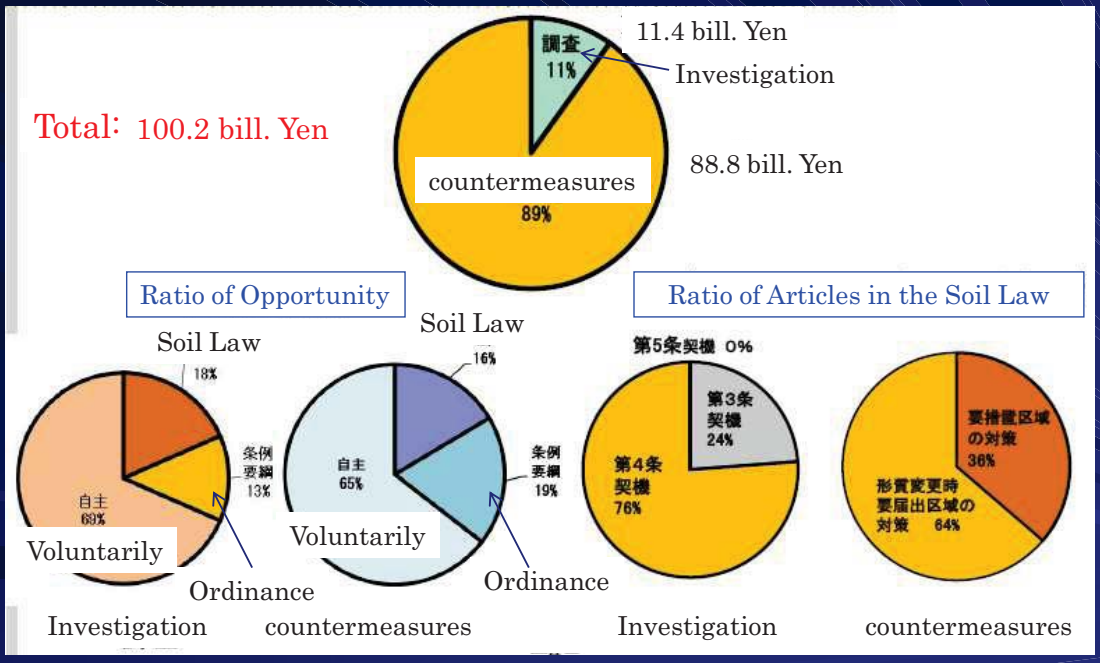
Awarded Amount and Works

2011 FY



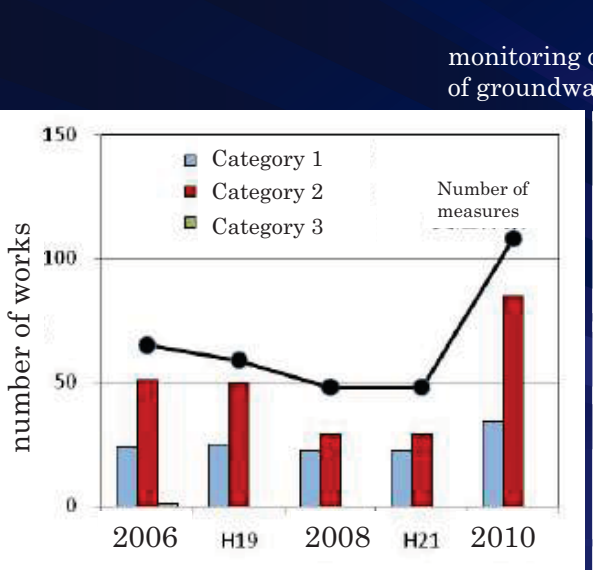
Source: GEPC 2011

Amount of Awarded Works



Source: GEPC 2010

Countermeasures according to the Soil Law



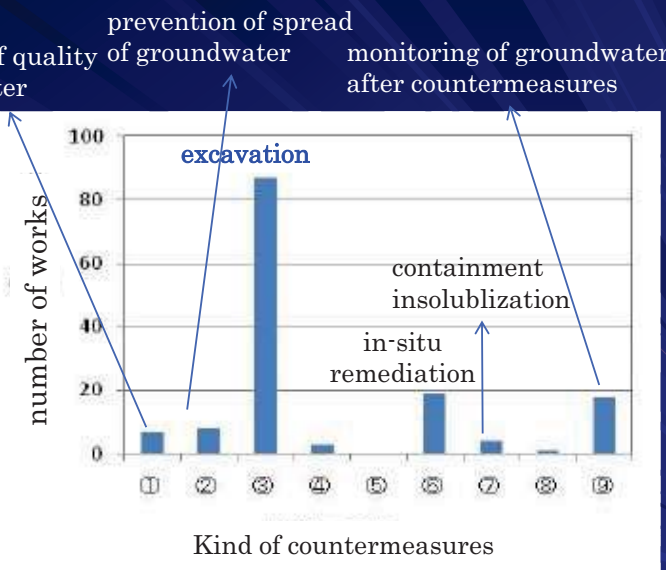
Number of works for contaminants

(multiple answers allowed)

monitoring of quality of groundwater

prevention of spread of groundwater

monitoring of groundwater after countermeasures



Number of works for countermeasures

(multiple answers allowed)

Source:GEPC 2010

3. Technologies to be selected for countermeasures

According to the Survey of GEPC (2010)

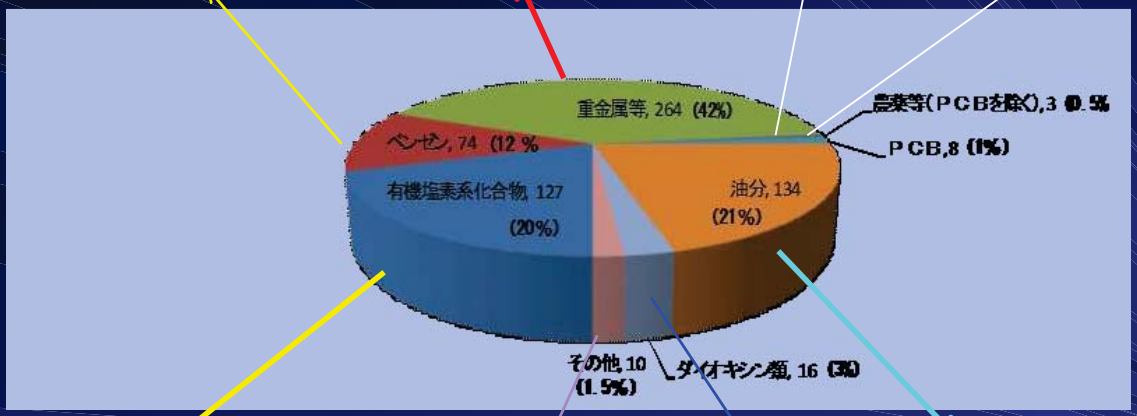
Hazardous substances implemented as countermeasures

Benzene
74 sites 12%

Heavy metals
264 sites 42%

Agri-chemicals
3 sites 0.5%

PCB
8 sites 1%



Chlorinated organic Compound
127 sites 20%

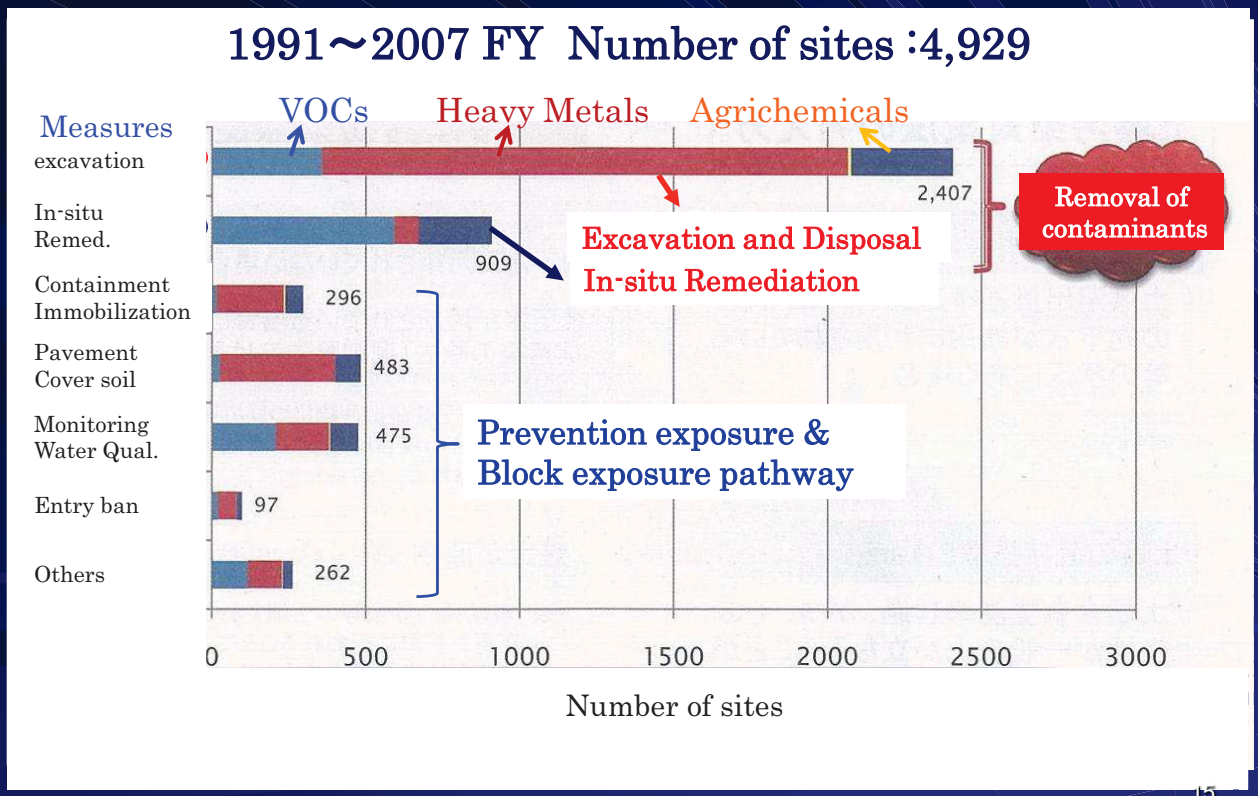
Others
10 sites 1.5%

Dioxins
16 sites 3%

Mineral oil
134 sites 21%

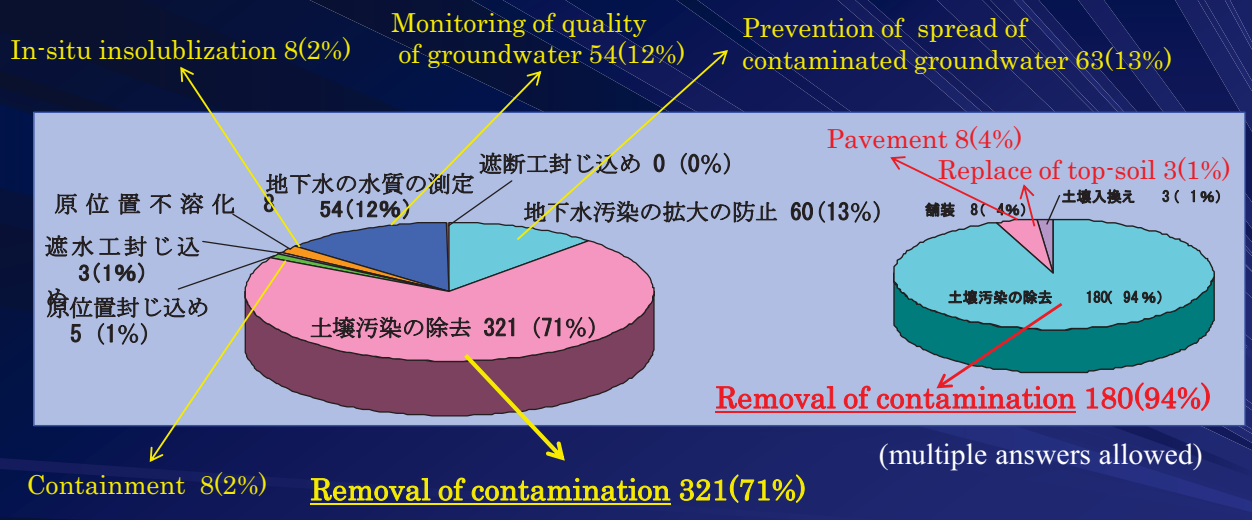
(multiple answers allowed)
Source: GEPC 2011

Countermeasures (before amendment)



Source: MOE Japan in 2007

Selected countermeasures for contaminated soil in leachate and content standard



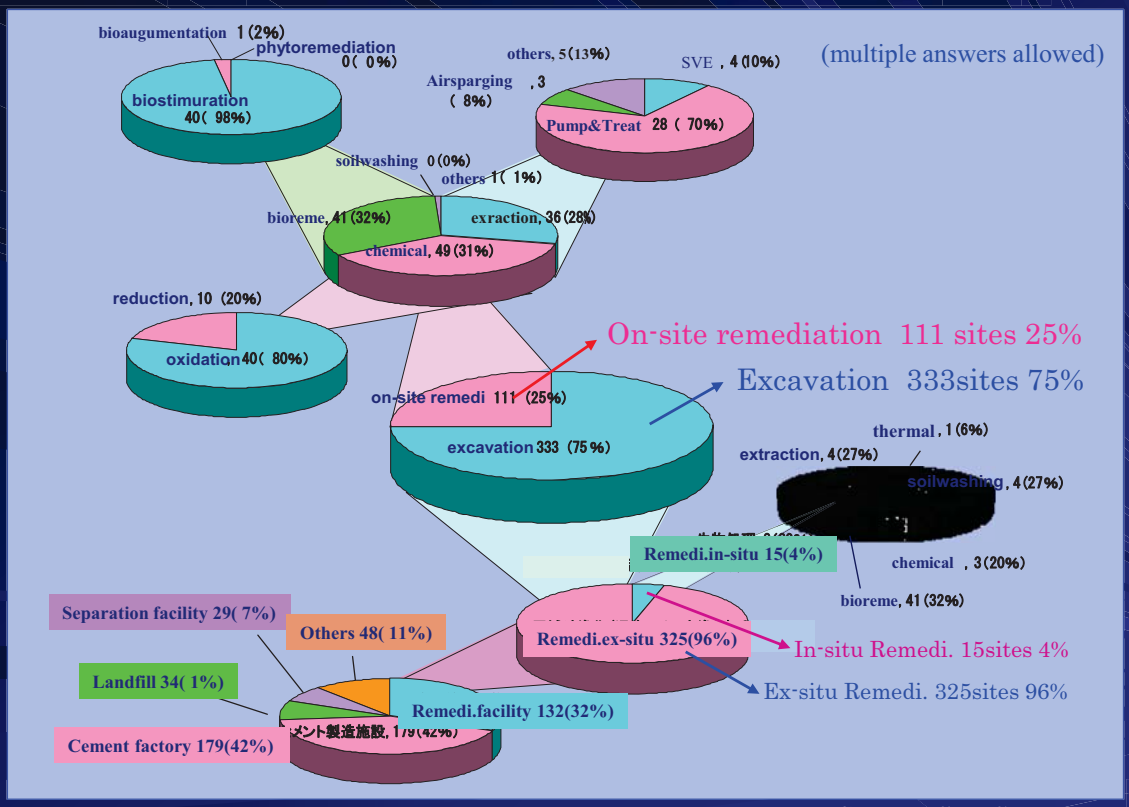
(multiple answers allowed)

(a) Non conformed leachate standard (452 sites)

(b) Non conformed content standard (191 sites)

Source: GEPC 2011

Selected countermeasures for removal of contaminants



Source: GEPC 2011

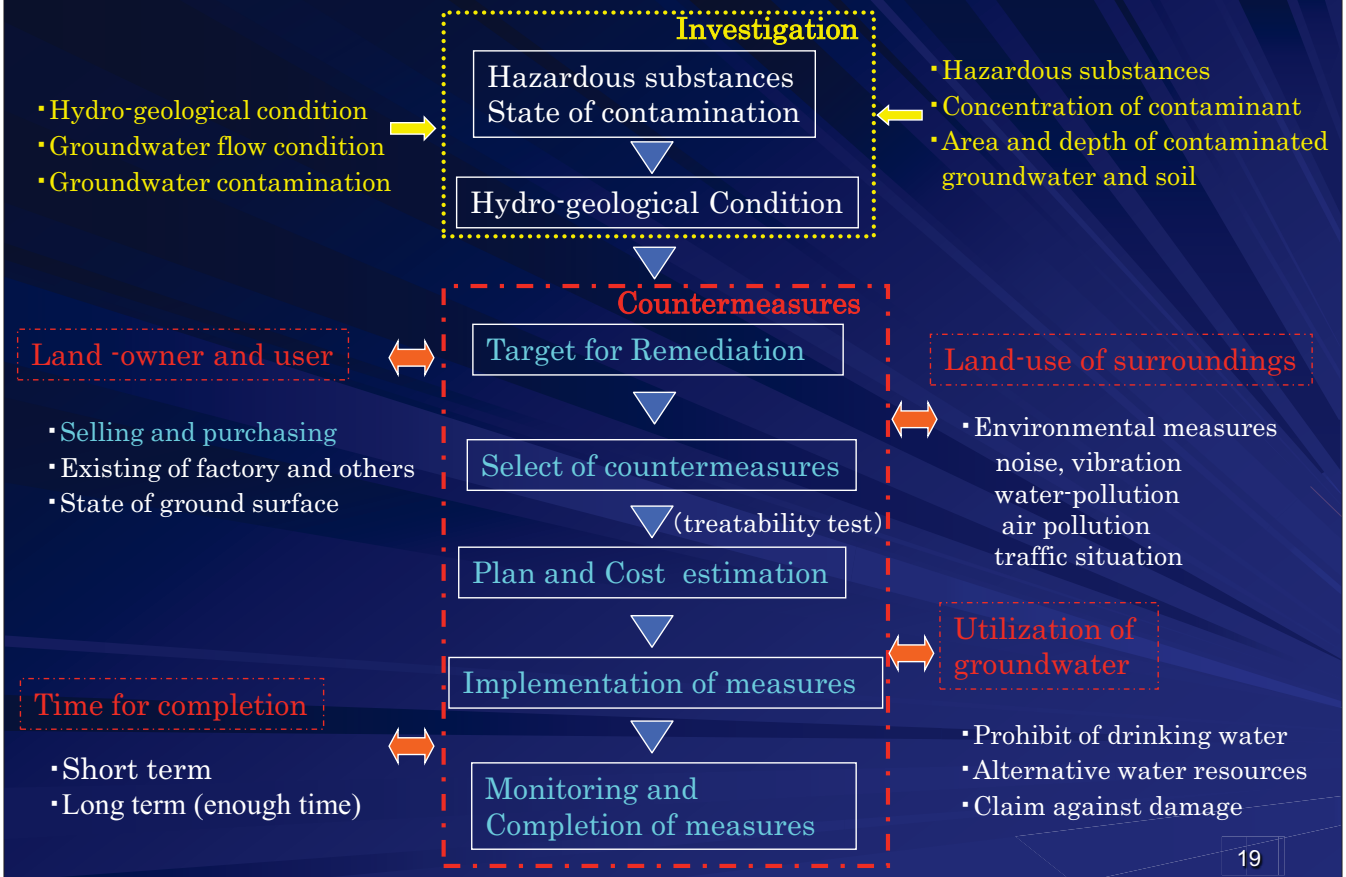
4. Examples of Remediation

(1) Procedure of investigation and measures

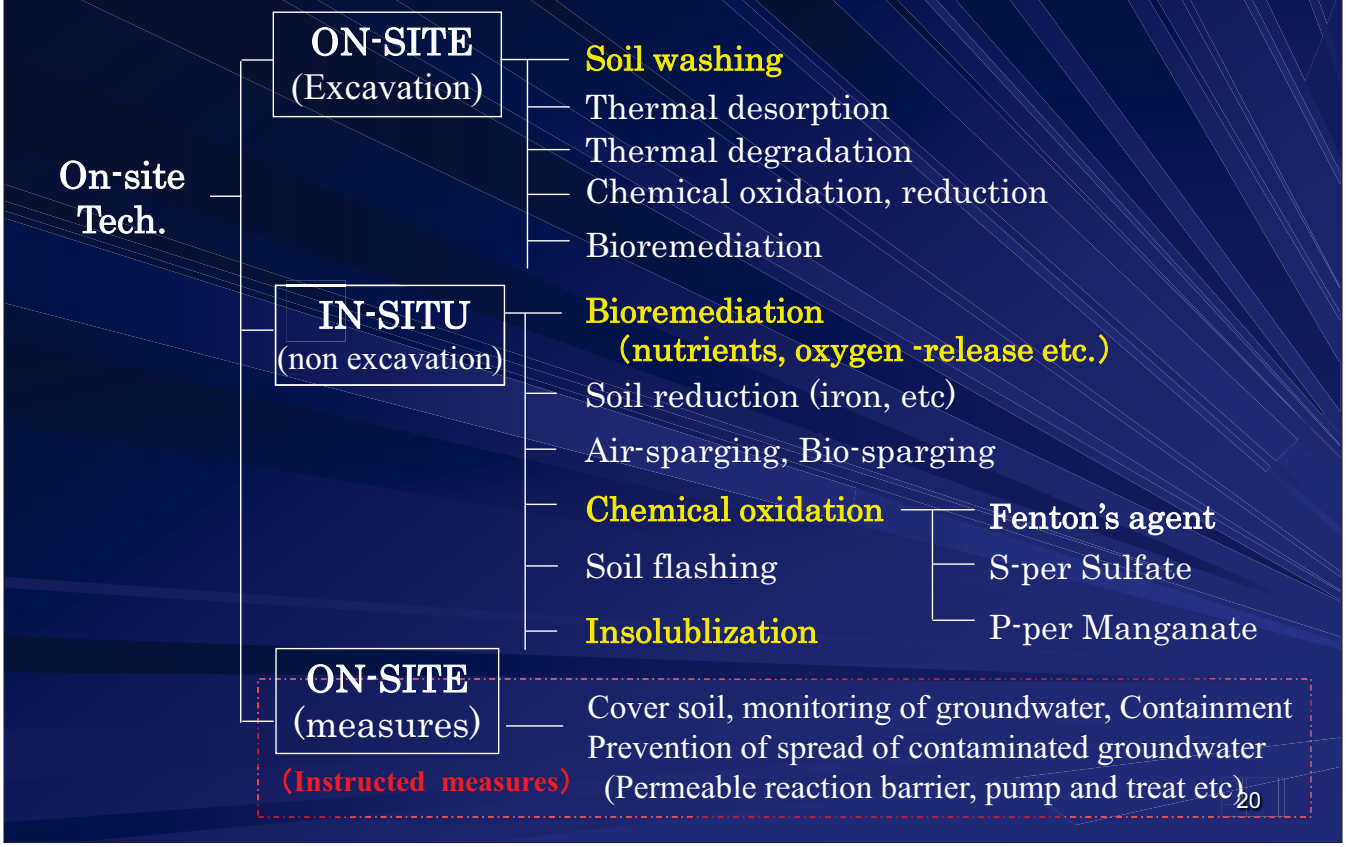
(2) On-site Remediation technologies and example of remediation sites

(3) Countermeasures and redevelopment on former factory site

(1) Procedure of investigation and measures

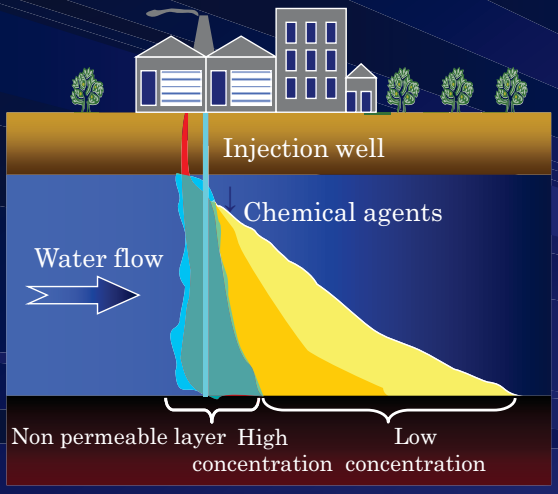


(2) On-site Remediation Technologies

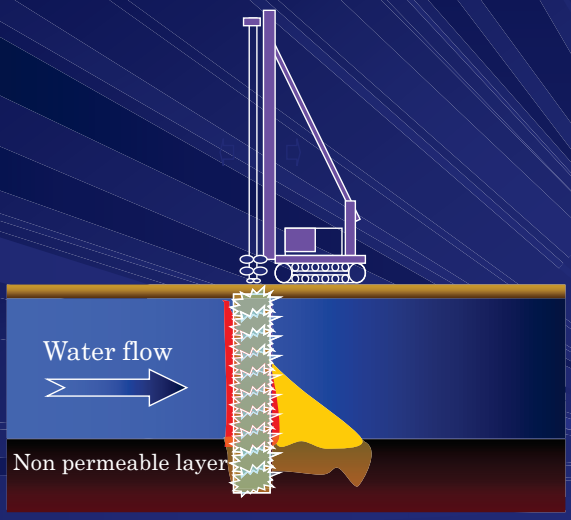


(2)-1 Fenton's reagent

- Chemical oxidation with hydrogen-peroxide and ferrous salts, etc
- Hazardous substances: VOCs, mineral oil, others



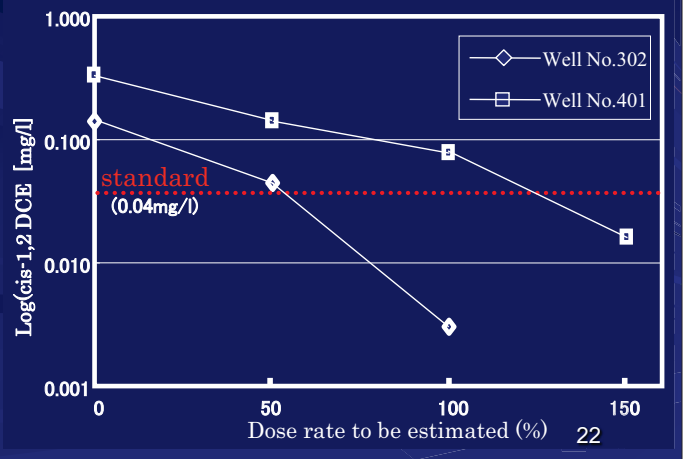
Injection type
(Sand, Sand and Silt)



Mixing type
(Silt, Clay)

■ Example of Fenton's injection type

- Contaminants : VOCs
- Concentration: 0.4 mg/L (ave.)
- Soil property : fine sand, silt
- Area : 5,000 m²
- Depth : GL-4 m～GL-6 m
- Quantity of soil : 10,000 m³

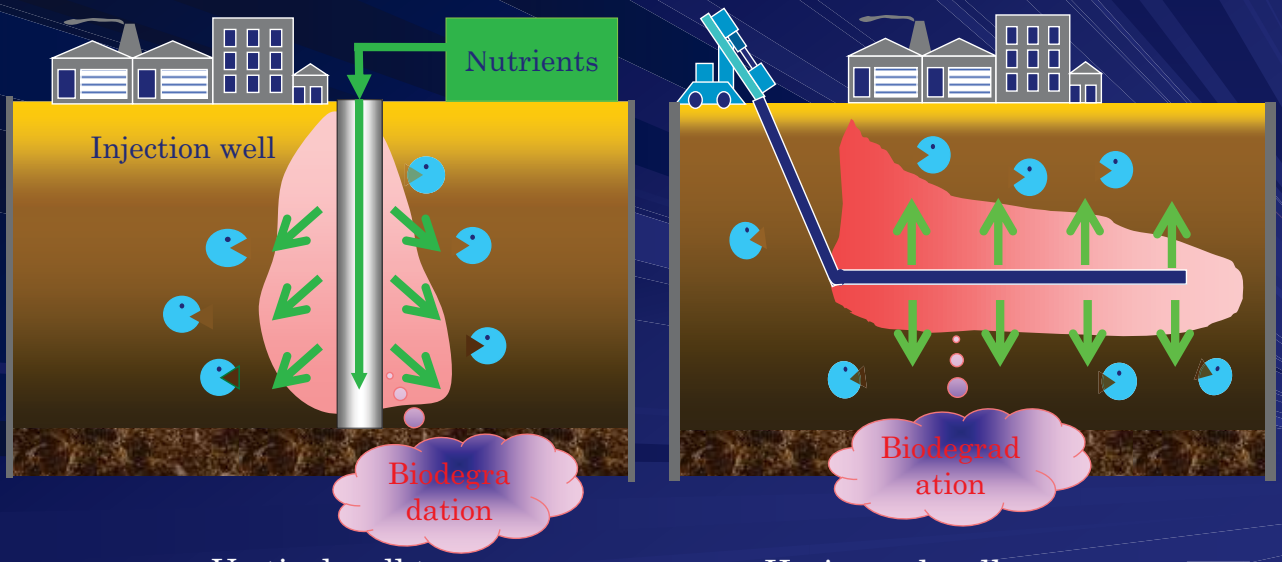


Injection facilities : 5 sets

Time of remediation: 2 months

(2)-2 Bioremediation

- biodegradation with dose of nutrients*, generally low cost, long term to be completed (* many kinds of nutrients)
- adaptable to relatively low concentration of substances



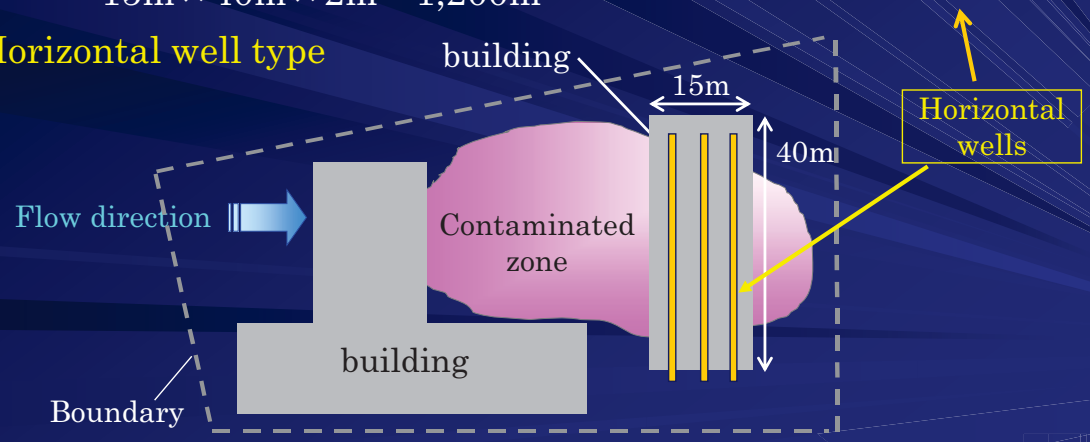
Vertical well type　　Horizontal well type

■ Property of site (in operation)

○ State of contamination:

- Soil: conformed to leachate standard
- Groundwater: PCE 0.063 mg/L(6.3 times)
  cis-DCE 0.73mg/L(18 times)
- Quantity of soil and groundwater:
  15m × 40m × 2m = 1,200m^3

※ Horizontal well type



Ground plan

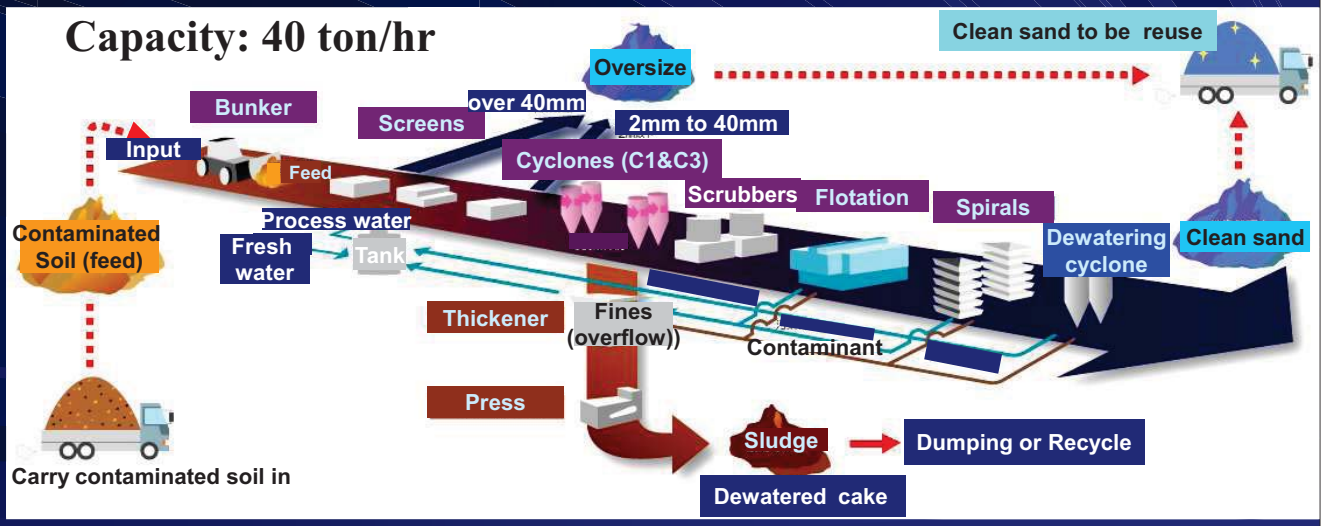
(2)-3 Soil Washing

- Clean up contaminated soil with heavy metals and dioxins, etc -

(mobile-type plant type-A)

■ Outline:

- ○ Soil washing efficiently separates the silt and clay from the larger-grained, cleaner soil, and with low cost
- ○ Separation techniques based on the parameters, such as particle size, density, magnetism, surface properties, etc

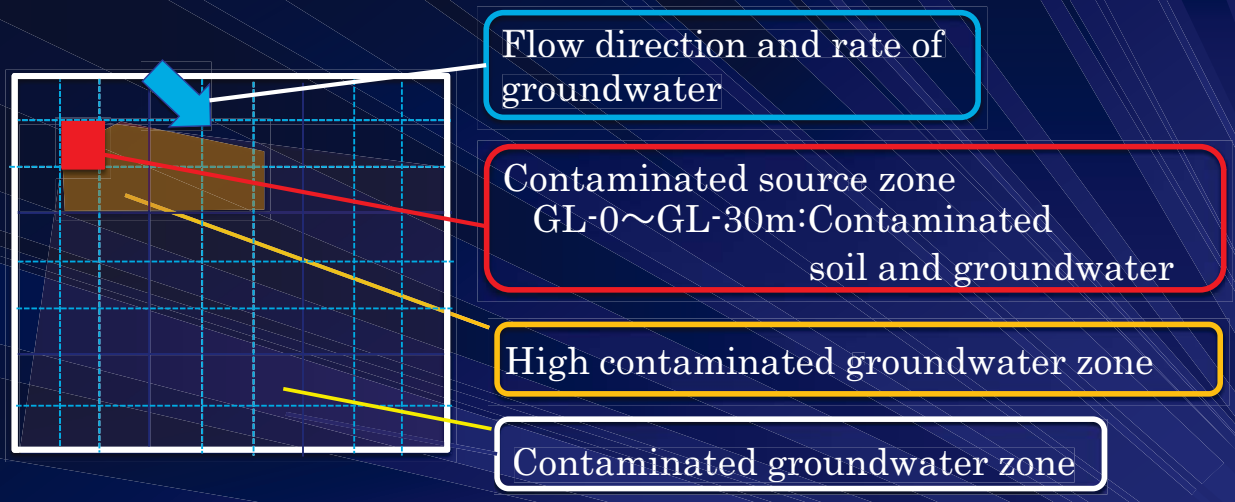


Soil Washing Process Flow

(3)Countermeasures and Redevelopment on former factory site

- Designation of countermeasure zone and Implementation of instructed measures
  - ① Excavation for high concentration area
  - ② Containment with liner for high concentration area
  - ③ Prevention of the spread of groundwater contamination
- Redevelopment on designated zone
  - ① Land reclamation and use for shopping mall
  - ② Control of contaminated groundwater level and changing land characteristics according to the Soil Law

State of Contaminated Site



- Land Area :30,000m^2 in area (former factory site)
- Hazardous substances : VOCs (PCE,TCE,1,2-cis DCE etc)
- Soil contamination :250 mg/L as PCE (max.)
- Groundwater contamination :1,450 mg/L (max.)
- Groundwater utilization : miscellaneous usage in neighbors

⇒ the potential of human health impacts

■Plan of Re-development and Land use

○Shopping mall Complexes

- Changing the land characteristics over 3,000 m2
- Plenty of people will enter and leave in shopping mall

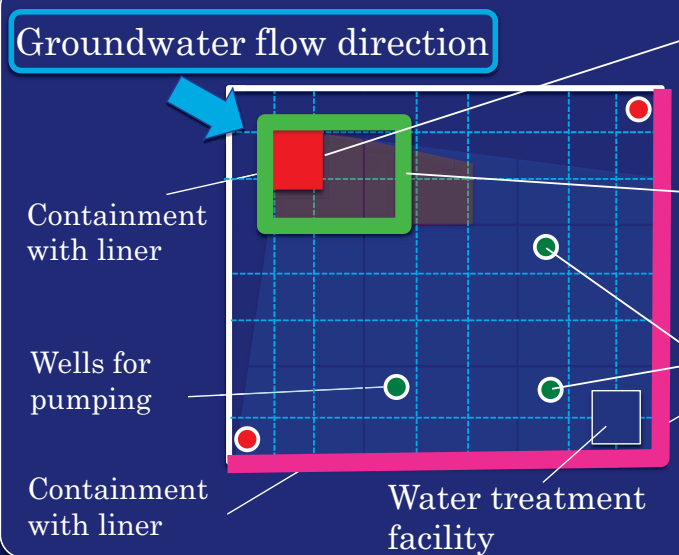
○Implementation of countermeasures to reclaim and develop the land, according to the Soil Law

Bird's-eye view (image picture)

■Countermeasures taking into account for Re-development

Wide range and high contamination → Difficulty to be conformed standard in the Soil Law

Ensure the human exposure pathway to be blocked



①Excavation of source

②Containment of contaminated groundwater and soil

③Prevention of the spread of contaminated groundwater with pump and treat and containment with liner

● Monitoring well for prevention of the spread of contaminated groundwater

■Conclusion of Countermeasures and Redevelopment

- Possibility to use the contaminated land without the removal of contaminants to be conformed the standard
- Importance to manage the potential of human health impacts

The Soil Law doesn't prohibit to use and develop the contaminated lands, as well as the other laws

5. Further Expectation

○ Countermeasures for soil and groundwater contamination

Primary ⇒ Risk management for human health
; to block human exposure pathway
; to be off-limit into contaminated zone

Secondary ⇒ Removal of contaminants

○ Development and spread of on-site measures such as chemical red-ox, bioremediation, etc

- In-situ tech. for clay and silt-type soil
- Improvement of reliability of in-situ technology
  ; Heterogeneous subsurface
  ; Non homogeneous contaminants dispersion

6. Sustainable Remediation

(1) Consideration in 4 Projects

(2) Consideration in Shinshu Project

(3) Three Legs;

- Environmental
- Social
- Economical

Examples of Contaminated Site

Examples of Contaminated Site for Sustainable Remediation

Project name	Shinsyu Proj. 2010	Kansai Proj. 2009	Tohoku Proj. 2007	Tokyo Proj. 2011 ~
Land area (m2)	30,000	90,000	85,000	400,000
Contaminants	VOCs (PCE, TCE, Benzene) As, Pb	PCB, Benzene, As, Pb	F, As	Benzene, Mineral Oil As, Pb, Cyanide, Hg, Cr^{+6}
Land Use before & after countermeasures	Electrical devises Factory ⇒ Shopping Mall	Depot Tanks of Mineral Oil ⇒ Warehouse for Logistics	In operation, as factory of Electrical devices	Gas Manufacturing Plant ⇒ Fish (Seafood) Market
Countermeasures	・Excavation (Source zone) ・Insolublization ・Containment ・Prevent the spread of contaminated groundwater ・Pavement ・Monitoring the quality of groundwater	・Excavation (All soil) ・Pump & Treat ・Monitoring the quality of groundwater	・Excavation (Source zone) ・Containment ・Pump & Treat ・Pavement ・Monitoring the quality of groundwater	・Excavation ・Thermal Degradation ・Soil Washing ・Bioremediation ・Containment(impermeable wall) ・Pump & Treat ・Pavement ・Monitoring the quality of groundwater
Goal of Remediation	Prevent the spread of contaminated groundwater	Conformed to Soil & Groundwater Standard	Prevent the spread of contaminated groundwater	Conformed to Soil & Groundwater Standard (Except natural contamination)
Environmental	・Usage of groundwater for neighborhoods ・Many persons come & leave to shopping mall	・Removal of Harmful substrates	・Usage of groundwater for neighborhoods ・Many persons work and come in the factory	・Safety of Foods ・Reduce human health impact of worker in the market
Social	・Redevelopment of the region ・Convenience for neighborhoods	・Redevelopment of the region ・Employment for neighborhoods	・Redevelopment of the region ・Employment for neighborhoods	・Redevelopment of the region ・Employment for neighborhoods ・Food market for Tokyo district
Economical	・Shopping Mall ・Cost & benefit	・Logistics for fashion goods ・Cost & benefit	・Electrical devices industry ・Cost & benefit	・New fish & seafood market ・Cost & benefit
Cost of Countermeasures	JPY 1.3 Billion	JPY 1.5 Billion	JPY 1.9 Billion	JPY 58 Billion

Considerations to be decided countermeasures in Shinshu Project

	Alternatives countermeasures to be selected			
Countermeasures	・Excavation (all contaminated soil) ・Pump and Treatment ・Monitoring the quality of groundwater at least for 2 years	・Excavation (Source zone) ・Containment in the down stream boundary of the Site ・Prevent the spread of contaminated groundwater ・Insolublization for As、Pb ・Pavement ・Monitoring the quality & level of groundwater	・Containment surrounding Site with impermeable wall ・Pump & Treatment ・Pavement ・Monitoring the quality & level of groundwater	・Prevent the spread of contaminated groundwater (Pump & Treat) ・Pavement ・Monitoring the quality & level of groundwater
Cost of Countermeasures	JPY 8.5 Billion	JPY 1.3 Billion	JPY 1.8 Billion	JPY 0.5 Billion
Duration for countermeasures	24 months Monitoring for 2 years	12 months Monitoring for long term	14 months Monitoring for long term	10 months For too long term
Notification	Enormous amount of money	Relatively Reasonable	Not conformed to the standard of measures in the Soil Law	Couldn't prevent the spread of contaminated groundwater
Goal of Remediation	Conformed to Soil & Groundwater Standard	Prevent the spread of contaminated groundwater for long term	Prevent the spread of contaminated groundwater for long term	Prevent the spread of contaminated groundwater for too long term
Environmental	・Most acceptable by neighbors ・Completely clean-up ・Excavated soil must be taken out to remediation factory & landfill	・Enough to reduce human health & environment impacts	・According to the Soil Law, not permitted by the Regulator. ・Not to reduce human health & environment impacts.	・According to the Soil Law, not permitted by the Regulator. ・Not to reduce human health & environment impacts.
Social	・Redevelopment of the region	・Redevelopment of the region ・Employment for neighborhoods ・Convenience for neighbors	・Governor orders to carry out countermeasures according to the Soil Law	・Governor orders to carry out countermeasures according to the Soil Law
Economical	・Unbalance between cost & benefit	・Balance between cost & benefit	・Balance between cost & benefit ・Prohibit the land use by the Soil Law	・Small amount of money ・Prohibit the land use by the Soil Law

Facet of Three Legs; Environmental, Social, Economy

	3 Legs of Sustainable Remediation		
3 Legs	Environmental	Social	Economy
Indicators of impact	1) impacts to air 2) impacts to water 3) impacts to soil 4) impacts to vibration 5) impacts to noise 6) impacts to odor 7) impacts to waste management 8) impacts to ecology (wildlife, nature)	1) impacts on human health 2) impacts on safety 3) impacts to regions 4) impacts to community 5) impacts to neighborhoods	1) cost & benefit 2) employment 3) project objectives 4) project flexibility 4) capital gain
Check &Eevaluation	1) energy consumption 2) saving energy 3) conserving natural resources 4) 3R (reduce, reuse, recycle) 5) carbon footprint 6) ecological footprint 7) conserving environment	1) reduction of human health risk 2) community activity 3) community satisfaction 4) community involvement 5) risk communication 6) compliance with regulatory	1) cost & benefit 2) capital gain 3) increasing of employment 4) induced economic benefit 5) indirect effectiveness 6) development of surrounding
Must do	1) Comply with regulatory ⇒ The Soil Law, Ordinance of Local government 2) Achieve the project objectives ⇒ Land Use (Manufacturing, Residencial, etc) 3) Be acceptable to stakeholders ⇒ Risk Assessment & Communication 4) Achieve a balance of risk & cost ⇒ Cost & Benefit, Risk Minimum (Zero) ・Environmental factors ・Social factors ・Economical factors		

Thank you for your attention

Please feel free to contact
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Attachment 6
Current State of Sustainable Remedies in Japan

Current state of remedy of contaminated soil and groundwater related with sustainable remediation in Japan

Dr. Wang Ning
Environmental Control Center Co. Ltd. Japan.
http://www.kankyo-kanri.co.jp

Contents

- Soil Contamination Countermeasures Law of Japan
- Development of Cost and Energy-Efficient Soil Investigation and Remediation technologies By Japan's Ministry of Environment
- Case Study of Calculation of CO_2 released from Different Remediation Methods by GEPC, Japan

The Background of the amendment of Japan's remediation law

- Previous SCC law announced in 2002.

  significant roles, but some problems

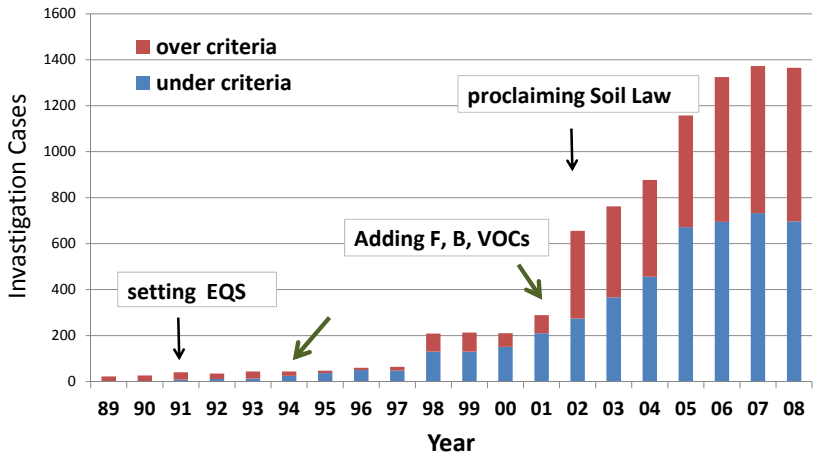
  e.g. ・ increasing of independent soil investigation.

  ・ improper treatment of contaminated soil after being hauled out of the site.

  ・ unnecessary use of Excavation method

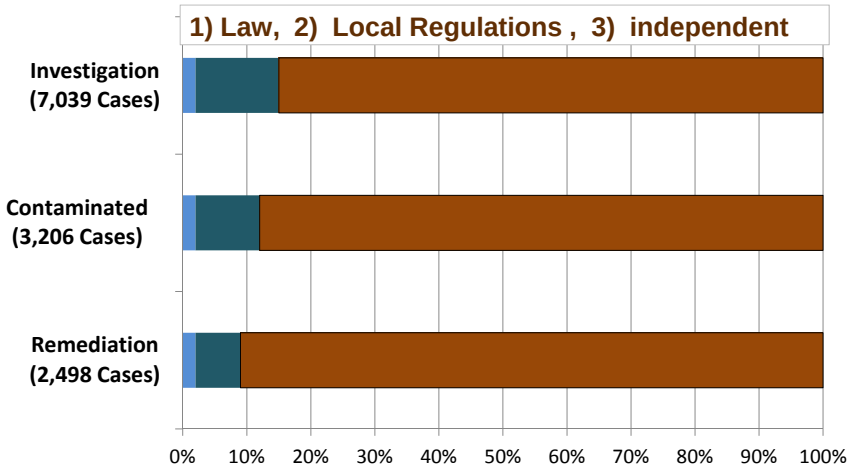
- Proclaiming an amended law in 2009

The numbers of investigation Cases of contaminated sites

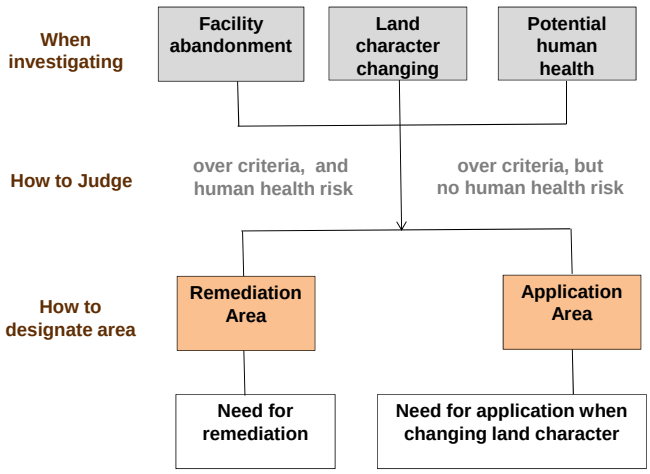


Cases of investigated sites at different investigation purposes

(data based on the GEPC's Survey, 2007)



The framework of Japan's remediation law



The triggers of investigation

- **When facility is abandoned**

  the specified facility: produced, used, or treated hazardous substances

- **When Land character will be changed**

  area: larger than 3000㎡

  e.g. excavation, replacement of soil

- **When having potential human health risks**

  administrative judgment: soil and groundwater contamination, potential human health risk

Designation of contaminated area

Remediation area (need to be remediated within certain time)

soil leaching standards exceeded, and
groundwater used as a drinking water.

soil content standards exceeded, and
person can get into the site.

Application area (need to be applied when changing land character)

the standards exceeded , but no potential human health risks.

e.g. groundwater is not used as a drinking water.
access limitation to the contaminated area.

Remediation methods of contaminated soil

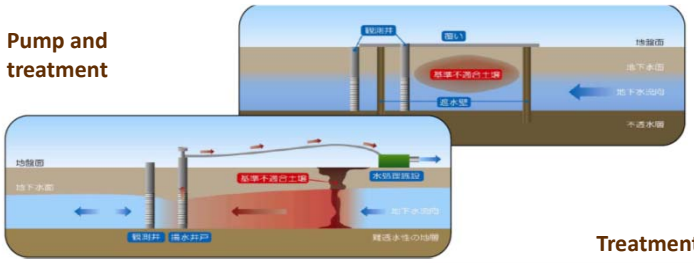
- **Prevent of contaminated soil direct ingestion.**
  access limitation, surface capping, filling, replacement of soil, treatment (excavation, thermal, washing, chemical, bioremediation, etc.)

- **Prevention of groundwater ingestion .**
  monitoring, containment (sheet pile, etc.), barriers, immobilization,
  treatment (excavation, thermal, washing, chemical, bioremediation, pump and treat, etc.)

Containment method etc.

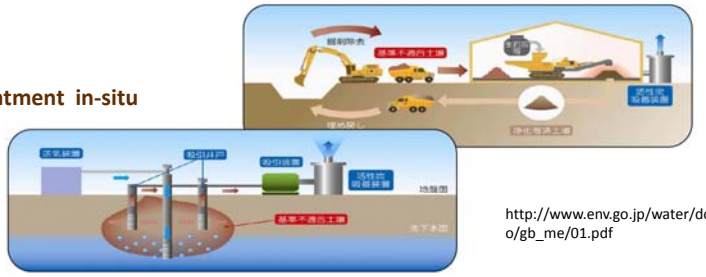
Pump and treatment

Containment method



Treatment on-site

Treatment in-situ



http://www.env.go.jp/water/dojo/gb_me/01.pdf

The target levels of remediation

	Items	Target level for soil		Target level for groundwater (mg/L)
		Leachate (mg/L)	Total content (mg/kg)	
	carbon tetrachloride	0.02	-	0.02
	1,2-dichloroethane	0.04	-	0.04
	1,1-dichloroethylene	0.02	-	0.02
	cis-1,2-dichloroethylene	0.04	-	0.04
	1,3-dichloropropene	0.002	-	0.002
□	dichloromethane	0.02	-	0.02
	tetrachloroethylene	0.01	-	0.01
	1,1,1-trichloroethane	1	-	1
	1,1,2-trichloroethane	0.006	-	0.006
	trichloroethylene	0.03	-	0.03
	benzene	0.01	-	0.01
	Cd	0.01	150	0.01
	Cr (VI)	0.05	250	0.05
	CN	ND	50 (for free cyanide)	ND
□	Hg	0.0005, ND for alkyl mercury	15	0.0005, ND for alkyl mercury
	Se	0.01	150	0.01
	Pb	0.01	150	0.01
	As	0.01	150	0.01
	F	0.8	4,000	0.8
	B	1	4,000	1
	simazine	0.003	-	0.003
	thiobencarb	0.02	-	0.02
□	thiuram	0.006	-	0.006
	PCBs	ND	-	ND
	organic phosphorus	ND	-	ND

Qualification licenses of interest

These licenses are qualified by ministry of environment, or the local governments.

Transportation of contaminated soil

Site Investigation

Treatment of contaminated soil

Development and Promotion of Cost and energy efficient Investigation and remediation Technologies.

initiated by Ministry of Environment of Japan from 2002

Purposes and evaluation aspects

- Aim : developing and promoting the new technologies.
- Adoption process:

  collection, demonstration, evaluation, adoption
- Evaluation aspects:

  effectiveness, economy,
  impacts on the surrounding environment,
  practicability, simplicity,
  comprehensive evaluation.

The technologies adopted by Ministry of Environment of Japan

Year	Investigation	Soil Washing	Thermal Tech.	In-Situ (on-site)			other
				Stabilization	Bio-Treatment	Chemical Degradation	
2002	2	4	1	1	1		
2003	1				3	1	2
2004	1			1	1	1	
2005		2	2			2	
2006		1	2			1	
2007	3	1	1		1		
2008	1		1		1	2	
2009		1			1	1	1
2010		1					1
2011						1	

Evaluation cases of technology of Benzene treatment on-site

1) Economy

Investment in energy 0.57MJ / kg - contaminated soil
efficiency: 24kg / person / hour
\8200 Japanese Yen / t - soil (for 40t soil)

2) Impact on the surrounding environment

Surrounding atmosphere: treated at tightly sealed equipment, so do not discharge hazardous substances into the surrounding atmosphere
wastewater: treatment of wastewater in the plant and discharge, and drainage shall meet the standards.
Noise: 58dB Vibration: 36dB (within background level)
CO_2 emissions: 6.44 kg-CO2 / t (for 1000t soil)

Case study on the calculation of the CO_2 released from the remediation activities

conducted by Geo-Environmental Protection Center, GEPC ,Japan

The Ge-Environmental Protection Center GEPC, Japan

established in 1996, Japan's sole non-government public service corporation involved in the issues of soil and groundwater contamination.

more than 100 members, mainly composed by the companies engaged in the activities of investigation, analysis and remediation.

The main activities

- studying investigation and remediation technologies,
- studying the evaluation and management methods
- organizing various meetings and seminars
- also carrying out grant work of qualification for the investigation and remediation of soil and groundwater.

Hypothetical conditions of the model site

Site No.	Site Area (㎡)	Contaminated Area (㎡)	Depth (m)	Transportation Distance (km)
1	9,600	1,200	10	20
2	96,000	12,000	10	20
3	960,000	120,000	10	20
4	9,600	1,200	10	200

Contaminant : arsenic (As).

Five remediation methods and different stages

Five remediation methods

a. Containment with sheet pile and asphalt capping
b. Containment with soil mixing wall and asphalt capping
c. Excavation and stabilization treatment on-site
d. Excavation and soil washing
E. Excavation and haul to cement plant

The % amount of CO2 released from different remediation methods

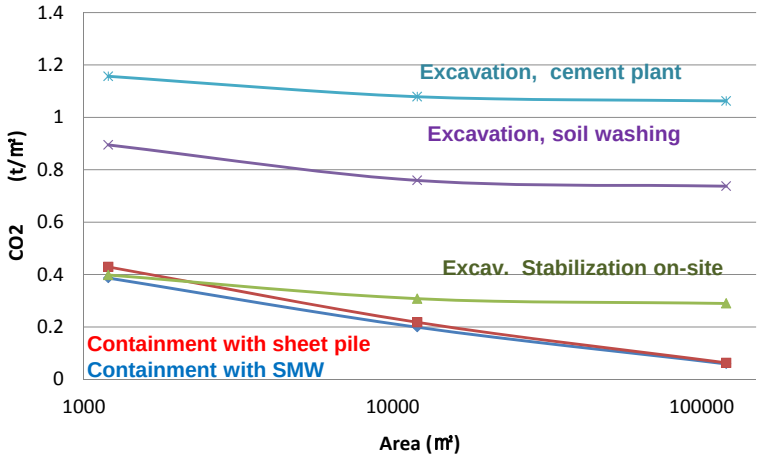
(Case 1: contaminated area is 1,200 ㎡)

methods	Different stages of remediation and material							
	①	②	③	④	⑤	⑥	⑦	⑧
Containment with sheet pile, asphalt	-	**84**	1	1	14	0	0	0
Containment with SMW, asphalt	-	**65**	2	1	31	0	0	0
Excav. stabilization on-site	-	18	21	1	**60**	0	0	0
Excav. , soil washing	-	**29**	**38**	1	21	11	0	0
Excav. to cement plant	-	21	**28**	0	17	**34**	0	0

Different Stages of remediation process

① Design activities ② Material, ③ Transportation activities,
④ Investigation activities, ⑤ Construction and remediation activities,
⑥ Treatment activities at cement plant or soil washing facility
⑦ Groundwater treatment activities, ⑧Disposal of solid waste

The amount of CO_2 released from different remediation methods



Conclusions

- **There is no requirement of sustainable remediation yet in the Japan's soil remediation law so far.**
- **But there are more and more similar concepts incorporated into the law and relevant remedial activities.**
- **In the future, the principles and practices of sustainability remediation are expected to be spread and applied much more in Japan.**

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The ministry of environment of Japan: Soil contamination countermeasures of Japan. from http://www.env.go.jp/en/water/soil/contami_cm.pdf (2012)

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Keisuke Omura, etc.(2012): Calculation of life-cycle CO2 for site investigation and remedial treatment of contaminated land. The 18th symposium on soil and groundwater contamination and remediation..

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Attachment 7
Recent Developments in the Chinese Brownfield Regeneration Market

Outline of the Presentation

- Status of Brownfield Site Contamination
- Problems and Challenges
- Risk Based Contaminated Land Framework
- HERA Software Introduction
- Recent Activities
- Platform for Collaboration
- Summaries

Status of Brownfield Site Pollution

Relocation of Contaminated Sites Intensified

Beijing：200 sites within the 4th Ring Road were relocated and subjected redevelopment (8 km^2) – Beijing Olympic Action Plan

Shengyang：56 polluted sites were subject to relocate in 2008；Relocate all heavily polluted industries in 2009.

Jiangsu Province：400 chemical works were relocation to suburbs, 1000 small scale were shut down between 2000 and 2005

Guangzhou：147 large scale industries shut down subject to relocation in 2007

Chongqing：112 sites in urban areas in 2010

Status of Brownfield Site Pollution

Presence of High Risk Sites

- **1000 Pesticides Manufacturing Sites（44 containing POPs）**
- **80 Mining waste sites，no prevention measures**
- **Numerous Chemical Works**

Problems and Challenges

Pressure on Realizing Land Values

- **Sites Dismantled and Demolished on Relocation**
- **Frequent Environmental Incidents**
- **Complicated Site Histories**
- **Groundwater Investigation being Largely Ignored**

Problems and Challenges

Relocation of Polluters Leading to Large Quantity of Sites

- 86,000 corporations shut down or relocated during 2001-2007
- 300,000 industrial corporations in China, 40% in urban areas, posing serious threat to human health and the environment

Problems and Challenges

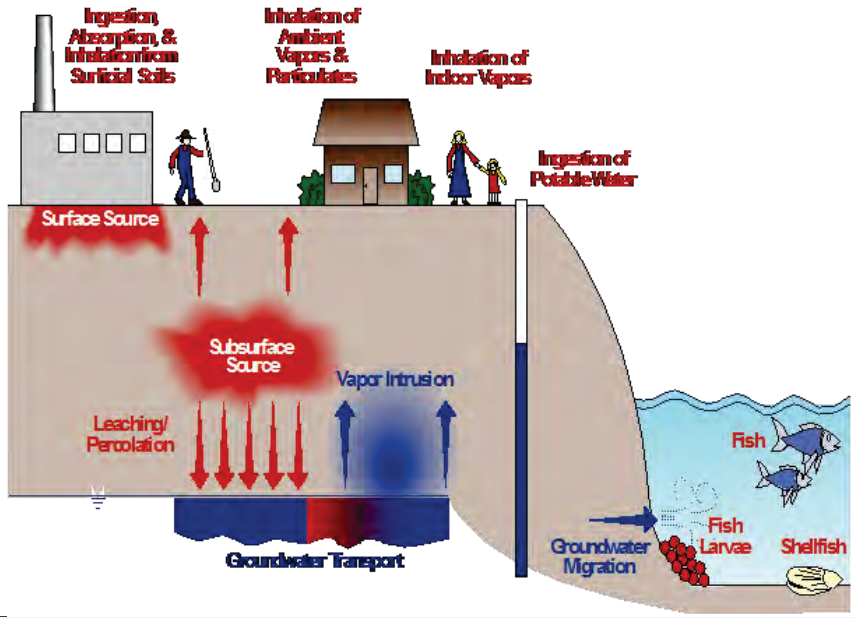
Lack of Relevant Chinese Guidelines

1. Technical Guidelines for Site Environmental Investigation (Draft)
2. Technical Guidelines for Site Environmental Monitoring (Draft)
3. Technical Guidelines for Risk Assessment for Contaminated Sites (Draft)
4. Technical Guidelines for Soil Remediation for Contaminated Sites (Draft)

Problems and Challenges

Understanding the Threat of Site Contamination

- Soil and Groundwater Contamination Sources
- Human Health
- Water Environment



Problems and Challenges

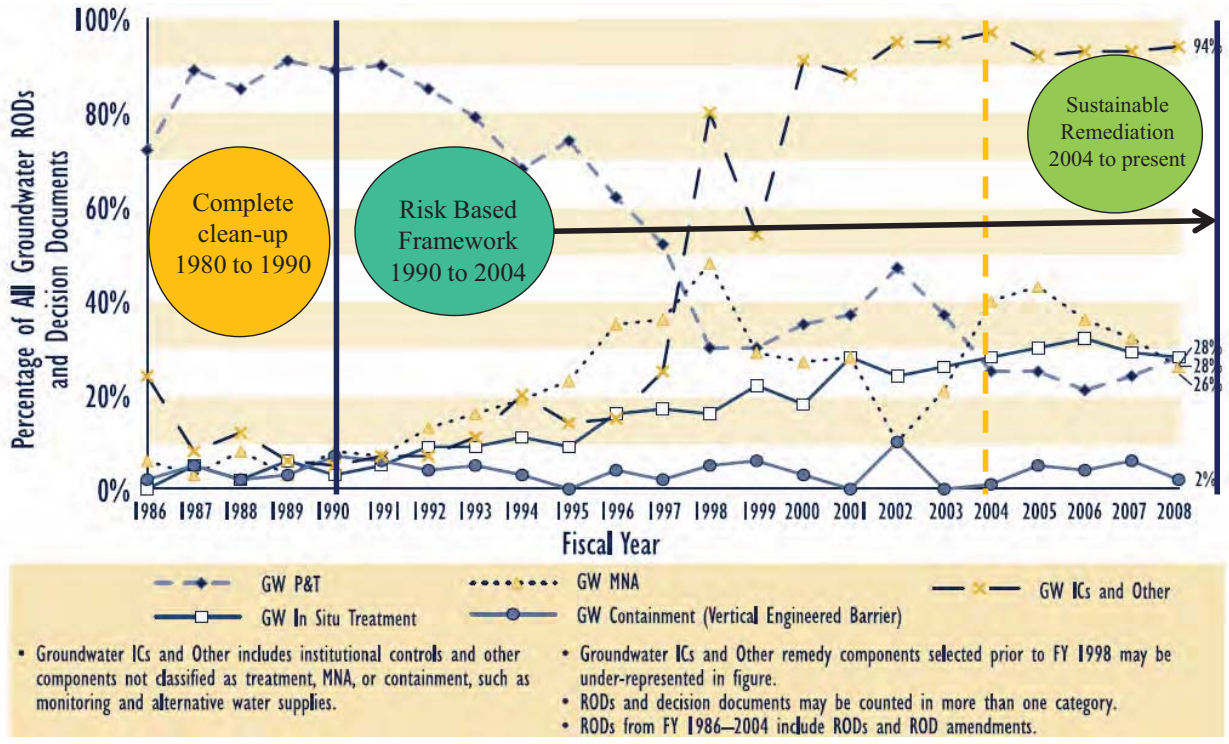
Catching Up with the Rest of the World (Mainly Europe and USA)

1980 - 1990	1991 - 2004	2005 – Present
Remediation to Natural Background	Risk Based Management	Sustainable Management
Complete Removal 1. Difficult to achieve 2. No need to do so	Risk based remediation framework that focuses on the selection of techniques and environmental effects	More attention on sustainability that balances on remediation and economy

Based on CL:AIRE Presentation

Problems and Challenges

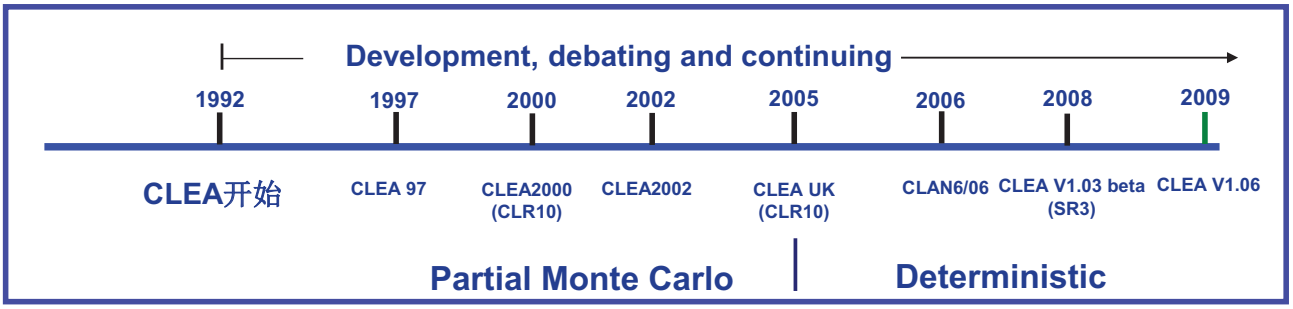
Trends in Selecting Groundwater Remediation (FY 1986-2008)



History of ASTM RBCA Development

Guidance	1989	1995	1998	2000	2002	2004	2005	2006
USA	USEPA RAGS	ASTM E1739 Petroleum RBCA	ASTM P104 Chemical RBCA	ASTM E2081 Chemical RBCA	No New Guidance being published			

History of UK CLEA Development



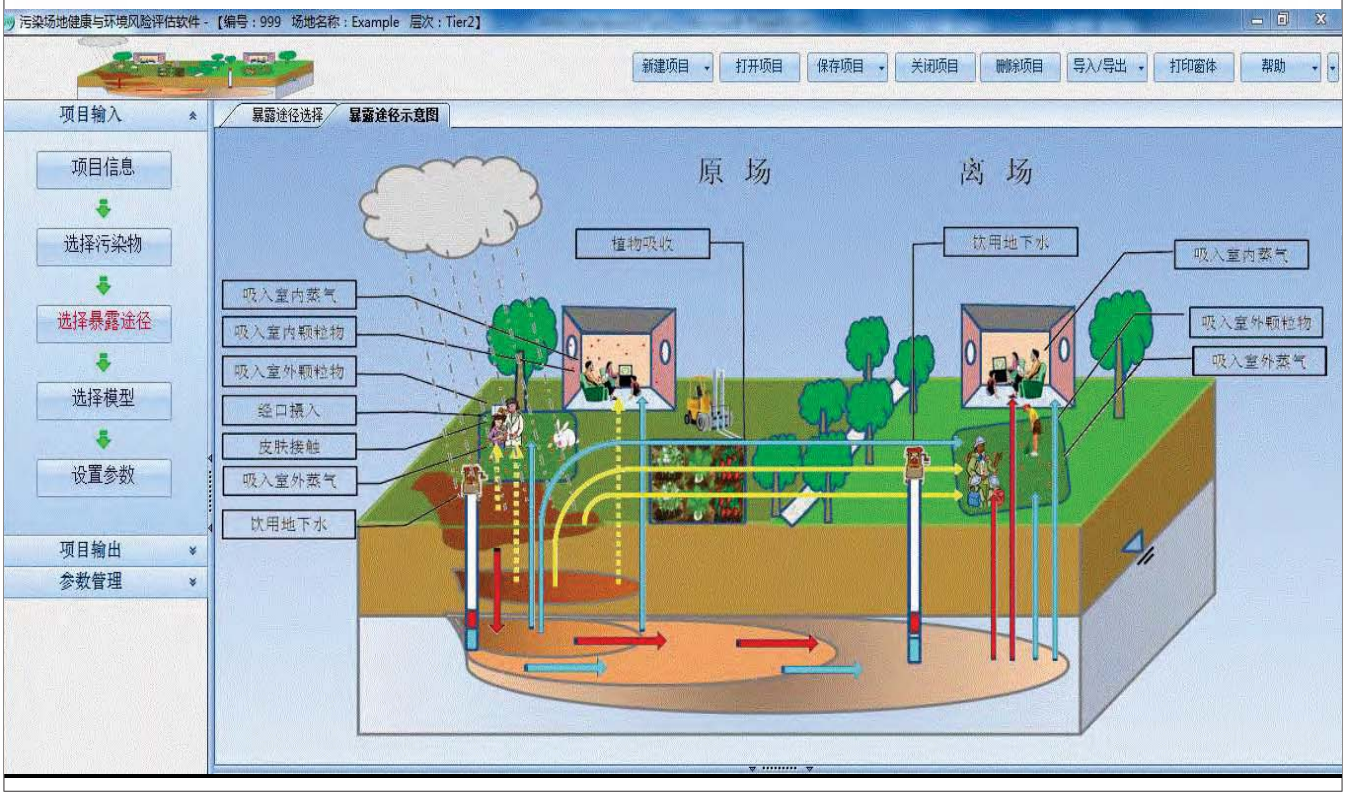
Risk Based Contaminated Land Strategies HERA

Relevant Chinese Guidelines

1. Soil Quality Standards for Industrial Sites - 1999
2. Technical Guidelines for Risk Assessment for Contaminated Sites (Draft) - 2009
3. Risk Assessment Tool – HERA (August 2012)

HERA Software Introduction

Human and Environmental Risk Assessment Software



HERA Software Introduction

Key Features

- Windows Based Software Using Visual Studio (C#)
- User Friendly Interface, High Stability and Fast Calculation Process
- Multi-Tiered Risk Assessment System
- Toxicity and MCL Based Soil and Groundwater Assessment
- Derivation of Generic and Site Specific Assessment Criteria
- Multi-Tiered Database Management
- Implementing CL: AIRE & CIEH Statistical Guidance

HERA Software Introduction

Exposure Pathways Included

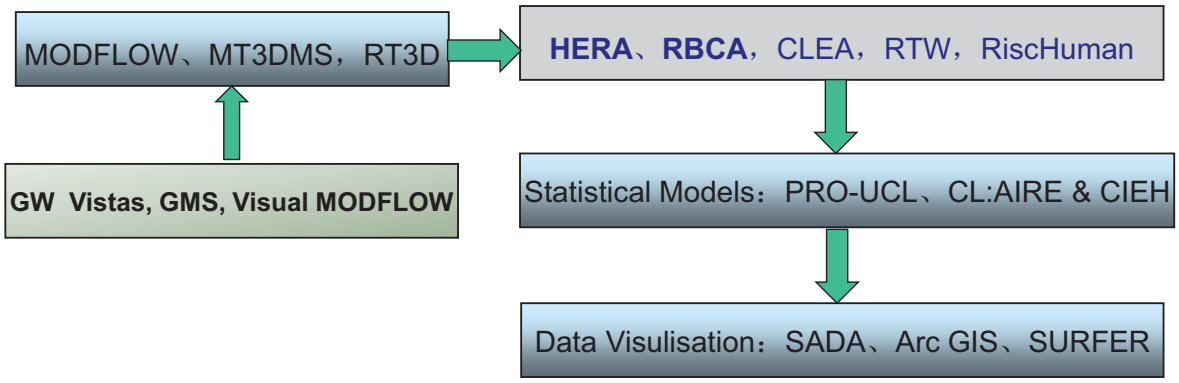
Exposure pathways	USA RBCA	UK CLEA	China HERA
Plant Uptake	√	√	√
Soil Ingestion	√	√	√
Dermal Contact	√	√	√
Indoor Dust	X	√	√
Outdoor Dust	√	√	√
Indoor Vapour	√	√ (Only Soil)	√
Outdoor Vapour	√	√ (Only Soil)	√
Soil Leaching	√	X	√
Air dispersion	√	X	√
Groundwater Migration	√	X	√

HERA Software Introduction

Exposure Pathways	Contaminant Transport Models
Plant Uptake	Ryan Model； Trap Model； PRISM Model
Inhalation of Indoor Particulates	USEPA Q/C Model； ASTM Model
Inhalation of Otdoor Particulates	USEPA Q/C Model； ASTM Model
Inhalation of Outdoor Vapour (Surface Soil)	ASTM Model； USEPA Q/C Model
Inhalation of Outdoor Vapour (Subsurface Soil)	Johnson-Ettinger Model Johnson-Ettinger & Mass Balance Model
Inhalation of Indoor Vapour (Subsurface Soil)	Johnson-Ettinger Model Mass Balance Model & Johnson-Ettinger Model
Soil Leaching	ASTM Model； SAM Model； SAM Model with Biodecay
Inhalation of Groundwater Vapour (Outdoor)	ASTM Model
Inhalation of Groundwater Vapour (Indoor)	Johnson-Ettinger Model
Air Dispersion (offsite)	3D Gaussian Dispersion Model
Groundwater Migration (offsite)	Domenico Model with First-Order Decay

HERA Software Introduction

Recommended Software Architecture for Undertaking Risk Assessment



Recent Activities

The First International Workshop on Site Remediation November 22nd to 24th 2010

- Policies
- Technologies
- Funding Mechanism

Recent Activities

The First Training Course
for Soil and Groundwater Risk Assessment Using RBCA
June 13th to 15th, 2011, Nanjing, China

Hands-On Training for RBCA Tool Kit V2.5

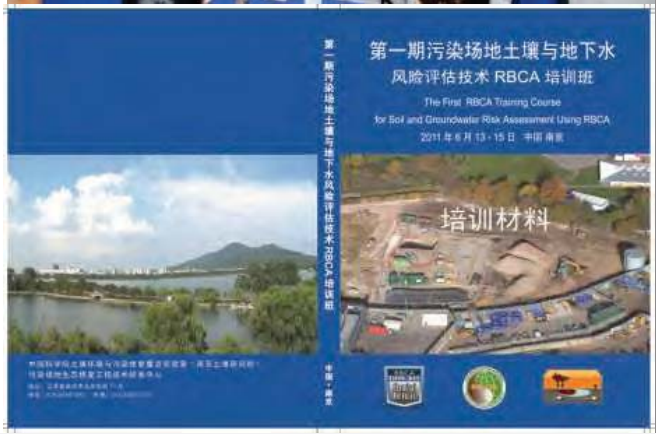
Organiser：Key Laboratory of Soil Environment and Pollution Remediation

Supporting Organiser：GSI Environmental Inc, Texas, USA

The First Soil and Groundwater Risk Assessment RBCA Training
June 13 to 15th 2011

- Risk Assessment Fundamentals
- Fate and Transport Modelling
- Collation of Physio-Chemical and Toxicity Parameters
- RBCA Interface Introduction
- Derivation of Generic and Site-Specific Assessment Criteria
- Comparison of International Risk Assessment Guidelines
- Developing Chinese Specific RBCA Model
- Application of Statistical Tools

No. of Attendees	120
Government	28
Universities	20
Research Institutes	22
Consulting	50



Recent Activities

The Second International Workshop on Site Remediation
September 22nd to 24th 2012

Recent Activities

The Workshop on Site Investigation, Assessment and Remediation
December 3rd 2012

Recent Activities

The Second Training Course
for Soil and Groundwater Risk Assessment Using HERA
December 4th to 5th, 2012, Nanjing, China

Organiser：Centre for Site Remediation, Institute of Soil Science, CAS

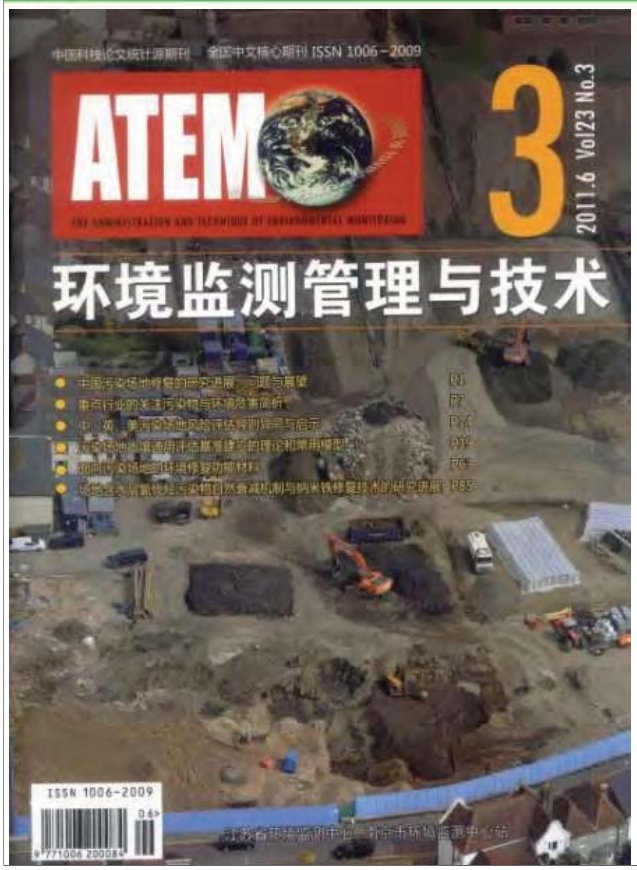
Nanjing Kaiye Environmental Technology Ltd

The Second Soil and Groundwater Risk Assessment HERA Training
December 4th to 5th 2012

- Risk Assessment Principles
- Fate and Transport Modelling
- Collation of Physio-Chemical and Toxicity Parameters
- HERA Interface
- Derivation of Generic and Site-Specific Assessment Criteria
- Example Application

No. of Attendees	100
Government	15
Universities	25
Research Institutes	20
Consulting	40

Recent Activities

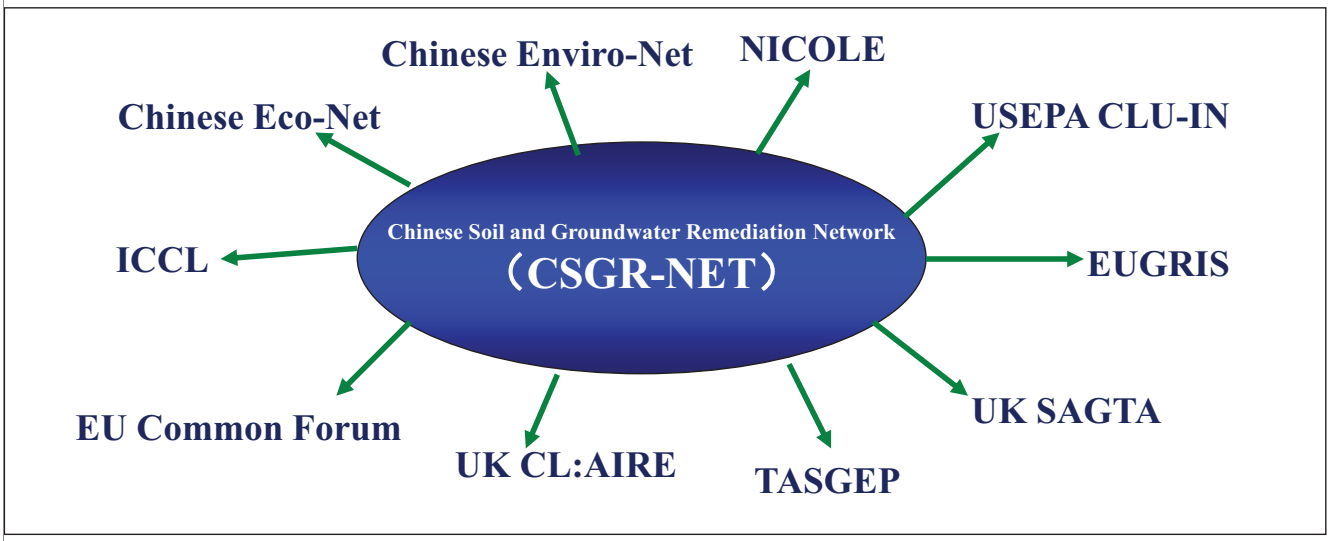


Special Publication on Contaminated Land Management

- Contaminants of Concern and Adverse Environmental Impact for Key Industries
- Comparison of USA, UK and Chinese Risk Assessment Guidelines and the Implications for China
- Theory and Common Used Models for the Derivation of Soil Generic Assessment Criteria for Contaminated Sites
- Natural Attenuation Mechanisms and the Status of Nano-iron Technology for the Remediation of Chlorinated Solvents in Groundwater

Platform for Collaboration

- SuRF China in 2013, SITEREM 2014, ICCL 2015
- Developing Chinese Soil and Groundwater Remediation Network



http://www.CSGR.net

Summaries

- Slowdown of Redevelopment Needs
- Establishing Risk-Based/Sustainable Contaminated Land Management Framework
- Learning from USA and European Experience
- Providing Opportunities for Business and Research (Remediation Technologies and Equipments)
- Leading to Safe and Sustainable Brownfield Redevelopment

Attachment 8
SuRF Australia and New Zealand

A voluntary forum of remediation industry participants
www.surfanz.com.au

Topics in this talk:

- Status of SuRF ANZ
- Sustainable Remediation (SR) in Australia and New Zealand
- ANZ special topics:
  - A perspective on SR and GSR
  - SR benefits in developing countries

Status of SuRF ANZ

Regulatory regimes in ANZ:

Australia:

Commonwealth

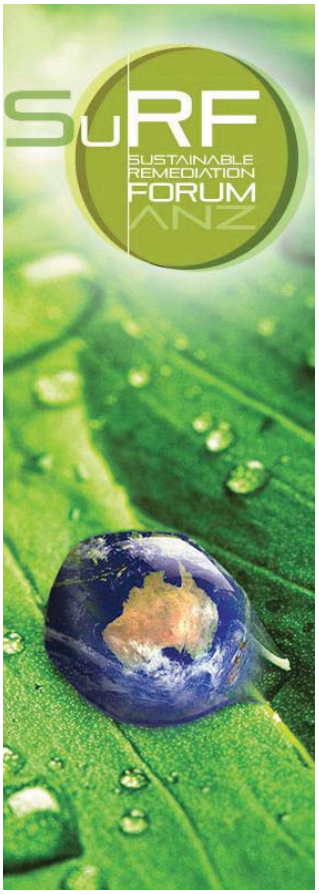
State Govt- regulator

Local Govt

New Zealand:

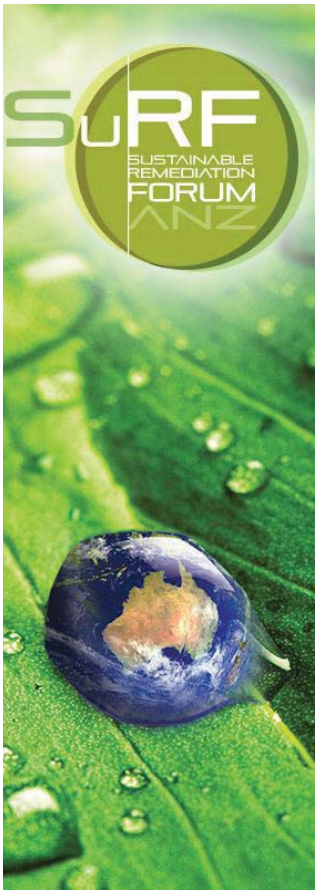
National Govt- regulator

Local Govt



The objectives of SuRF ANZ:

- Establishing SuRF ANZ policy in consultation with members;
- Providing website-based SR tools;
- Organising meetings and forums for SR dialogues;
- Facilitating contact with international SR associations; and
- Contributing to development of the National Remediation Framework.



Working Groups have prepared draft position papers for ANZ on:

- Planning aspects of Sustainable Remediation;
- Sustainable Remediation (SR) Metrics;
- SR Case Examples; and
- SR conferencing opportunities.

SR in Australia and New Zealand

Australian *National Strategy for Ecologically Sustainable Development* 1992.

Core Objectives of the strategy are:

- **To enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations;**
- **To provide for equity within and between generations; and**
- **To protect biological diversity and maintain essential ecological processes and life-support systems.**

Australian States (which hold the environmental legal powers) have enacted distinct legislation with the objective of promoting these principles of ESD and of ensuring that contaminated land and groundwater is managed with regard to them.

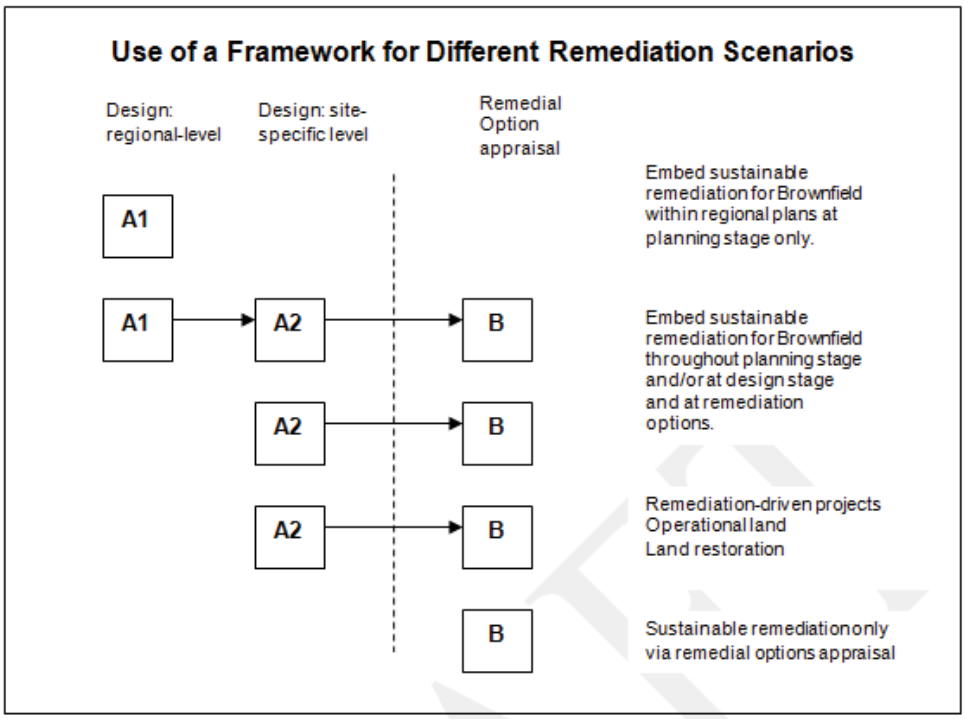
***The New Zealand Environment Act 1986* states as an objective assurance that, in the management of natural and physical resources, full and balanced account is taken of:**

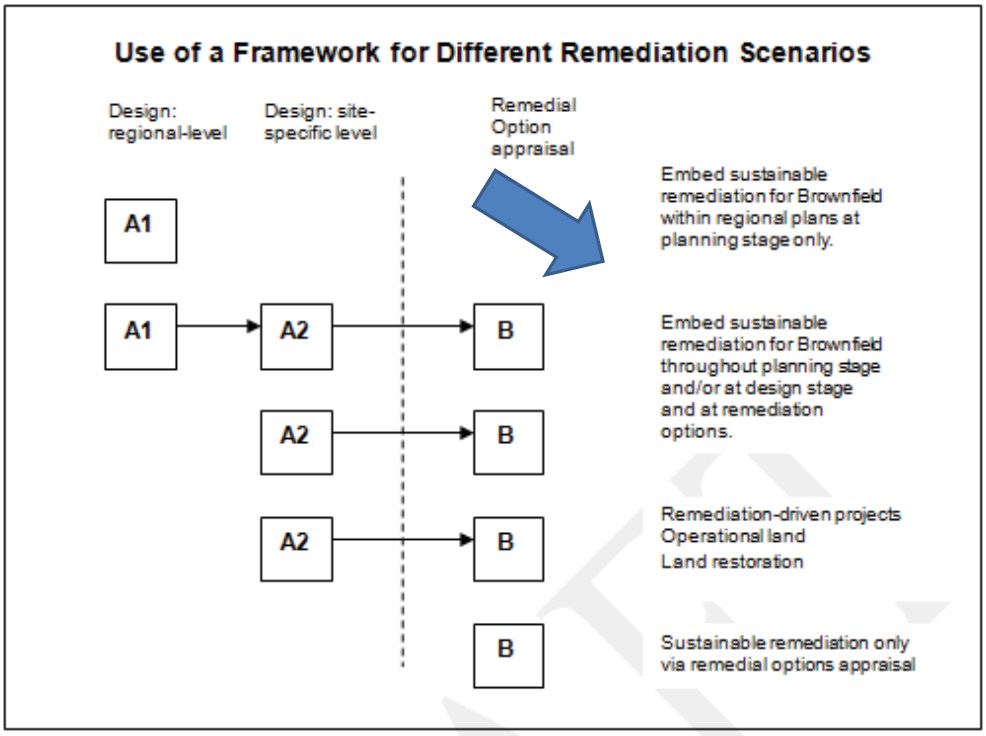
- the intrinsic values of ecosystems; and
- all values which are placed by individuals and groups on the quality of the environment; and
- the principles of the Treaty of Waitangi; and
- the sustainability of natural and physical resources; and the needs of future generations.

SR-based site contamination assessment and remediation consistent with Australian and New Zealand environmental regulations promotes:

- A goal whereby site contamination remediation removes the threat of harm to human health and/or the environment as part of a sustainable (socially and environmentally acceptable and cost-effective) outcome; and
- Assessment and remediation objectives which are consistent with the Sustainability Indicators originally identified by SuRF UK and included in the SuRF ANZ 2011 draft Framework (found at www.surfanz.com.au).

SuRF ANZ draft Framework for SR:





Sister sites: 'Allied feeds' and 'Lednez', Sydney, Australia:

- Contaminated fill dioxins in fish
- 'State/private' cleanup
- Private development
- Differential residual endpoints

SR case example Template

Project name	
Project location	
Client and/or client type	
Project description	
Project objectives/ key drivers	
Sustainable remediation aspects incorporated (delete aspects that are not applicable and include explanation/description of incorporated aspects	Environmental - Impacts on air - Impacts on surface and groundwater - Impacts on soil health - Impacts on ecology - Intrusiveness and aesthetics - Resource use and waste
	Economic - Direct costs and economic benefits - Indirect costs and economic benefits - Gearing - Employment/human capital - Lifespan and project risks - Flexibility
	Social - Community involvement and satisfaction - Human health - Ethical and equality considerations - Impacts on neighbourhoods and regions - Fit with planning and policy strategies and initiatives - Uncertainty, evidence and verification
Responsible working group member	
Photos available and provided	
Suitable for multi media presentation	
Suitable for detailed project review	

SuRF ANZ special topic 1- a perspective on SR and GSR

As SuRF ANZ understands it:

- **GSR may be simply put as mandated risk-based endpoints for determination of remediation plans;**

- **SR may be put as remediation plans which balance environmental, social and economic endpoints.**

Brownfields-based remediation as practised in Western countries promises considerable environmental, social and economic benefit through urban renewal.

Western Evolution of Brownfields:

- Brownfields : Abandoned idle or underutilized properties, where past actions have caused environmental contamination, with an active potential for redevelopment.

- Evolution of brownfields development in USA and developed nations

Remediation.....Health Protection

↓

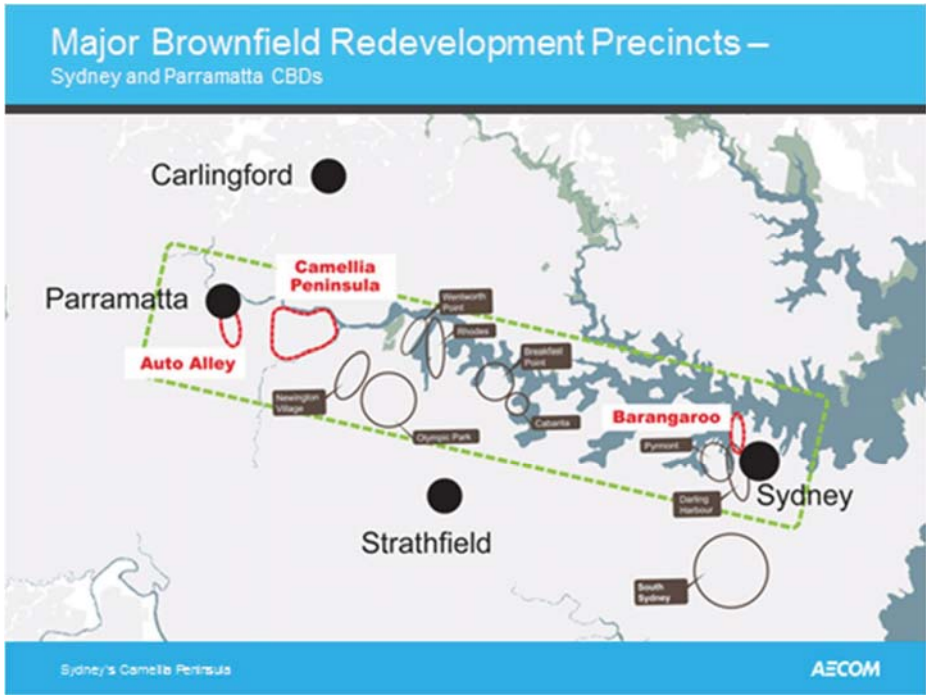
Urban renewal.....Co-location

↓

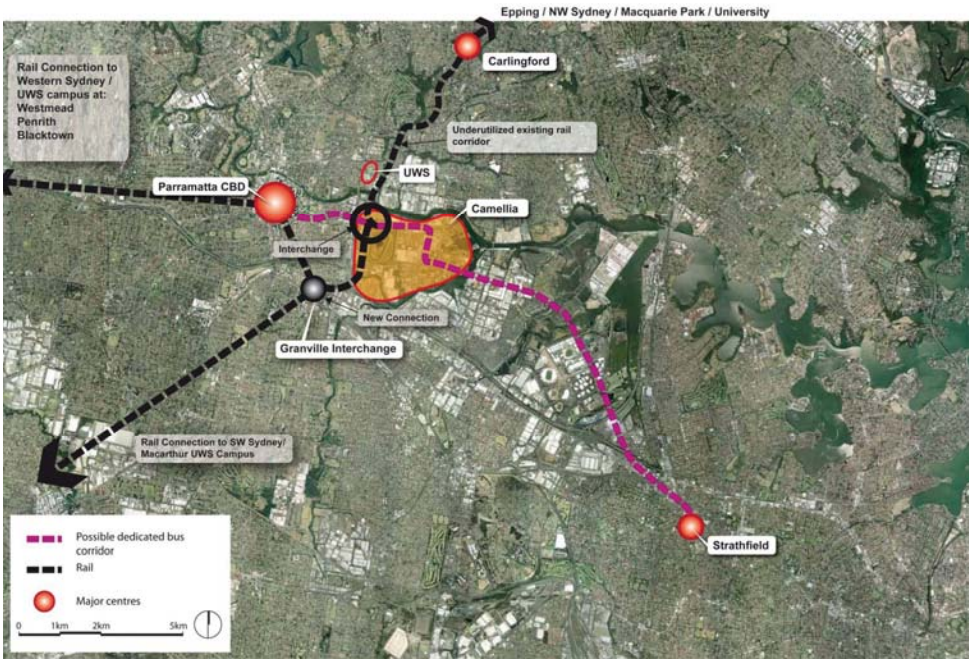
Climate Change .....Carbon Mitigation

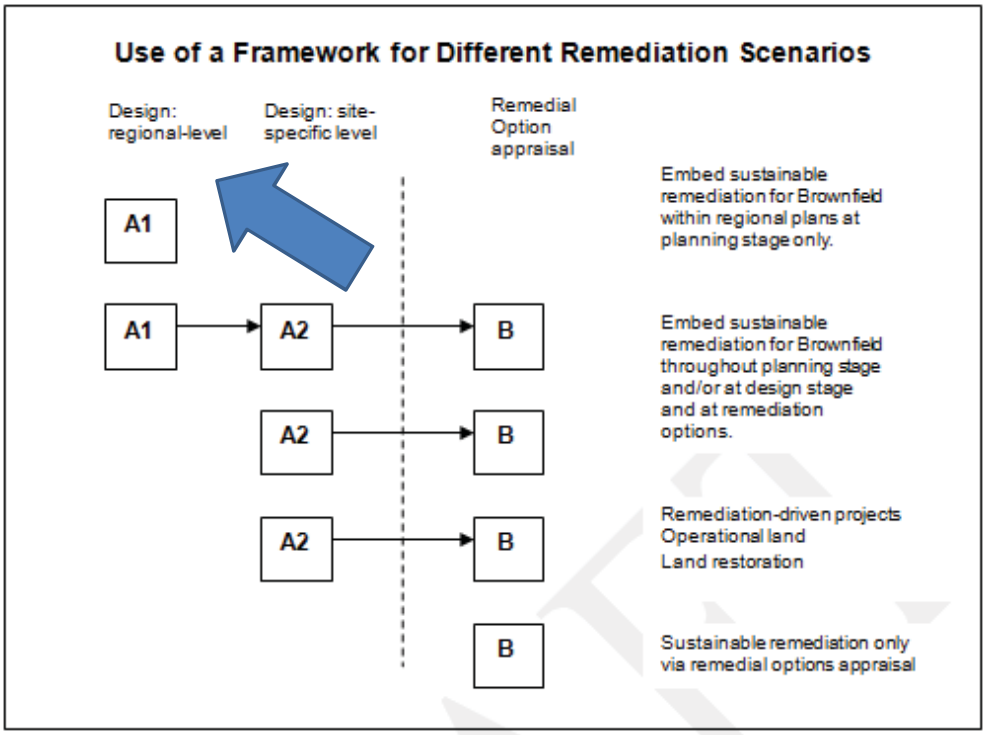
AECOM

'Co-location': **an urban 'revitalization strategy that links the redevelopment of brownfields with nearby or adjacent properties that—like brownfields—can be a challenge to redevelop (International City/County Management Association)**



Possible Dedicated Transit Corridors





- **The urban renewal attributes , and the ESD components, of SR will ultimately resonate with public stakeholders and regulators in ANZ**

- **Remediation outputs can expect to be publicly endorsed if they include social and economic endpoints as well as the important environment endpoints**

- **Best offered in an SR (while including the more singular GSR) framework.**

Are Sustainable remediation and Risk management inherently conflicting?

No: they are related and overlapping

- Each brings important distinct considerations to remediation planning and practice
- A key consideration however is which takes precedence and priority.

Tiered ANZ regulatory-based remediation requirements are:

1. protection of human health and the environment (i.e. comply with regulatory requirements);
2. ensuring that risk to stakeholders is acceptable – i.e. risk is managed); and
3. achieving sustainability (i.e. sustainability is managed).

Emissions (lbs CO_2e	Brownfield site: Summerset (phase 1)	Greenfield site: Cranberry Heights
Site construction phase	24×10^6	4×10^6
Housing construction	80×10^6	110×10^6
50 yrs Utility consumption	470×10^6	940×10^6
50 yrs vehicle Usage	170×10^6	490×10^6
Total	750×10^6	$1{,}600 \times 10^6$

Source: Auld 2010

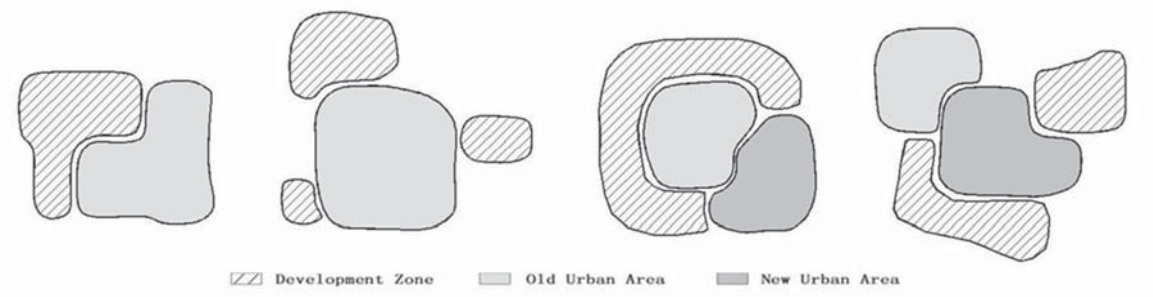
SuRF ANZ topic 2: SR benefits in developing countries

External Sprawl, Kathmandu Valley, Nepal

Source: Subba and Bjonness, ISoCaRP Congress 2008

China: unsustainable development zones?

Government urban land development partitions uses – negative carbon emissions mitigation implications.



Source: Zhang and Hu (2008) ISOCARP 44th International Planning Congress, Dalian, China.

Large slums in growing African cities exhibit petrol, municipal waste and sewage waste infiltration to soil and groundwater.

Kibera slum, central Nairobi, Kenya

Might the Kibera slum qualify as a carbon credit-generating brownfield site?

14

Conclusions:

- **SuRF ANZ is establishing policy in consultation with members, providing website-based SR tools, and engaging regulators and the industry re SR;**
- **Key policy development areas are the planning aspects of SR, SR metrics, practical ANZ case examples and conferencing**
- **The SuRF ANZ SR framework looks outward to urban development and inward to site and remediation design**
- **GSR endpoints remain fundamental to remediation however the urban renewal attributes of SR ultimately will resonate with public stakeholders and with environmental regulators in ANZ**
- **Brownfield remediation contributions to sustainable urban renewal and development in developing countries may contribute to climate change mitigation and to social and economic development**

Thankyou:

- SuRF
- AECOM
- SuRF 21 participants
- the Australasian Land and Groundwater Association

www.surfanz.com.au

GSR and SR may be considered complementary rather than conflicting.

- **The issue is really 'what is mandatory'.**
- **If regulations make reaching a particular endpoint mandatory, then the effort would be directed to achieving a sustainable and balanced approach to the achievement of that endpoint. This is effectively GSR.**
- **If the jurisdiction does not fix the endpoint (e.g. MNA or containment may be acceptable options - as long as the risk level of each is considered acceptable) then effort would be directed to which option provides the most sustainable solution. This is SR.**
- **In application of SR to a specific site a variety of criteria-based endpoints may emerge as appropriate to site use and to sustainability outcomes while protective of human health and the environment.**

Attachment 9
SuRF Canada: Sustainable Remediation

SuRF FORUM SUR LA RÉHABILITATION DURABLE

SuRF SUSTAINABLE REMEDIATION FORUM

Sustainable Remediation SuRF Canada

SURF 21
December 12, 2012

Stella Karnis
Sr Manager Environmental Affairs CN

OUTLINE

- Our definition…
- Our beginnings and mission
- Drivers and barriers
- Our Structure
- Where we stand
- Lessons Learned/Next Steps

Definition of Sustainable Remediation

Sustainable remediation considers the environmental, social and economic impacts of a project to ensure an optimal outcome, while being protective of human and environmental health, both at a local level and for the larger community (SuRF Canada, 2012).

SuRF Canada beginnings

- Discussions between government and industry began in December 2010 to set up a Canadian professional network to discuss and promote sustainable remediation
- The first workgroup meeting was held in Toronto in May 2011 with representatives from industry, provincial and federal government and academia
  - Introduction to sustainable remediation concepts
  - Defined the SuRF Canada mission statement
  - Discussed drivers/barriers to Sustainable Remediations in Canada
  - Defined short, medium and long term objectives

SuRF Canada beginnings
Objectives

- Short Term
  - Define objectives for the group and definition of sustainable remediation
  - Work within the existing regulatory framework to show benefits
  - Evaluate existing frameworks that we can build upon
  - Awareness and outreach
- Medium Term
  - Structure the group
  - Beneficial Partnerships
  - National Guidelines
  - Awareness and outreach
- Long Term
  - Regulatory or policy changes if necessary
- "What is SuRF" document created

SuRF Canada - Mission

« To establish a Canadian network group to promote sustainable remediation that aims to give systematic consideration to the three dimensions of sustainability (society, economy and environment), in decision-making about rehabilitation and management of contaminated sites. The network will bring together public and private organizations and launch an information and awareness initiative in Canada. »

Drivers

Sustainable Remediation

Environment
- By-products of remediation activities
- The finite availability of resources
- Permafrost zones

Social
- Knowledgeable stakeholders/shareholders
- Local sustainability plans/programs
- First Nations

Economic
- Shareholder value of positive corporate image
- Calculating the true cost of the remediation

Drivers for Sustainable Remediation

Barriers

Regulatory / Policy
-Variability of regulations
-Current regulations
-Lack of regulatory tools to make regulators comfortable
-Regulators at Provincial Level

Procurement
- Tendering and sustainability policies

Communication / Awareness
-Lack of a clear and defined goals
-Lack of understanding
-Perceptions

Financial
-Real or perceived increase in $
-Lack of funding pgms
-Govt and industry accounting preferences
-Financial institutions

Barriers Example
Subset of Provincial Regulations

Province	Regulations	Sustainable Remediation
BC	Prescriptive but risk assessment accepted. Some case studies for this area for sustainable remediation	Amenable
Alberta	Rigid approach	Not amenable
Saskatchewan	The tiered approach outlined in RBCA, which considers risk and allows for conditional closure, is amenable to SuR.	Amenable
Manitoba	Although regulations do exist - defer much to federal standards	Potentially amenable
Ontario	Prescriptive but risk assessment accepted.	Potentially amenable
Quebec	The requirement of the Environmental Quality Act to remove "all contaminated material" is a challenge	Not amenable
Atlantic Provinces	The tiered approach outlined in RBCA, which considers risk and allows for conditional closure, is amenable to SuR.	Amenable

Structure of SuRF Canada

- Adhocracy with no current formal structure although there is a leadership team.
- Committees created for Outreach, Planning, Technical Initiatives and Group Structure, and Website
  - Outreach
    - We have defined Provincial leads
    - Regular calls to ensure updates and consistency
    - Development of an outreach plan
  - Planning conference or sustainable remediation workshops and presentations.
  - Technical Initiatives
    - Working on a paper on "Sustainable Remediation in Canada"
    - Input on technical requests (nationally and internationally)
  - Website created www.surfcanada.org
- Membership up to over 100 members from industry, consultants, government and academia
- Regular calls initiated with group at large


SURF Canada
The Sustainable Remediation Forum
What is SURF?
Remediation projects often come with a hidden cost: the impact of the clean-up itself.
Cleaning up a contaminated property often requires the consumption of substantial energy, water, other natural resources; the emission of greenhouse gases; and the substantial disposal of wastes. It may also have social and economic impacts to the proponent and the community. Understanding the benefits and impacts of a remediation project allows for a more holistic approach to site remediation decision-making.
To address these challenges, a group of environmental professionals organized the Sustainable Remediation Forum (SURF).
The mission of SURF Canada is
To establish a Canadian network group to promote "sustainable remediation" that aims to give systematic consideration to the three dimensions of sustainability (social, economic and environmental), in decision-making about rehabilitation of and management of contaminated sites. The network will bring together public and private organizations and launch an information and awareness initiative across Canada.
SURF has been meeting internationally since 2006 to advance sustainable clean-up practices and develop a vision, framework, and metrics to help bring sustainability to the environmental remediation industry. In Canada, we have taken the first steps towards organizing a similar group.
Other International SURF Agencies:
- SURF US
- SURF Brazil
- SURF Italy
- SURF UK
- SURF China
- SURF Australia

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 life-cycle of remediation projects, from site investigation to closure.
Benefits of Membership
The practice of sustainable remediation is gathering world-wide momentum. By joining SURF, you establish partnerships and build relationships with a wide variety of remediation stakeholders: industry and agency peers, customers, clients, academia, technology vendors, and the public.
One of the goals of SURF is to facilitate discussions and sharing of "lessons learned" in environmental footprint reduction. You'll have access to members who are helping to shape green and sustainable remediation guidance and assessment tools.
Participation in SURF activities demonstrates:
- Environmental Stewardship
- Employee involvement and accountability
- Stakeholder engagement
- Commitment to a leadership role in sustainable remediation practices
- Alignment of business and sustainability objectives

For more information, contact one of the primary SURF Canada Contacts below:
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Sebastien Perlo
Sebastien.perlo@lasalle.uregina.ca
Robert Noel De-Tilly
RNoel-De-Tilly@golder.com
Austin Kelley
austin.kelley@aecom.com
www.surfcanada.org
Website Under Construction

Where we stand
Objectives – 2012

Outreach and Planning

- ✓ Diversify membership through information sharing tools (website and social media) and conferences
- ✓ Partner for conferences, workshops and university programs
- Use Linked'in to communicate
- ✓ Continue with the monthly calls – more structured
- ✓ Develop provincial and regional leadership and increase provincial government and non-government membership and support

Technical Initiatives and Group Structure

- ✓ Collaborate on the FCSAP project for the incorporation of sustainability in the FCSAP program
- ✓ Develop definition of sustainable remediation for use
- Formalize structure as a "non profit"
- "Sustainable Remediation in Canada" to document current context and current/proposed framework (2013)
- ✓ Collaborate on international initiatives

Website

- ✓ Create a member only access
- Bilingual ✓
- ✓ Post presentations from conferences, agenda for meetings, minutes of meetings, and other pertinent information
- ✓ Quick links to other sustainable remediation websites

Events Planning and participation

Planning and/or participation of SuRF Canada in the following Events :

- 2011 FCS Regional Workshop - Sustainable Remediation in Canada, Kingston, May 31- June 1, 2011 http://www.rpic-ibic.ca/en/events/federal-contaminated-sites-fcs-regional-workshops/2011-fcs-regional-workshop
- Remediation Technologies symposium (Remtech), Banff, October 19-21, 2011 http://www.esaa-events.com/remtech/call2011.htm
- Salon des technologies environnementales du Québec 2012, Québec City, March 13-14, 2012 http://steq.reseau-environnement.com/tiki-index.php
- 2012 FCS National Workshop ,Toronto, April 30-May 3, 2012 http://www.rpic-ibic.ca/en/events/federal-contaminated-sites-fcs-national-workshop/2012-fcs-national-workshop
- EMA of BC 2012 Workshop , Vancouver , February 2012 http://www.emaofbc.com/wp-content/uploads/2012/01/Workshop-Outline-V10_mm.pdf
- 2012 37th National CLRA/ACRSD Conference, Sydney, September 26-27, 2012 http://arc2012.ca/
- CSAP Fall PD Workshop, Vancouver, Oct. 10, 2012 http://www.csapsociety.bc.ca/node/36
- Sustainable Remediation 2012 - Environment Agency Austria, Vienna, Austria, November 14 - 16, 2012 http://www.umweltbundesamt.at/sustainable_remediation2012

Coming Events :

- SuRF US Meeting in Washington, D.C. December 12-13, 2012
- Americana 2013, Montréal, March 19-21, 2013 http://americana.org/fr/calendar
- 2013 FCS National Workshop – detail to come

Events Planning

Lessons Learned and Next Steps

- Understand the drivers and barriers to sustainable remediation in Canada *(technical initiative)*
- Understand and continue to communicate the value of sustainable remediation
- Examine the policies and initiatives that promote sustainable remediation in Canada and make recommendations for further integration/synergies *(technical initiative)*
- Benefits of partnerships
- Perform, document and communicate case studies
- Network and collaborate nationally and internationally with wide range of professionals (industry, government, academia)

SuRF Canada

- **Acknowledgements**

  - Justin Kelley - justin.kelley@aecom.com
  - Robert Noël-De-Tilly - Robert_Noel-De-Tilly@golder.com
  - François Beaudoin - Francois_Beaudoin@golder.com
  - Sébastien Yelle - Sebastien.Yelle@tpsgc-pwgsc.gc.ca

  And all our members…

- **Website** - http://www.SuRFcanada.org/

Questions ?

Attachment 10
Development of Green and Sustainable Remediation in Taiwan

行政院環境保護署
Environmental Protection Administration
Executive Yuan, R.O.C.

Development of Green and Sustainable Remediation in Taiwan

Hao Chun HUNG, Ph.D.
Soil and Groundwater Remediation Fund Management Board,
Environmental Protection Administration, Taiwan

December 12, 2012
SURF 21,Washington DC

Outline of Presentation

1. Policies for Contaminated Soil and Groundwater in Taiwan
2. Strategies for Green and Sustainable Remediation
3. Pilot Case Studies
4. Future work for Green and Sustainable Remediation in Taiwan

Policies for Contaminated Soil and Groundwater in Taiwan

- "Soil and Groundwater Pollution Remediation Act" enforced in January 2000 and revised in February 2010
  - Manage contaminated soil, groundwater and sediments
    - Soil Control Standards
    - Groundwater Control Standards
    - Sediment Quality control standards
  - Control site and remediation site
  - Risk assessment and risk communication
  - Remediation fund

Current Contaminated Sites Nationwide

Type	Completed		In progress	
	Number	Area (ha)	Number	Area (ha)
Farmland	1,757	410	391	77
Gas Stations	57	12	96	19
Storage Tanks	7	40	8	171
Industrial Sites	85	96	135	751
Illegal Dump Sites	10	5	19	14
Others	15	8	66	120
Subtotal	1,931	571	715	1,152

Challenges in Taiwan

❖ Need Green and sustainable clean-up strategies

Mega sites and Industrial sites

1. Heavily contaminated
2. Community issue
3. Need for a balanced solution

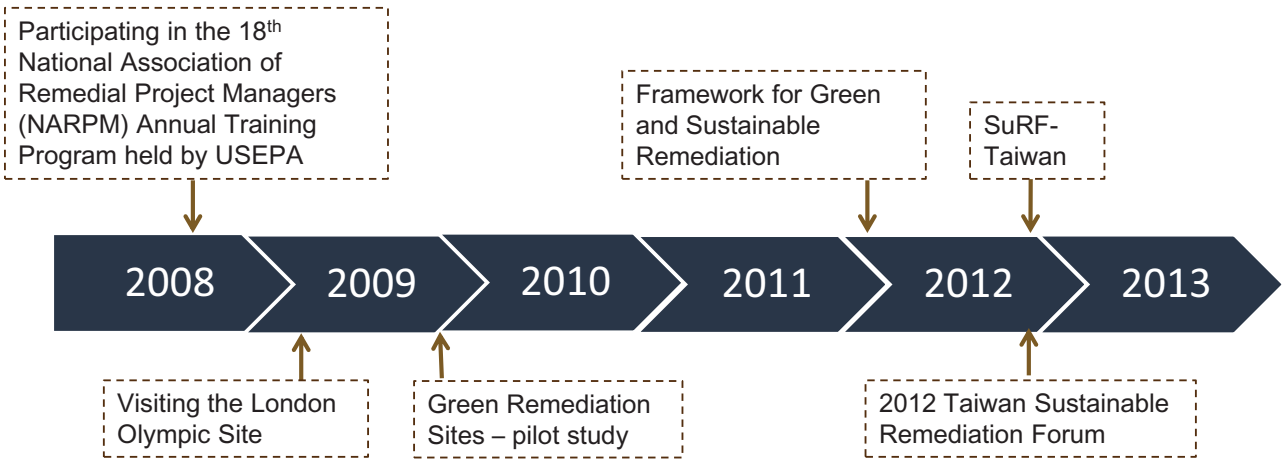
Farmland pollution

1. The world food crisis
2. Crops and plants selection
3. Renewable energy

Illegal dumping sites

1. No responsible party
2. Partial or thorough remediation

Green and Sustainable Remediation in Taiwan



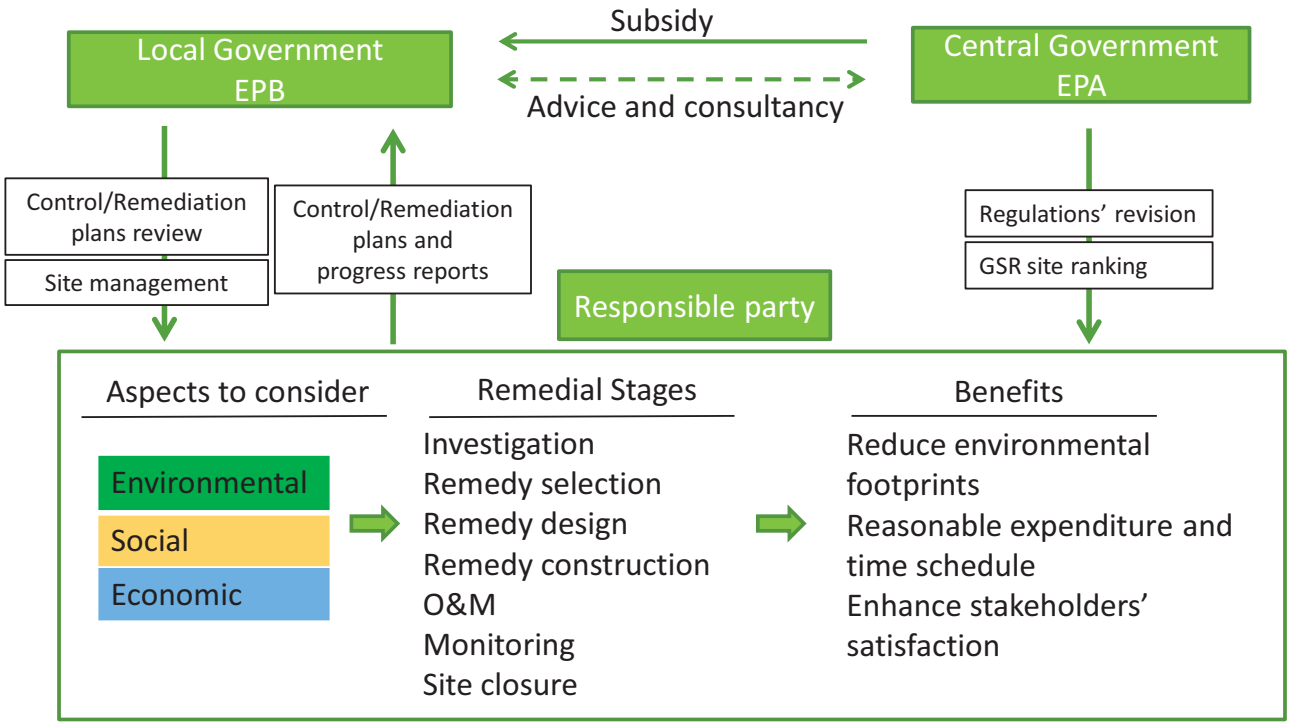
Important initiatives for GSR in Taiwan

2012 Taiwan Sustainable Remediation Forum

2012 Taiwan Sustainable Remediation Forum

Taiwan EPA's Framework of GSR

- Top-Down Approach

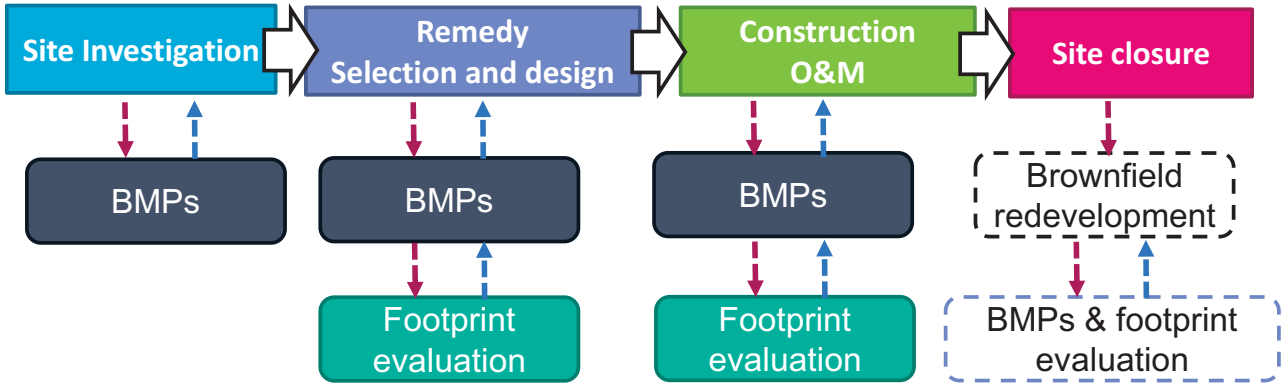


Strategies for promoting GSR

- GSR toolkits
  - Environmental footprint evaluation
  - BMPs recommendation
- Case study
  - Pilot test cases
  - Full scale case study
- GSR guideline
  - Social and economic experts involved
- Regulations' revision
- Communication / Education
  - Education for general public
  - Training for contractors and governments' officials

Draft processes for applying GSR

- BMPs can be applied to all phases of a remediation programme
- The environmental footprint evaluation results support the decision making process and the adoption of BMPs



Major considerations of GSR

Environmental	Social	Economic
Energy requirements	Human health safety	Direct economic effect
Air emissions	Social justice and acceptance	Indirect economic effect
Water consumption impacts		
Land and ecosystem impact		
Material usage and waste		

15 measures | 8 measures | 9 measures

BMP check list for GSR

表 3.1.1-1 綠色及永續導向型整治定性評估表單

面向	核心項目	原則	是否適用	最佳管理作業(BMPs)	是否達成(Y/N) 整治工法選擇/設計	整治策略執行 設備建置	整治策略執行 操作維護	整治策略執行 長期監測	紀錄文件
環境面	減少能耗	提高能源使用效率							
		使用再生能源							
		採行節能措施							
	降低大氣排放	減少空氣污染物排放							
		降低溫室氣體排放							
		防止關切污染物大氣排放或逸散							
	最小化水資源使用影響	減少水資源消耗與廢水							
		廢水回收再利用							
		防止對地表及地下水體造成衝擊							

Core elements

measures

Applicability

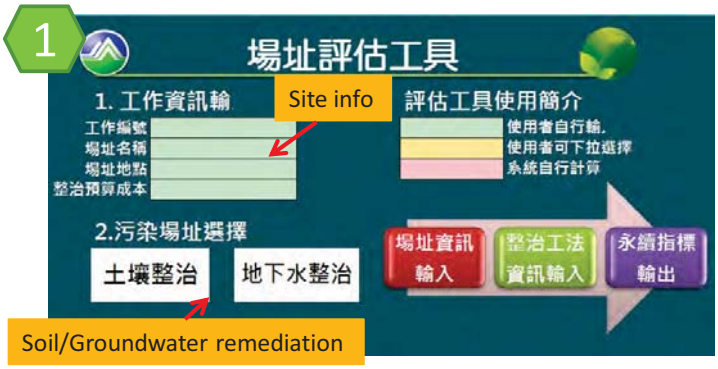
Remedial stages

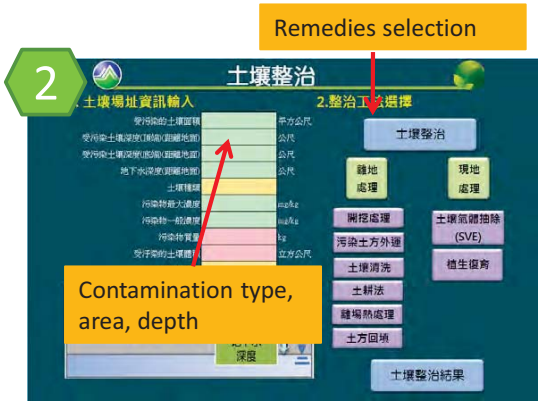
Documentation

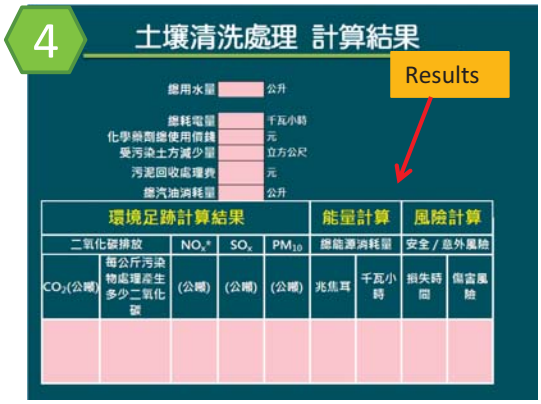
Social justice and acceptance consideration

- Public meetings
- Survey and Questionnaire
  - Understand the needs of stakeholders
  - Access local community's satisfaction with the remedial activities

Environmental footprint evaluation



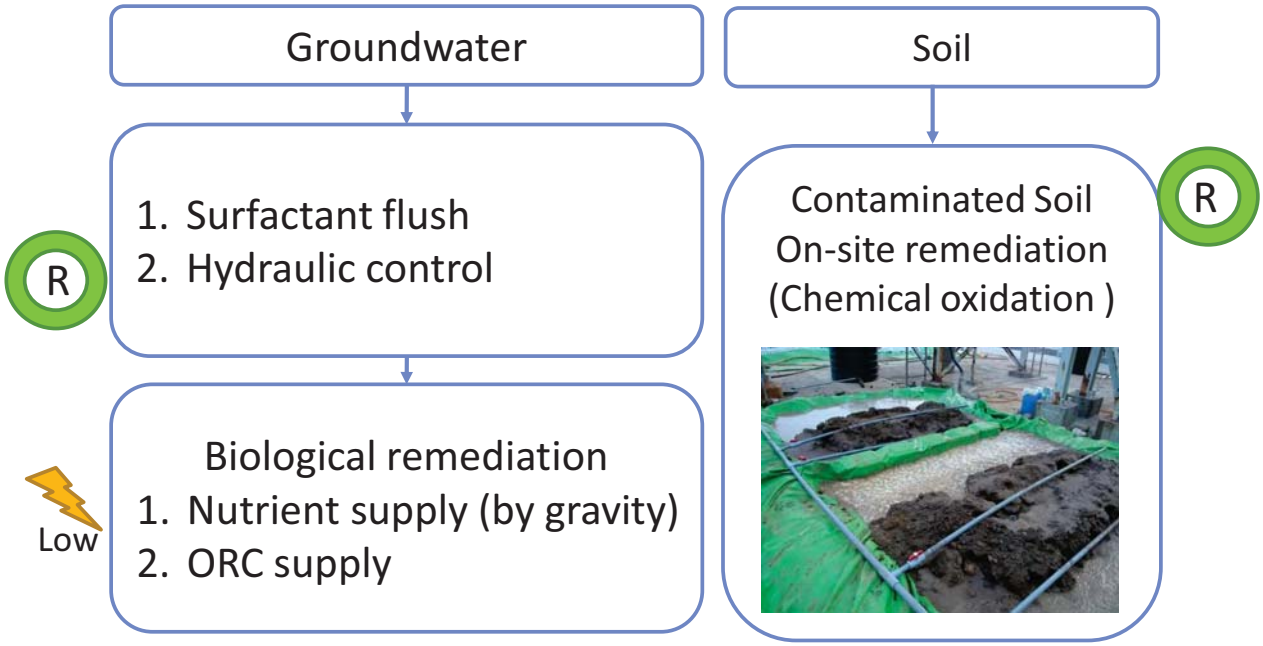




Pilot study - Jianshan Power Plant

- Site area：11.8 hectares
- Contaminants ：TPH
  - 29,7000mg/kg

Pilot study - Jianshan Power Plant



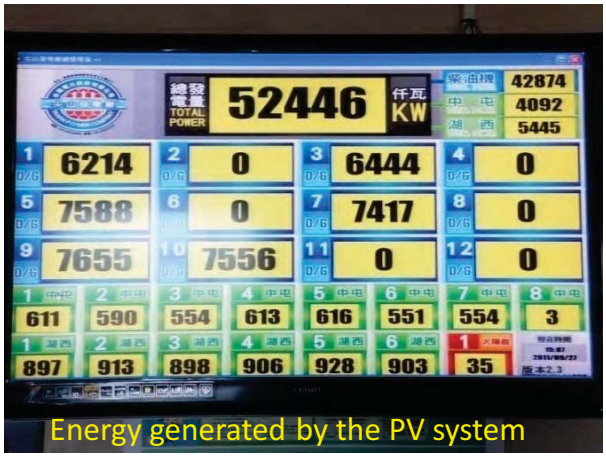
R Renewable energy apply

Low Low energy demand strategy

Pilot study - Jianshan Power Plant

- GSR approaches
  - PV system for the remediation
  - Sustainable usage of the PV system

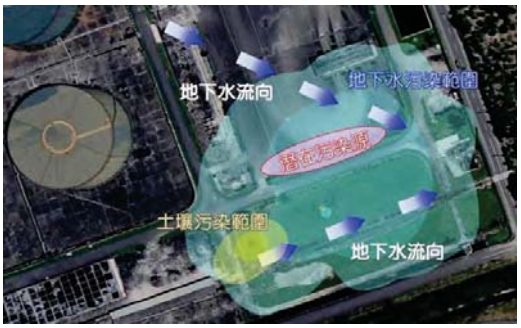
Solar panels in the Jianshan Power Plant



Energy generated by the PV system

Pilot study - Peipu oil storage tank

- Site area：71.8 hectares
- Contaminants
  - Soil：TPH
  - Groundwater：Benzene
- Concentration
  - TPH：1,190~3,470mg/kg
  - Benzene：0.1~6.6 mg/L



Groundwater flow

Plume

Soil contaminated zone

Pilot study - Peipu oil storage tank

Alternative A

Pollution source hydraulic control

SVE/AS

Phytoremediation

MNA

Estimate CO_2 emission
192,432 kg

Alternative B

Excavation

hydraulic control /SVE/AS

Off site bioremediation

Phytoremediation

MNA

Estimate CO_2 emission
578,182 kg

Pilot study - Peipu oil storage tank

- Source Zone
  - Hydraulic control
  - SVE/AS
- Less contaminated zone
  - Phytoremediation
    - Vetiver grass
    - Madagascar almond

Pilot study - Peipu oil storage tank

- GSR approaches
  - SVE system optimization
    - Reduced energy consumption
    - 204,000 kg CO_2 reduction
  - Phytoremediation
    - Vetiver grass
      - Engineering controlled
      - Low ecological effect
      - Amount of CO_2 absorbed estimated to be 2,855 kg by 2012

Future Work

- 2013 - 2014
  - Green and sustainable remediation guidelines
  - Publication of the environmental footprint evaluation and BMPs toolkits
  - Guidance and consultation for selected sites
- Continuously promoting GSR
- Increase SuRF-Taiwan members and influence
- Share GSR experience with Asian countries

Attachment 11
Day 1 Participant Reflections

DAY 1 PARTICIPANT REFLECTIONS

At the beginning of Day 2, Mike Rominger (meeting facilitator) asked participants for their reflections on the first day of the meeting by asking three questions. These questions, along with participant responses, are provided below.

What did you hear yesterday?

- *Potential Action Items*
  - Invite some social scientists!
  - Collaborate on the message. Consider working on training materials together. Be cohesive in what we present.
  - .
  - Rethink how we are packaging societal issues. Consider changing to local/community. How do we define social objective for sustainable remediation?
  - Use international white paper to communicate successes.
  - As a representative for SURF, write an abstract for a social scientist conference. Find social scientist to come to the next meeting and present.
  - For the 2013 SURF Chicago meeting, invite a social scientist from the American Planning Association to present.
  - Leverage resources available at universities and in towns for social science questions.
- *Comments*
  - Impressed to see international regulatory agencies taking lead role in sustainable remediation.
  - Humbled by work being done around the world, which has fast-forwarded what's being done in more established SURF organizations.
  - We don't understand the social science mindset; we need to break the paradigm and move on.
  - Groups here are from all around the world, but are going through the same learning steps.
  - Through white papers and practice guides, we're pushing sustainable remediation forward.

What didn't you hear that you expected to hear?

- Hold another international gathering in a couple of years from now…maybe in another country.
- Clarify SURF's expectations and goals, including a definition of sustainable remediation.

What should SURF be doing?

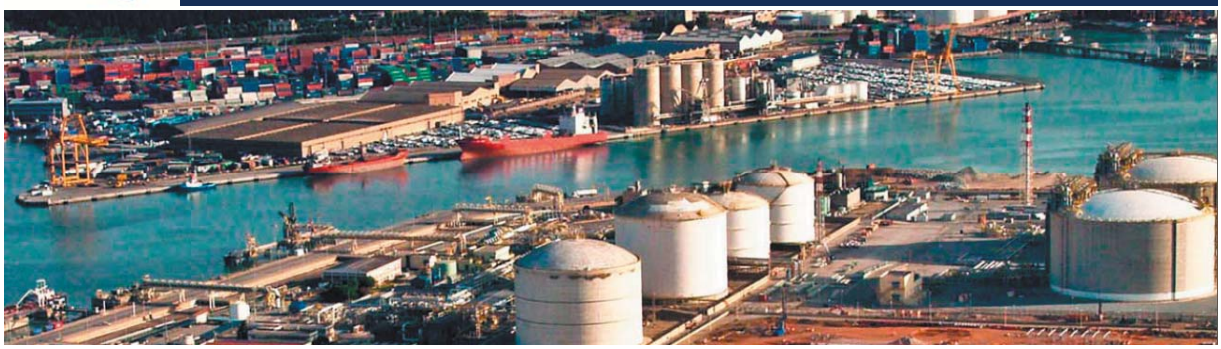
- Reach out to sustainable development community.

- Strive for better collaboration and more synergy with other SURF organizations so we can advance.
- Continue to work on value proposition (i.e., what does sustainable remediation bring that really makes a difference).
- Continue to focus on the value that sustainable remediation brings, and measure that value.
- Regularly issue press releases, especially about this meeting.
- Consider standardizing case studies so that successes are reported in a similar manner and are communicated consistently. (Note: SURF currently has a technical initiative that standardizes case studies. If you would like to volunteer to help, please contact Pamela Dugan or Mary Kean.)

Attachment 12
The Road to Sustainable Remediation

NICOLE

Network for Industrially Contaminated Land in Europe



The Road to Sustainable Remediation

SuRF 21, Washington DC

Lucy Wiltshire, Co-chair NICOLE Working Group on Sustainable Remediation

December 13, 2012

Content

- NICOLE Network
- NICOLE Sustainable Remediation Working Group
- NICOLE Roadmap for Sustainable Remediation
- Road Map case studies and feedback
- Next steps

What is NICOLE?

NICOLE is

- a unique network in Europe, linking contaminated land management professionals from the Industry, Service Providers and Academics

- a leading organisation in the development and promotion of state of the art solutions for contaminated land management

NICOLE background

- Started in 1996 as a concerted action under the 4th Framework Program of the European Community

- Since 1999 NICOLE has been self supporting and is financed by membership fees

- Since December 2009 NICOLE has been organised as a non profit association under Dutch law

NICOLE's objectives

- To provide a European forum for exchange of knowledge and ideas about contaminated land management (share best practice)
- To communicate with stakeholders inside and outside Europe to promote its views
- To identify research needs and promote collaborative research that will enable its members to identify, assess and manage contaminated sites more efficiently and within a framework of sustainability

Interfacing

NICOLE is interfacing with other networks/organisations, such as:

- Common Forum
- CEFIC
- Eurometaux
- EURODEMO+
- EUGRIS
- Heracles
- SedNet
- SNOWMAN
- SuRFs

NICOLE Influencing

NICOLE Policy work:

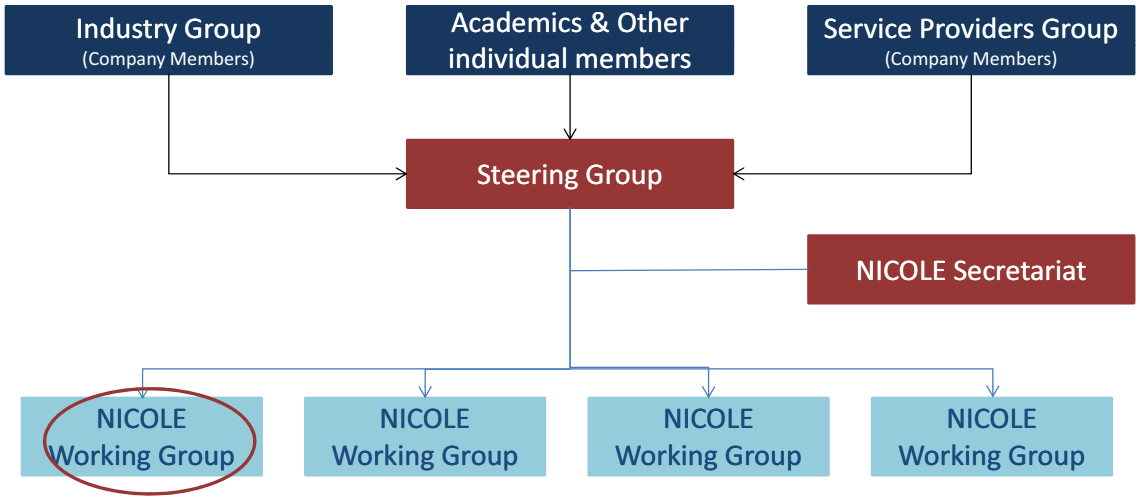
- Direct discussions with EU Directorate-General for the Environment on development and implementation of Directives
- Members therefore gain first sight of new and developing legislation

Direct contact with EU DG Research regarding research needs

Joint statements with other networks

NICOLE Organization

NICOLE is run and represented by its members and companies member groups, a Steering Group and thematic Working Groups.



Sustainable Remediation

Road to NICOLE's vision

NICOLE/SAGTA workshop on SR in May 2008, London

SR working group launched October 2008, Madrid

- 5 subgroups working in parallel :
  - Communication: Promotion of SR (networking, papers, conferences...)
  - Risk management: Understand RM within the context of SR
  - Economics and Tools – tools on the market and how best to use them
  - Indicators – KPIs to measure performance of a SR project
  - Case studies – Compile case studies to illustrate the value brought by SR
- Questionnaire to members to map the use of SR concepts in different EU Member States (2009)
- Development of guidance – how to implement SR across EU

Questionnaire main outcomes (2009)

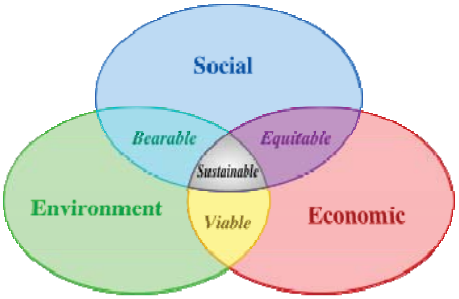
- Confirmed SR was a 'new' concept
- SR principles were being referred to and used across Europe in very different ways
- Legislation referred to sustainable principles to varying degrees across the European countries
- Risk assessment widely used and referred to in Europe
- Cost benefit analysis (or equivalent) is an accepted tool only in some countries
- Economic and social impacts are not widely considered in remediation projects … bit as engineers, we are not yet experts in economic and social concepts

Developing guidance

- Publication of **Road Map for Sustainable Remediation** in September 2010
  - Definition of Sustainable Remediation
  - Visual representation of the path toward sustainable remediation
- Supplementary work to the Road Map published in March 2012 (series of standalone **research chapters**)
  - Economics
  - Indicators
  - Risk assessment

Sustainable Remediation – General definition

- Brundtland report (1987)
- Sustainable Development "*meets the needs of present generation without compromising needs of future generations*"
- Integrates environment, social and economic aspects



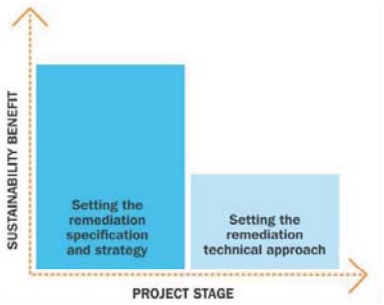
NICOLE's definition of Sustainable Remediation

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

- Sustainable remediation (SR) is a comprehensive approach to optimizing the management of contaminated sites and sits comfortably within the discipline of risk-based land management
- In order to achieve such objectives, NICOLE has highlighted the importance of building consensus between multiple parties and produced guidance on how to do this

NICOLE's principles and vision #1

- The earlier in the process the more sustainable gain
- Green Remediation, greening the selected remedial option, is a component of SR
- Measuring performance to build trust and consensus
- SR is not strictly a technical issue but a consensus building issue
- Communication is the number one barrier and enabler
- Favour a "Bottom-up" approach



NICOLE's principles and vision #2

- Risk based land management goals should be consistent with those of sustainable remediation but experience has shown (especially in some EU member states) that the two can diverge when the balance between environmental, social and economic factors is skewed (not balanced)
- When managing contaminated land, measures must be proportionate to the risk which is to be limited or eliminated. Being too conservative can result in significant barriers to the implementation of sustainable solutions.

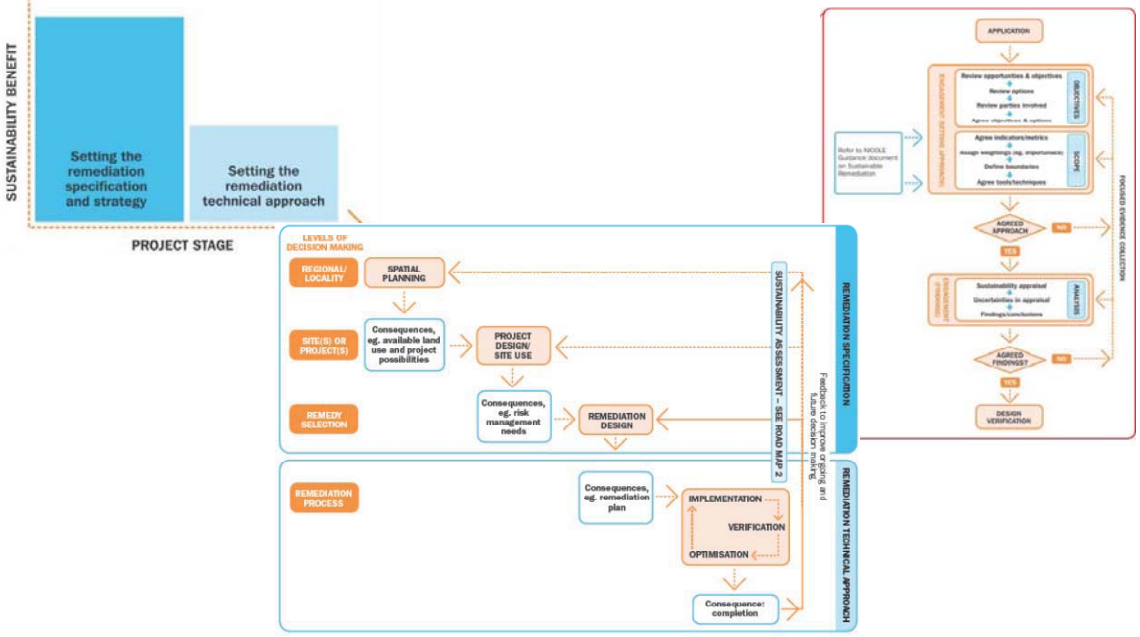
[Specific guidance on risk assessment and the precautionary principles : Guidance on Risk Assessment and the use of Conceptual Models for groundwater, in Common implementation strategy for the Water Framework Directive, 2000/60/EC, guidance document nº 26, or EU's Communication on Precautionary Principle, 2 February 2000, www.gdrc.org/u-gov/precaution-4.html]

Framework of a Sustainable Remediation project

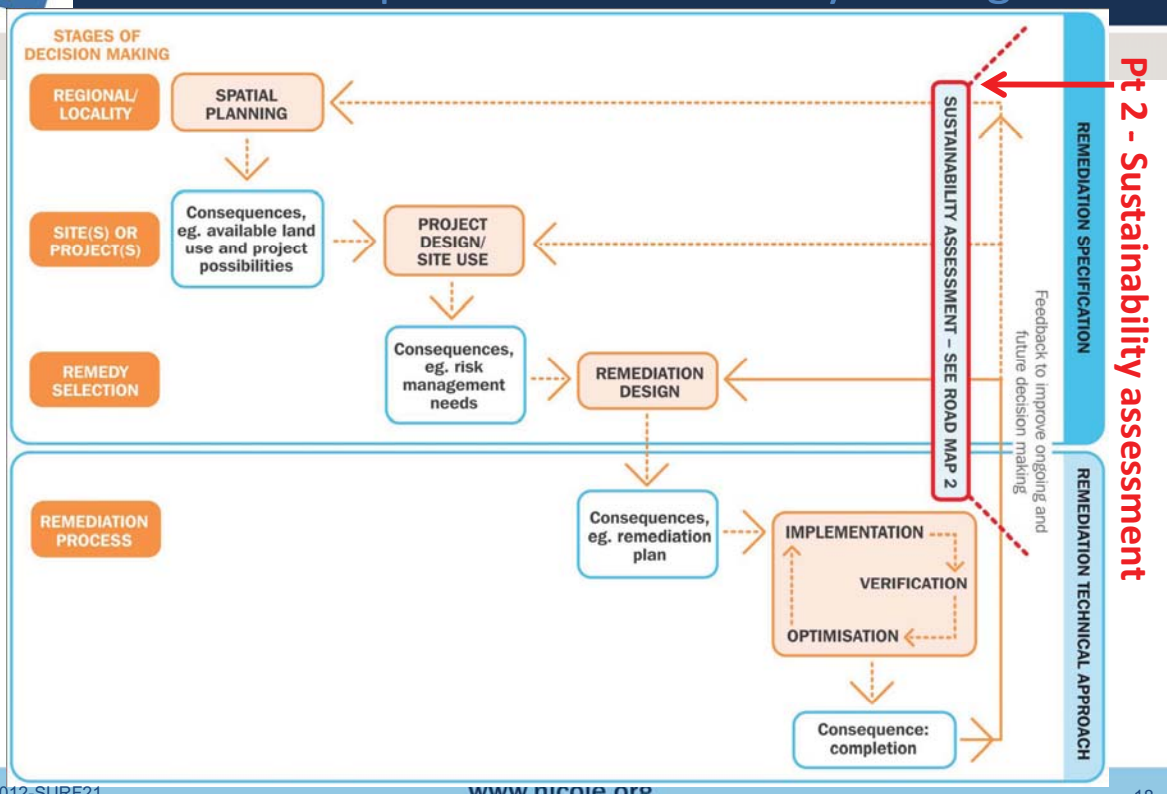
- Similar to risk management and risk assessment, sustainable remediation (SR) can be divided into two inter-related components:
  - Sustainability management: the discipline of integrating sustainability assessment into contaminated land management decision making ;
  - Sustainability assessment: the process of gaining an understanding of possible outcomes across all three elements (environmental, social and economic) of sustainable remediation.
- SR is an iterative process with feedback loops to demonstrate performance and adjust when needed.
- SR can be applied to any project regardless of size

NICOLE Road Map

http://www.nicole.org/documents/DocumentList.aspx?l=9&w=n



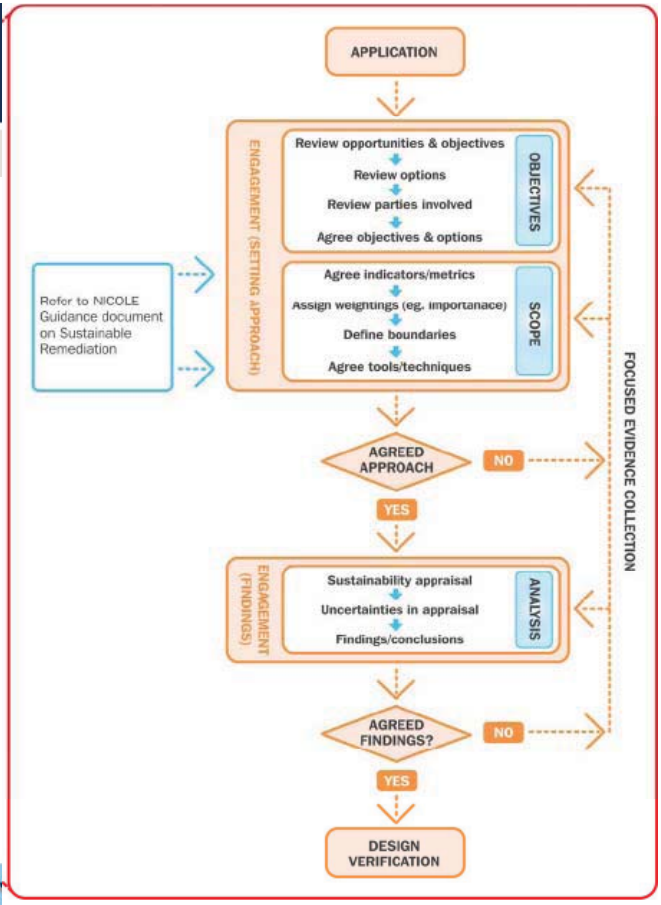
Road Map Pt 1 – Sustainability Management



Road Map Pt 2

Sustainability assessment

Again an iterative process



The feedback loop

Case studies - evaluation

- Countries – UK, Italy, Portugal, Netherlands
  - Greatest uptake in NL and UK - unsurprising as SURF groups well developed in these countries
  - Embedded as principles in legislation in UK
  - Embedded in practise in NL
- Tracking down case studies in other countries

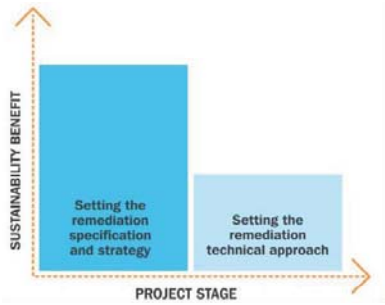
Case studies – Key preliminary findings

- Open communications and increased transparency
- Improved regulator engagement
- Consensus on benefits of integrating sustainability assessment as early as possible
  - Early adoption by stakeholders
  - Removes uncertainty around options later in the process
  - Removes unviable options early on
- Broader consideration of economics, social and environmental factors
- Broad range of tools – value not related to complexity

Sustainability Gains

There are sustainability gains to be made which can be demonstrated:

- Carbon savings
- Demonstrable reduction of disruption to local communities
- Reduction of water impact
- Unlocking marginal sites
- Facilitation of project to deliver actual environmental benefit
- Improved outcome for Project owners
- Economic savings made



Example outcomes

"Our technical approach has not changed significantly"

"The evidence base we have gathered to support our decisions is more robust"

"The lines of evidence of we have presented are enhanced"

"The way we have engaged the regulators and stakeholders is more meaningful"

"The overall outcome is a similar remedial strategy but….We can readily demonstrate *duty of care* which is beneficial to all project stakeholders including us as remediation designers"

"We have helped out client integrate sustainability into all stages of decision making"

"By considering sustainability, we found that the existing remediation scheme was actually having a negative impact on the site"

Challenges and opportunities

- Acceptance/uptake by regulators
- Potential shifts in balance depending on existing legislation, regulator experience and level of conservatism
- Management of residual liability depending on the SR solution

Starting out at the planning stage

Problem statement: Remediation technically difficult to implement in the dock and land
Activities could disturb and release contamination to the water environment

This case study embodies the principles of the first stages of the Road Map:

- ✓ Making sure everyone who should be involved is
- ✓ Defining the purpose of and putting forward SR opportunities to stakeholders
- ✓ Identifying what remediation options to consider
- ✓ Real opportunity to sustainably remediate the site

Now working towards a remedy which will

1. Create enhanced ecological services (incorporated with local ecological areas)
2. Enhance water quality for leisure users
3. Uniform engineered backfill will allow easier and more controlled collection of contamination

Using the RM to derive portfolio SR targets

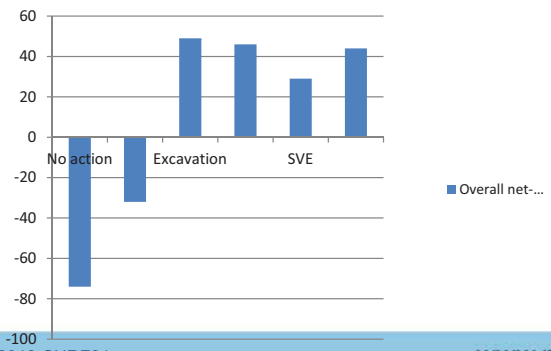
Appraisal of small European portfolio to establish:

1) extent to which sustainable remediation principles described in the NICOLE roadmap have been or could be adopted;

2) to identify where principles are consistent with the corporate goals and if there are broader environmental, social or economic indicators that influence the approach taken; and

3) if applicable, quantify the benefits and/or costs of the sustainable remediation approach

		Env	Social	Econ
Client	Corporate	X	X	X
	Business	X	X	X
	On Site Workers		X	
Neighbours	A		X	
	B	X	X	
	C	X	X	
Regulators	Regional Agency	X	X	X
	Water Agency	X		
	National Agency	X		
Others	NGO 1	X	X	
	Press	X	X	
	NGO 2		X	



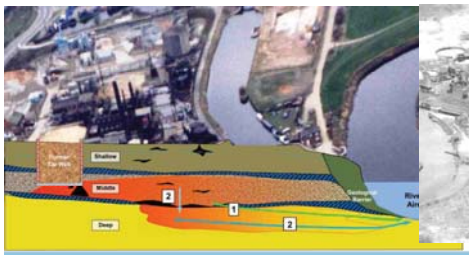
In absence of country specific guidance, NICOLE RM offers a structure that can be applied in variety of national and local circumstances;
Gives clarity & focus - more tangible and site specific
Identified need for more formal recognition of SR problem definition stage, more explicit engagement and adoption of indicators and metrics during project

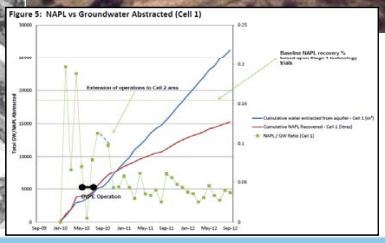
Former tar works remediation– UK NAPL extraction

Former chemical works for tar distillation with more than 100 years of operation. Complex layered aquifer system with DNAPL. Risk of dissolved phase contamination entering adjacent River.

Worked with regulators (Environment Agency) and wider stakeholders every step of the way to look at sustainability in chosen solution.

- selection of appropriate end use of site
- selection of remedial strategy
- acceptable residual levels
- defining the end point for NAPL extraction
- ongoing optimisation of system.





2012 and next steps

- Support and **network session** at Sustainable Remediation conference organised by Eurodemo, November 2012
- Preparing a summary paper on Road Map case study feedback
- Working towards a **joint position statement** with the Common Forum and other European networks

Info

- More information at:
- www.nicole.org/sustainability

Thank you for your attention

Attachment 13
Soil Quality: Guidance on Sustainable Remediation

ISO/TC 190 ISO/NP 18504

Soil quality:
Guidance on sustainable remediation

Qualite du sol:
Lignes directrices sur l'assainissement durable

Professor Paul NATHANAIL
University of Nottingham
Convenor of ISO/TC 190 ISO/NP 18504

Ευχαριστω

- Paul Bardos
- Karin Holland
- Mike Smith
- Long suffering students
- Alexander Nathanail
- SURF

LQM www.lqm.co.uk
Sound science – defensible decisions
SURF
The University of Nottingham

February 27, 2012

HOME ABOUT MEMBERSHIP APPLICATION SUBSCRIBE TO SURF NEWS

SURF
SUSTAINABLE REMEDIATION FORUM

SURF's mission is to make every phase of every cleanup more sustainable.

Protecting the Environment

***DuPont Corporate Remediation Group** launch forum focused on protecting the environment across the globe.*

Dave Ellis, a senior scientist for the DuPont Corporate Remediation Group (CRG), has spent years studying a great conundrum facing environmental remediation professionals—how to clean up the environment without making it dirtier in the process.

Bulldozers, dump trucks and heavy equipment used during cleanups burn millions of gallons of fuel and emit many millions of tons of carbon dioxide and airborne particulate matter. Cleaning up a contaminated property also requires a lot of electricity, natural gas and diesel fuel.

"The primary, non-negotiable goal of any remediation must be to protect human health and the environment," Dave said. "But the emission of global warming gases is an unfortunate, unintended consequence of large-scale remediation."

That's why environmental remediation professionals put DuPont science to work to prevent the cleanup of hundreds of pounds of contaminants in the soil from creating millions of pounds of contaminants in the air.

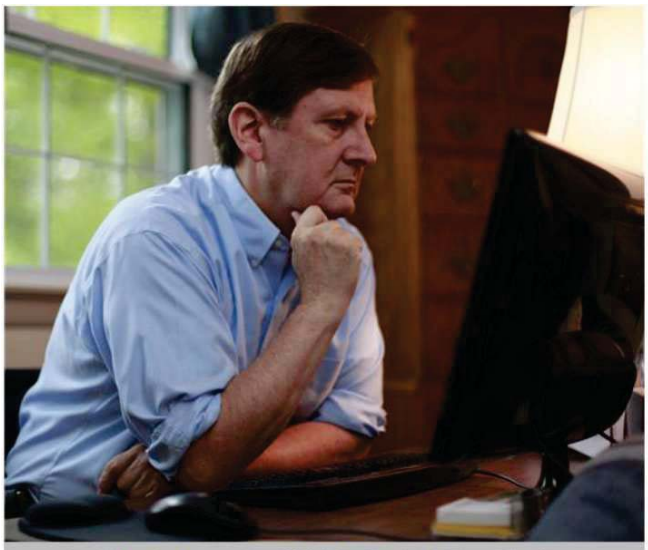
About five years ago, Dave and his colleagues around the world formed SURF, the Sustainable Remediation Forum.

"SURF's mission is to make every phase of every cleanup more sustainable," Dave said. "Regulators, businesses and the public have become increasingly aware of site remediation, and they're demanding cleanups with smaller environmental footprints."

SURF scientists set sustainable remediation goals and devise ways of reducing the amount of energy consumed and emissions created during environmental cleanups. Some methods include on-site treatments, which reduce the number of trucks used to transport contaminated soil or water and the use of biomaterials to encourage the natural attenuation of potential contaminants.

Environmental regulators and policy makers around the globe are taking notice of SURF's work. Dave said that over the next several years, sustainable remediation principles will move from the cutting-edge to the commonplace.

"A warming planet needs remediation solutions that reduce greenhouse gases," Dave said. "Our goal is to deliver them to people when they need them and before they demand them."



Dave Ellis and colleagues formed SURF, the Sustainable Remediation Forum.

Land Quality Management

- Specialist SME consultancy
  (so small we're not even a boutique consultancy!)
  - Risk assessment
  - Remediation options appraisal and verification
  - Expert witness/ intelligent client
- Known for cutting edge consultancy
- Development of
  - LQM/CIEH Generic Assessment Criteria
  - LQM/CIEH Dose Response Roadmaps
  - KeyCSM (with Keynetix)
  - Contaminated Land Ready Reference (with Paul Bardos)
- Training
  - regulators, developers, practitioners everywhere

LQM www.lqm.co.uk
Sound science – defensible decisions
SURF
The University of Nottingham

University of Nottingham

Online Masters in Contaminated Land Management

- Taughts modules:
  - Site investigation
  - Risk Assessment
  - Remediation
  - Urban Regeneration
- Dissertation
- Optional study tour

Members of the National Expert Panel on Contaminated Land

Phil Crowcroft - Consultant ERM
Paul Nathanail - Professor of Engineering Geology at the University of Nottingham and Managing Director of Land Quality Management Ltd
Sarah Rea - Regeneration Manager, National Grid
Simon Cole - Technical Director, URS
Naomi Earl - Freelance Consultant
Seamus Lefroy-Brooks - Principal at LBH WEMBLEY Geotechnical and Environmental
Matt Whitehead - Environment Agency
Ann Barker - Lead Officer Contaminated Land; City of Bradford Metropolitan District Council
Chris Taylor - Enforcement Officer (Contaminated Land), Brent Council
Liz Hamer - Environmental Protection Officer North Lincolnshire Council
Steve Moreby - Contaminated Land Officer Gloucester City Council

The NAS frieze

The investigation of truth is in one way hard and in another way easy. An indication of this is found in the fact that no one is able to attain the truth entirely, while on the other hand no one fails entirely, but everyone says something true about the nature of things, and **by the union of all a considerable amount is amassed**.

Metaphysics a. 1. 993a30-993b4 (Quoting Aristotle)

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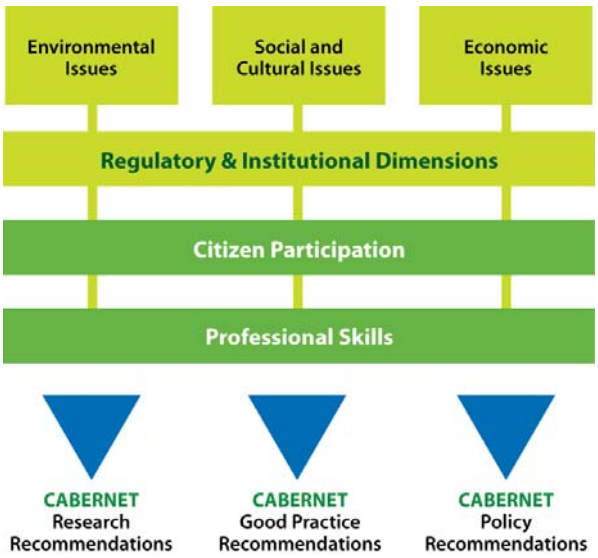
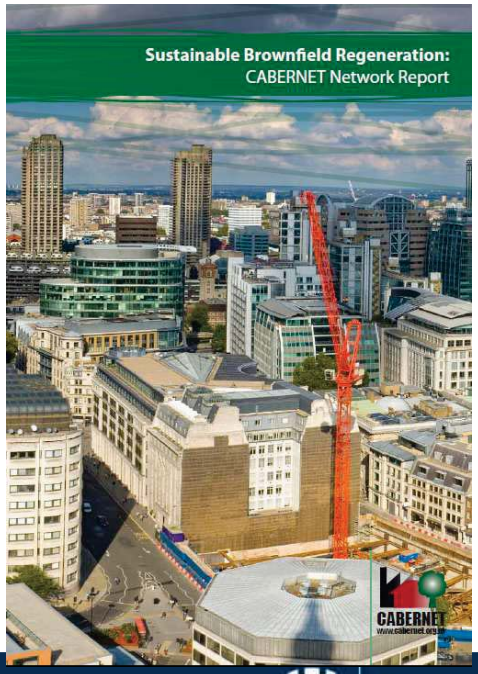
On sustainability

- The investigation of **sustainability** is in one way hard and in another way easy. An indication of this is found in the fact that no one is able to attain the **truth** entirely, while on the other hand no one fails entirely, but everyone says something true about the nature of **sustainability**, and by the union of all a considerable amount is amassed.
- After *Metaphysics a. 1. 993a30-993b4*

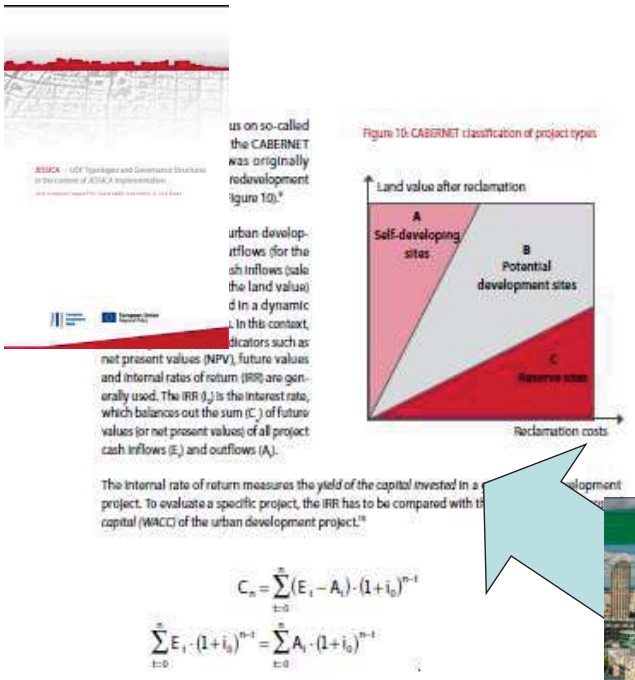
CABERNET

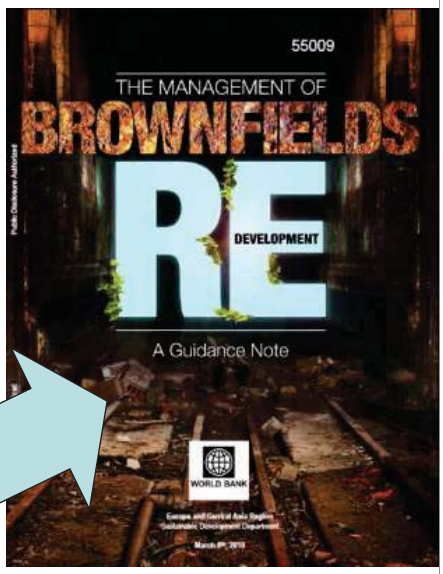
Europe's Sustainable Brownfield Regeneration Network





2010: World Bank adopted the CABERNET definition





JESSICA Fund adopts Cabernet ABC Model

Remediation: paying for past sins

- Should *demonstrably* break the contaminant-pathway-receptor linkage by
  - Removing, destroying, modifying the source
  - Interrupting the pathway
  - Modifying the nature or behaviour of the receptor
- Can include
  - Long term monitoring
  - maintenance
- it is not sustainable *per se*
- It is usually not the main aim of a project

"The best solution is remediation that eliminates and/or controls unacceptable risks in a safe and timely manner, and which maximises the overall environmental, social and economic benefits of the remediation work. We call this sustainable remediation"

SURF-UK, 2010

Legal drivers for remediation

- Stop (significant) harm
- Stop (significant) pollution of surface or groundwater
- Removal of very high (?significant) levels of risk (Part 2A)
- Demonstration of suitability of new land use (Planning)
- Liability management
- Hazard removal – eg IPPC, IED

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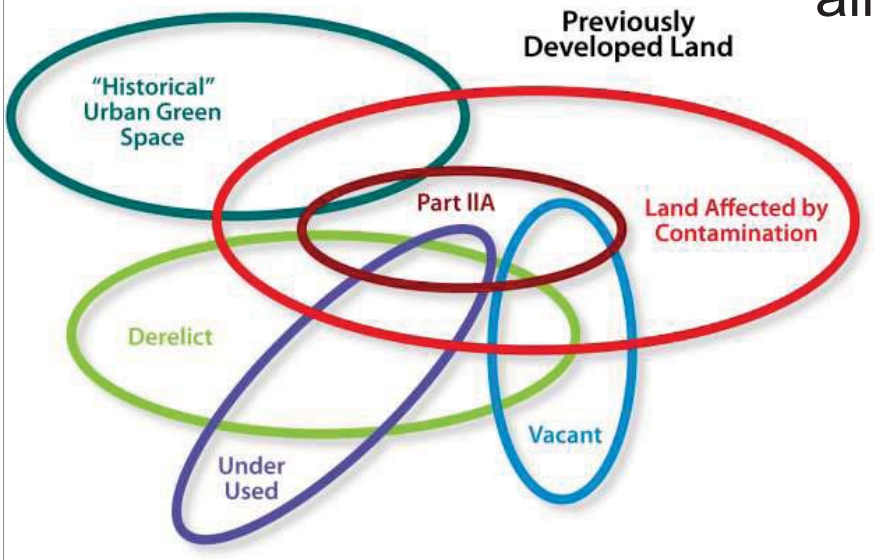
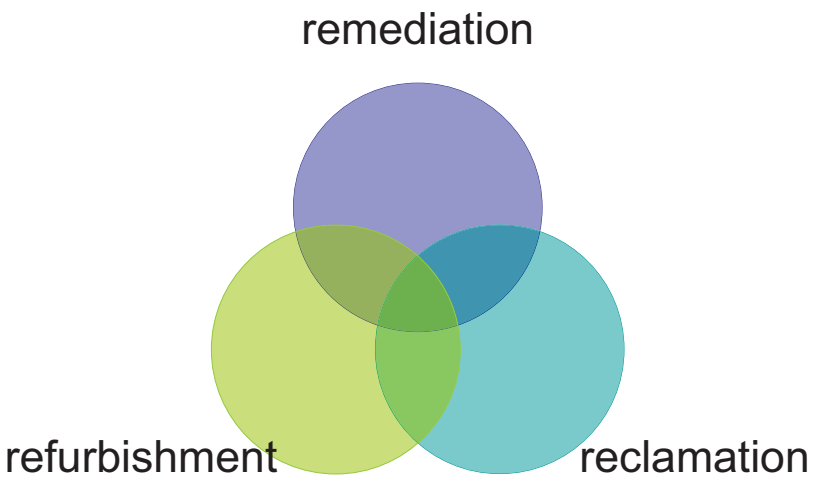
Remediation is usually an objective not the aim of a project



"Buy land – they're not making it any more" Mark Twain

Remediation is not the only result

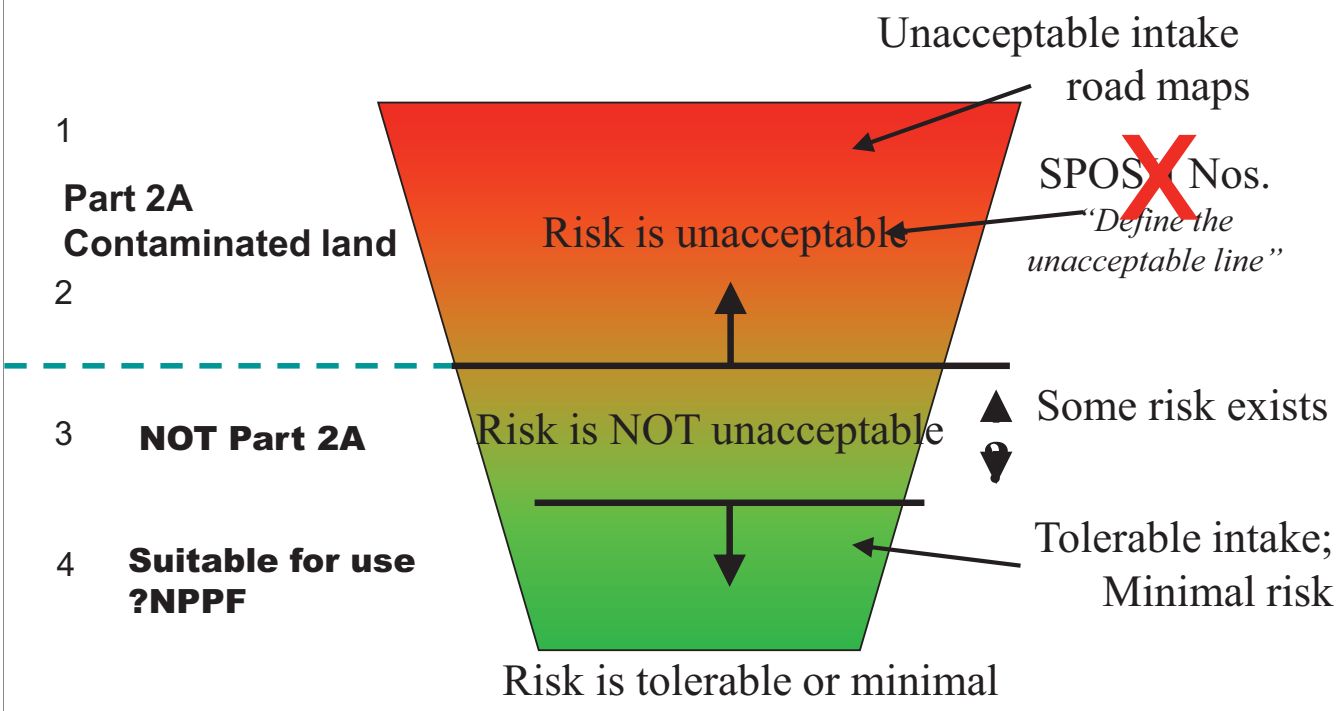


Embedding remediation into regeneration

"The best ***site specific*** solution is remediation that eliminates and/or controls unacceptable risks in a*n* ***integrated****,* safe and timely manner, and which maximises the overall environmental, social and economic benefits of the ***regeneration*** work. We call this ***smart regeneration***..."

(**After** SURF-UK, 2010)

Levels of risk: 'human' world



What has ISO ever done for me?

CMA CGM Marco Polo

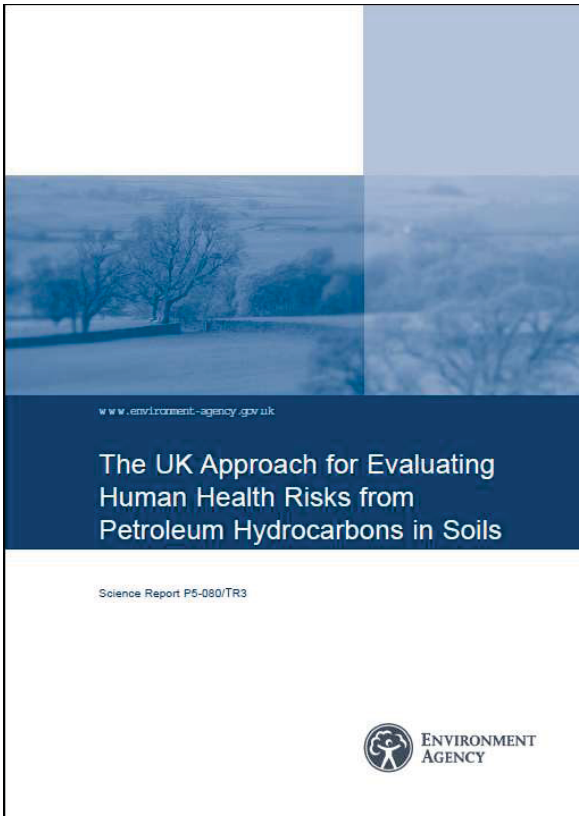
"Much of the cargo was consumer goods destined for businesses and goods in time for Christmas".

"The great thing about standards is that there are so many to choose from." - Anon.

ISO/TC 190/SC 7
Secretariat: DIN
Voting begins on: 2012-03-07
Voting terminates on: 2012-05-07

Soil quality — Assessment of impact from soil contaminated with petroleum hydrocarbons

Qualité du sol — Évaluation de l'impact du sol contaminé avec des hydrocarbures pétroliers



(CPN email to DE 6/3/2012)

- My vision for the ISO document is for it to be an informative rather than normative document that establishes a common baseline in terminology, concepts and contexts from which either national or further ISO documents could hang.
- We have seen in the UK and elsewhere (eg some local laws in the USA as presented in SuRF19) legal requirements for sustainability appraisal yet in most cases the skills, tools and consensus on how to go about this are lacking.

Arguing with an ISO 9000 auditor is like wrestling with a pig in mud. Sooner or later you realise the pig enjoys it!

Who develops standards?

"ISO standards are developed by groups of experts, within technical committees (TCs). TCs are made up of representatives of industry, NGOs, governments and other stakeholders, who are **put forward by ISO's members**. Each TC deals with a different subject, for example there are TCs focusing on screw threads, shipping technology, food products and many, many more."

ISO

The ISO way…

Key principles in standard development

1. ISO standards respond to a need in the market
2. ISO standards are based on global expert opinion
3. ISO standards are developed through a multi-stakeholder process
4. ISO standards are based on a consensus

ISO: a network of 164 national standards bodies

Australia	SA	France	AFNOR
Austria	ASI	Germany	DIN
Brazil	ABNT	Japan	JISC
Burundi	BBN	New Zealand	SNZ
Canada	SCC	South Africa	SABS
China	SAC	USA	ANSI
Cyprus	CYS	United Kingdom	BSI
Eritrea	ESI		

ISO Technical Committees

TC 1	Screw threads
TC 20	Aircraft and space vehicles
TC 29	Small tools
TC 41	Pulleys and belts (including veebelts)
TC 174	Jewellery
TC 190	**Soil Quality**
PC 273	Customer contact centres

ISO TC 190 Soil Quality Working Groups

ISO/TC 190/SC 01 "Evaluation of criteria, terminology and codification“

ISO/TC 190/SC 02 "Sampling"

ISO/TC 190/SC 03 "Chemical methods and soil characteristics“

ISO/TC 190/SC 04 "Biological methods“

ISO/TC 190/SC 05 "Physical methods“

ISO/TC 190/SC 07 "Soil and site assessment“

- ISO/TC 190/SC 07/WG 06 "Leaching tests"
- ISO/TC 190/SC 07/WG 08 "Bio-availability“
- ISO/TC 190/SC 07/WG 10 "Soil impact on groundwater“
- ISO/TC 190/SC 07/WG 11 "Soil functions“
- **ISO/TC 190/SC 07/WG 12 “Sustainable remediation"**

TC190 Participating Countries

Secretariat: Netherlands (NEN)

participate actively in the work and obliged to vote on all questions submitted to vote

- **Australia (SA)**
- Austria (ASI)
- Belgium (NBN)
- Czech Republic (UNMZ)
- Denmark (DS)
- Egypt (EOS)
- Finland (SFS)
- **France (AFNOR)**
- Germany (DIN)
- India (BIS)
- **Italy (UNI)**
- Jamaica (BSJ)
- **Japan (JISC)**
- Kenya (KEBS)
- Korea, Republic of (KATS)
- Libya (LNCSM)
- Mongolia (MASM)
- Norway (SN)
- Poland (PKN)
- Russian Federation (GOST R)
- Sri Lanka (SLSI)
- Sweden (SIS)
- Turkey (TSE)
- Ukraine (DSSU)
- **United Kingdom (BSI)**

☹ *NO Brazil, USA, New Zealand*

TC190 Observing Countries

- Argentina (IRAM)
- Bosnia & Herzegovina (BAS)
- Botswana (BOBS)
- **Canada (SCC)**
- **China (SAC)**
- Colombia (ICONTEC)
- Croatia (HZN)
- Cuba (NC)
- Côte d'Ivoire (CODINORM)
- Ecuador (INEN)
- Estonia (EVS)
- Greece (ELOT)
- Hungary (MSZT)
- Iran, Islamic Republic of (ISIRI)
- Iraq (COSQC)
- Ireland (NSAI)
- Lithuania (LST)
- Portugal (IPQ)
- Romania (ASRO)
- Saudi Arabia (SASO)
- Serbia (ISS)
- Singapore (SPRING SG)
- Slovakia (SUTN)
- Slovenia (SIST)
- Spain (AENOR)
- Switzerland (SNV)
- Syrian Arab Republic (SASMO)
- Thailand (TISI)
- Tunisia (INNORPI)
- Viet Nam (STAMEQ)

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The University of Nottingham

The ISO way…

BSI EH4

Dec 2012

Key principles in standard development

1. ISO standards respond to a need in the market
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3. ISO standards are developed through a multi-stakeholder process
4. ISO standards are based on a consensus

1. New standard is proposed to relevant technical committee

If proposal is accepted

2. Working group of experts start discussion to prepare a working draft
3. 1st working draft shared with technical committee and with ISO CS

If consensus is reached within the TC

4. Draft shared with all ISO national members, who are asked to comment

If consensus is reached

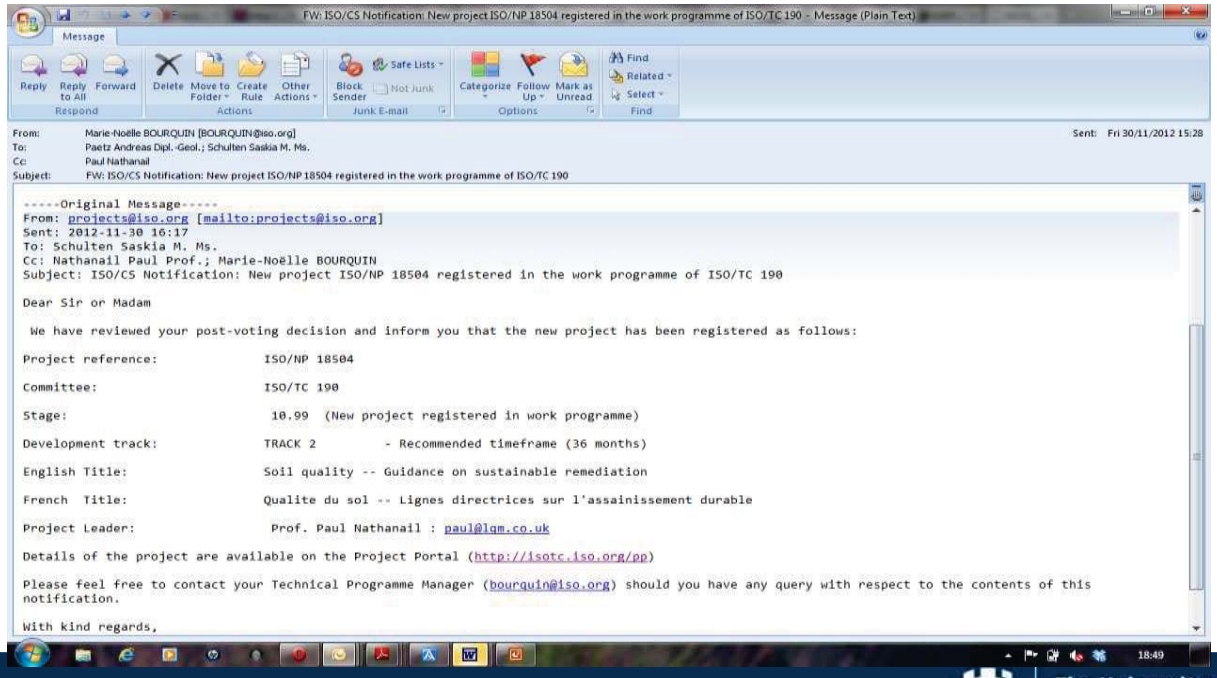
5. Final draft sent to all ISO members

Need 75% yes

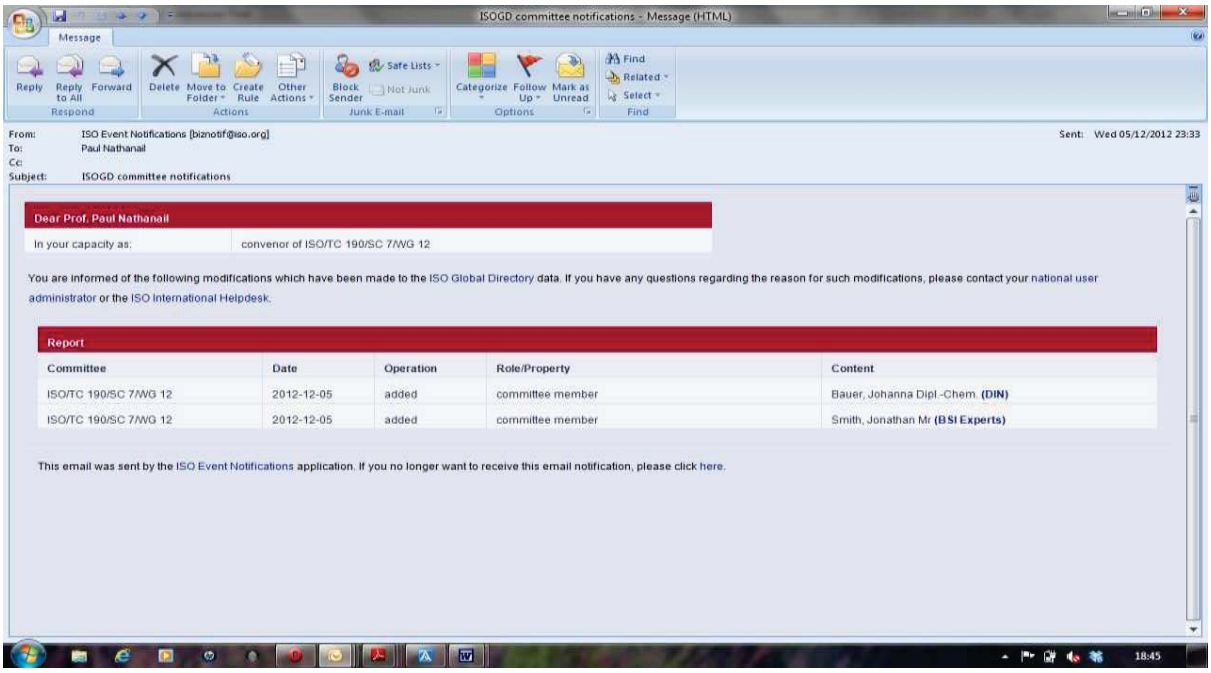
If standard is approved by member vote

6. **ISO International Standard**

Green light….



Ask not for what …



Modus operandi

- WGs work among the members on informal drafts until ready to submit a **Committee Draft** for formal circulation by the member bodies. This is followed in due course by a **Draft International Standard** and then by a **Final DIS** – which is essentially the version to be published.

Title	Contents
Sustainable development	Summary of the concept and how it has been adopted around the world
Sustainable remediation	Summary of risk based and other approached to contaminated land management; the role of remediation and the scope of such remediation to be sustainable
Related concepts:	Clear summaries on the related concepts (Green remediation; sustainable redevelopment; sustainable regeneration and how they are similar to and distinct from sustainable remediation
Integrated appraisals, metrics and evaluations	Summary of ways to integrate the various dimensions to provide an holistic measure to benchmark against the definition of SR
Economic dimension	Economic aspects of sustainability –generic and remediation specific
Social dimension	Social aspects of sustainability –generic and remediation specific
Environmental dimension	Environmental aspects of sustainability –generic and remediation specific
The role of Governance and institutional structures	The influence of legislative, policy and institutional controls on achieving SR; illustrated with explicit or implicit examples
Metrics and indicators	How can individual elements be measured and monitored
Trends and thresholds	What trends or thresholds indicate SR OR unsustainable remediation
The role of tools	The strengths and weaknesses of different types of sustainability appraisal tool; what they can and cannot do; ways of evaluating such tools to ascertain on a project specific basis their suitability for use

Next steps

- Kick off meeting: week of 21 January 2013
  - Agree scope and structure of document
  - Agree lead authors & reviewers
  - Agree schedule (See right)
- Bimonthly online progress meetings
- Face to face opportunities in 2013
  - EU Aqua Consoil,
  - USA US EPA Brownfields, Battelle
  - ANZ CleanUp

SURF25

Thank you!

Copies of slides or to continue the conversation:
paul.nathanail@nottingham.ac.uk

Keep in touch:
@cpnathanail

www.jiscmail.ac.uk
(sustainableremediation forum)

www.linkedin.com (contaminated land management group)

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(sustainableremediation forum)

www.linkedin.com (contaminated land management group)

"A warming planet needs remediation solutions that reduce greenhouse gases. Our goal is to deliver them to people when they need them and before they demand them."

Dave Ellis, DuPont

Attachment 14
Protecting Human Health and the Environment with a Lower Environmental Footprint

Protecting Human Health & the Environment with a Lower Environmental Footprint: US EPA's Experience to Date

Carlos Pachon

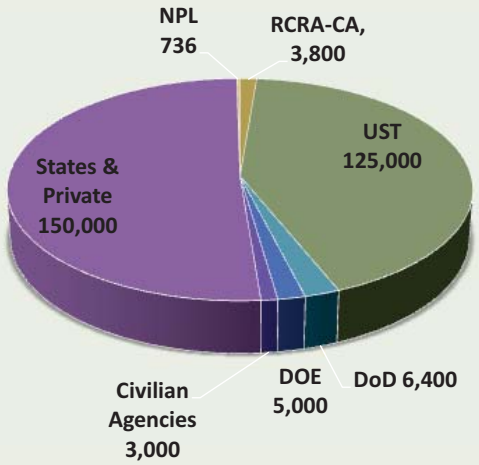
SURF 21 Meeting
Washington, DC
December 12-13, 2012

EPA Contaminated Site Programs: We Still a Lot of Remediation Work to Do

- We have made great progress cleaning up contaminated sites…
- Going forward we will invest significant resources cleaning up contaminated sites in all programs
  - » Superfund
  - » RCRA Corrective Action
  - » Underground Storage Tanks
  - » Brownfields
  - » Federal Facilities
- We have an opportunity to take lessons learned over the past decades, and apply the innovations and best management practices to future sites.

Estimated Number of Contaminated Sites
(United States, Cleanup horizon: 2004 – 33)

Total Sites = 294,000



Source: www.clu-in.org/market

Sustainability : U.S. Policy Drivers at Many Levels

- **Executive Order 13514: Federal Leadership in Environmental, Energy, and Economic Performance**

  It is the policy of the United States that Federal agencies shall increase energy efficiency; measure, report, and reduce their greenhouse gas emissions from direct and indirect activities; conserve and protect water resources through efficiency, reuse, and stormwater management; eliminate waste, recycle, and prevent pollution (President Obama)

- **EPA Strategic Plan 2011-2015: Goal 3: Cleaning Up Communities and Advancing Sustainable Development**

  EPA's Superfund program will implement its green remediation strategy to reduce the energy, water, and materials used during site cleanups while ensuring that protective remedies are implemented (Administrator Lisa Jackson)

- **EPA Office of Solid Waste & Emergency Response Policy (OSWER): Principles for Greener Cleanups**

  As a matter of policy, OSWER's goal is to evaluate cleanup actions comprehensively to ensure protection of human health and the environment and to reduce the environmental footprint of cleanup activities, to the maximum extent possible. (OSWER Assistant Administrator Mathy Stanislaus)

- **Regional policies and action plans**
- **… consistent with regulatory requirements**

Sustainability in Superfund Site Remediation

- **Social:**
  - » Engaging communities in site cleanup decisions
  - » Turning contaminated sites into community assets
- **Economic:**
  - » Redevelopment in blighted areas (aligns with smart growth goals)
  - » Fostering employment opportunities in communities where sites are cleaned up
  - » Rising property values in communities
  - » Remediation in the U.S.: A $7billion/year economic engine
- **Environmental:**
  - » Protecting Human Health and the Environment
  - » Liberating contaminated sites for reuse (1 remediated acre redeveloped = 4 acres of green field development)
- **Challenge: A smaller footprint in cleaning up sites**

Community Involvement (CI): Robust "Social" leg in Superfund

- By Law, Superfund requires community input in remedy decisions and implementation
- EPA parallels the International Association for Public Participation 7 "core values of public participation"
- EPA has a CI policy since 1981, and nearly 100 CI Coordinators across the 10 regional offices
- Technical assistance (grants and services) are provided to ensure communities are independently advised on challenging technical issues
- Our experience shows good CI results in better remedies
- Environmental justice link

…members of the public affected by a Superfund site have a right to know what the Agency is doing in their community and to have a say in the decision-making process. (Superfund Community Involvement Handbook).

Fostering Redevelopment and Economic Opportunities

- In Superfund, Remedial Action Objectives factor *reasonably anticipated future landuse*.*
- EPA serves as an active partner in helping to return sites to productive uses
  - » Funding reuse assessments and redevelopment planning
  - » Removing reuse barriers, real or perceived
  - » Partnering with local governments, communities, developers, and other interested stakeholders
- Beyond cleanup: Sites ready for anticipated reuse is a key Superfund "GPRA" goal
- Annually 300 businesses at 142 Superfund sites with redevelopment has taken place generate $8.8 billion in sales, 25,000 jobs and $1.6 billion in employment income

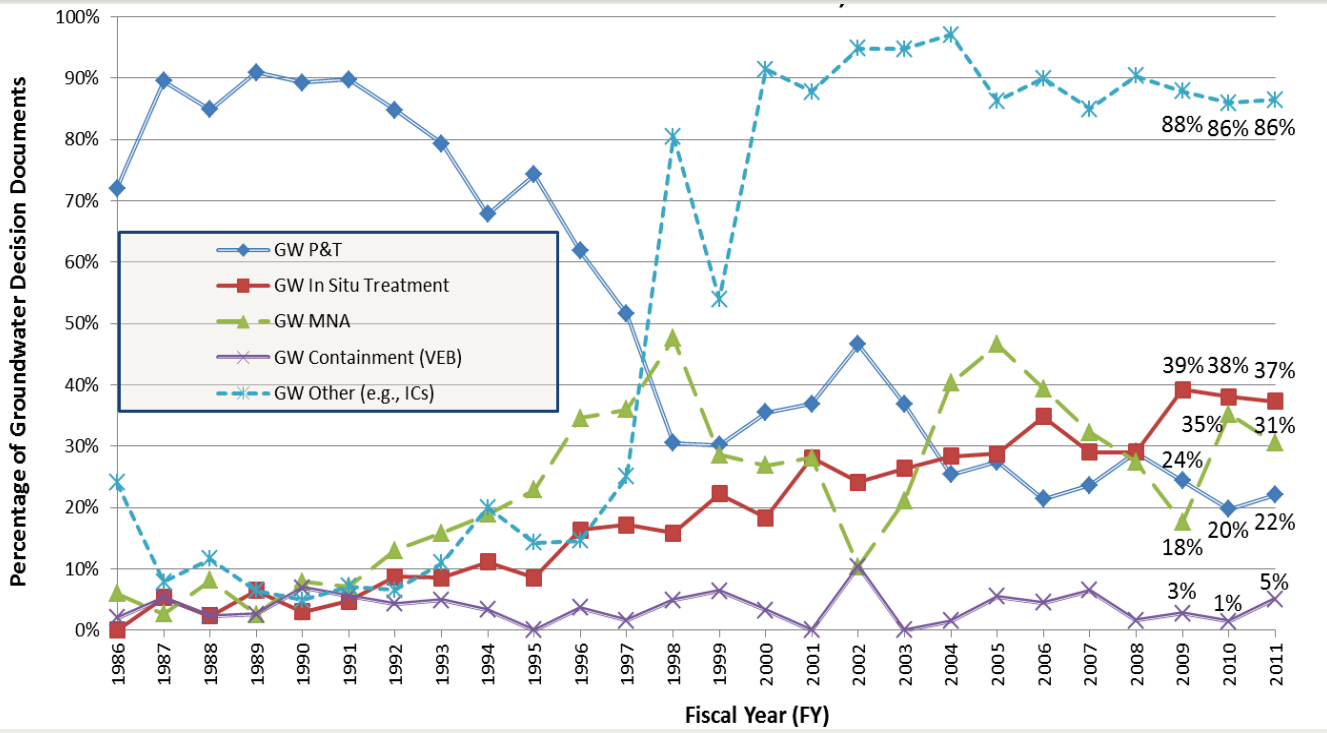
Challenge: Lowering the Environmental Footprint of Site Cleanup Projects

Green Remediation

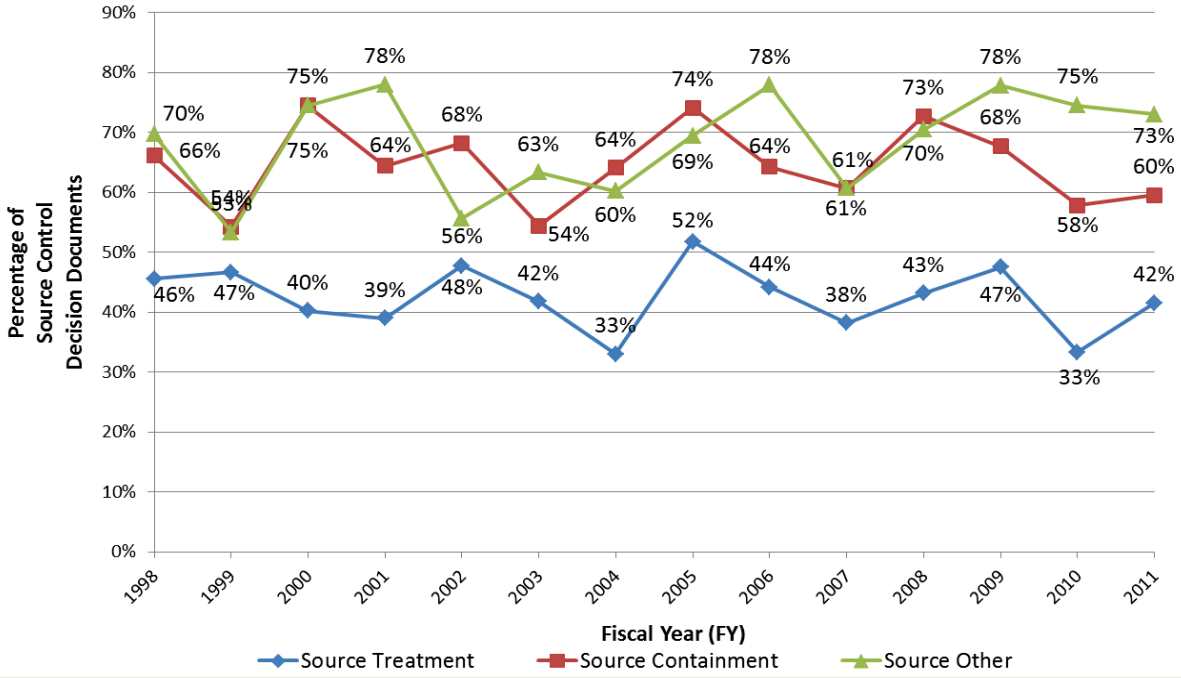
The practice of considering all environmental effects of remedy implementation and incorporating options to minimize the environmental footprints of cleanup actions.

*as defined by US EPA, *a.k.a.* greening response actions, greener cleanups, etc.

Trends in Superfund Decision Documents Selecting Groundwater Remedies (FY 1986–11) Total Groundwater Decision Documents = 1,912



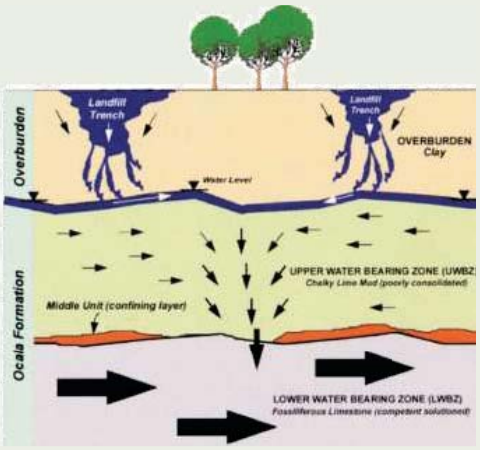
How Are We Cleaning up Contaminated Sites?
Trends in Types Superfund Source Control Decision Documents



It's no

Footprint Reduction in Remedies

- **Consistent with science and engineering principles and lessons learned to date**
- **Minimizing footprints and large reductions in footprints come from…**
  - » Accurate conceptual site model (CSM)
  - » Well-characterized source areas and contaminant plumes
  - » Optimal remedial strategy
  - » Sound engineering in design
  - » Streamlined performance monitoring



- **…then, focus on greening the resulting remedy**

Addressing the Environmental Leg of Sustainability: Core Elements of Green Remediation

Footprint Reduction Opportunities: The Superfund Energy & GHG Example

- Site cleanups often involve energy intensive remedies (see below)
- The annual carbon footprint of Superfund remedies is estimated at over 400MMT CO2e
- Use less: Optimizations completed at over 200 Superfund pump and treat systems
- Renewables: 185MW renewable capacity has been installed on contaminated sites*
- RECs for the rest: Superfund purchased 100k RECs in 2012

Technology	Estimated Energy Annual Average ($kWh*10^3$)	Total Estimated Energy Use in 2008-2030 ($kWh*10^3$)
Pump & Treat	489,607	11,260,969
Thermal Desorption	92,919	2,137,126
Multi-Phase Extraction	18,679	429,625
Air Sparging	10,156	233,599
Soil Vapor Extraction	6,734	154,890
Technology Total	***618,095***	***14,216,209***

Implementation of GR in EPA Contaminated Site Programs

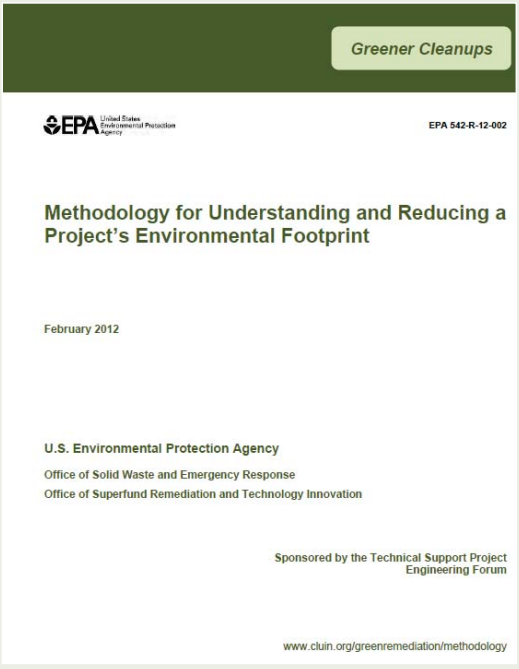
- Define internal policies, strategies and program action plans:
  - » Cross-Agency Principles for all cleanup programs
  - » Superfund green remediation strategy & 40 action items
  - » Leverage related programs such as Re-Power America
  - » Update contracting language to reflect new practices
- Develop technical guidance for practitioners
  - » Best management practice fact sheets (13 to date)
  - » Environmental footprint evaluation methodology
- Leverage voluntary market driven options
  - » ASTM Standard Guide for Greener Cleanups
- Collaborating with other Federal Agencies
- National strategy to advance remedy optimization

Options for Implementing Green Remediation

- **Direct Use of Best Management Practices (BMPs)**
  - Excavation and Surface Restoration
  - Site Investigation
  - Pump and Treat Technologies
  - Bioremediation
  - Soil Vapor Extraction & Air Sparging
  - Clean Fuel & Emission Technologies for Site Cleanup
  - Integrating Renewable Energy into Site Cleanup
  - Sites with Leaking Underground Storage Tank Systems
  - Landfill Cover Systems & Energy Production
  - Mining Sites
  - Implementing In Situ Thermal Technologies
  - Overview of EPA's Methodology to Address the Environmental Footprint of Site Cleanup

www.cluin.org/greenremediation/

- **For Complex Projects – Apply Footprint Methodology**



Information and Resources

- **Guidance Documents**
- **Special Issues Primers**
- **Technical Bulletins**
- **Fact Sheets**
- **Case Studies and Project Profiles**
- **Technology Descriptions**
- **Vendor Support**
- **Current and In-depth Information:**
  - » BMPs for common cleanup approaches
  - » Policy information at Federal and State level
  - » Assessing a project's environmental footprint
  - » Technical support

Hazardous Waste Clean-Up Information (CLU-IN)
www.clu-in.org/greenremediation

Green Remediation Focus

US EPA
www.epa.gov/oswer/greenercleanups

Brownfields and Land Revitalization Technology Support Center
www.brownfieldstsc.org

Optimization
cluin.org/optimization

Thank You!

Carlos Pachon
pachon.carlos@epa.gov

EPA Office of Superfund Remediation and Technology Innovation

US EPA, Washington DC

http://cluin.org/greeremediation

Attachment 15
Common Forum Activities and Approaches on Contaminated Land Management

Common Forum and ICCL activities and approaches on Contaminated Land management

D. DARMENDRAIL
October 2012

"COMMON FORUM" / ICCL

- Network of contaminated land policy experts and advisors:
  - International scale (since 1993), Europe (since 1994)
- Mission:
  - Being a platform for exchange of knowledge and experiences, for initiating and following-up of international projects among members,
  - Establishing a discussion platform on policy, research, technical and managerial concepts of contaminated land,
  - Offering an exchange of expertise to the European Commission and to European networks.

The European and International Networks on contaminated land management

- NATO CCMS (80s – 2007)
- **International Committee on Contaminated Land (since 1993)**
- **Common forum on contaminated land in Europe**
  - CARACAS (1996 – 1998)
  - CLARINET 1998 – 2001)
- NICOLE (since 1996)
- Sednet
- Cabernet
- Eurodemo / Eurodemo+
- SNOWMAN
- IMPEL (Environmentinspectorate)
- SURF 21

- WHO / Contaminated Sites & Health

COMMON FORUM on Contaminated land in the European Union

Common Forum

3

45 participating countries in ICCL (1993 - 2011)

COMMON FORUM on Contaminated land in the European Union

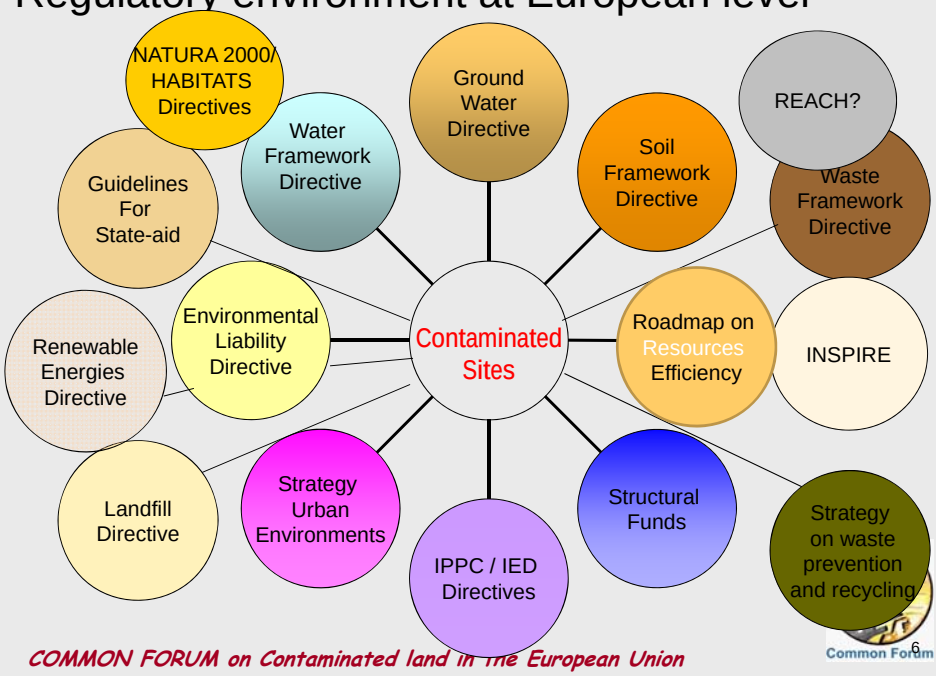
Common Forum

4

Some examples of Common Forum actions

- New concepts for Contaminated land management:
  - Risk based land management (now in place in some EU countries – third generation of legal frameworks)
- Critical analysis of EU Directives proposals
  - Alternative proposal for a Soil Protection Directive
- Proposal of technical guidance documents for EU Directive implementation
- Discussions with researchers:
  - i.e. need for harmonisation

Regulatory environment at European level



Evolution of contaminated land policies at national level

- **First generation: the early days 1980**
  - Drastic risk control, focus on soil contamination
  - systematic approaches (protocols, national inventories)
- **Second generation: contaminated land risk assessment 1990**
  - Possibilities for tailor-made approaches with cost effective investigations
  - Landuse becomes very important in assessment and decision making
- **Third generation: Risk Based Land Management and solution design 2000**
  - Integration with spatial planning, water management, socio-economy
  - Economic development vs. protection of Environment & HH

Managing contaminated sites Key messages

- **Several dimensions / a single framework**
  - **With legal, technical, financial, organisational tools**
  - Preventing new pollution – Impact Assessment of new projects
  - Operating industrial sites:
    - Preventing Accident / special infrastructures, warning systems, monitoring
    - Reducing emissions / Use of BATNEEC (processing, filtering)
    - Polluter pays principle
    - Act as soon as emission.
  - Legacy pollution:
    - Risk based approach – from RBLM to sustainable land management
    - Use a tiered approach using cost-benefits approach
    - Combining and balancing the three pillars of sustainable remediation

Needs of evolution to meet new challenges 4th generation of policy framework

- Sustainable use of natural resources:
  - consumption of resources should not exceed the carrying capacity of the environment,
  - de-coupling of resource use and waste generation from economic growth.
- Verification of environmental technologies (eco-efficient, evaluated against 'indicators)
- Life cycle thinking integrated to sector policies
- EU climate and energy targets ("20-20-20"-targets): highly energy-efficient, low carbon economy.
-

Contaminated Land Management Milestones

- **Risk Assessment**: investigating and understanding environmental impacts and risks taking a tiered approach
- **Land Management:** designing and implementing actions to reduce negative consequences and ***balance benefits***

WATCH OUT:

- **not trading unacceptable risks against other management objectives & aspects**

Contaminated Land Management Principles

- **Fitness for use:** to ensure safe use or reuse of contaminated sites by preventing unacceptable risks for citizens and the environment
- **Stand-still**: no further degradation of natural resources (soil and groundwater)
- **Supporting sustainable development:** to balance benefits at an appropriate scale and time frame
- **Transparency and fairness**: to establish well known assessment and decision criteria within appropriate consultation processes facilitating possible consensus of involved stakeholders

Common Forum

What's common? What's different?

	Risk	Sustainability
origin / use	economy/science	ecology/policy
based on …	mental construct	ethical construct
objective	transparency	fairness
important	• single target • accountability • effectiveness	• multi-objective • interdependency • efficiency
question	Should we act?	How can we act?
support to	better decisions	better action
strategy	prevent or limit	synergy

Common Forum

4th generation of legal framework CLM objectives

- **risk reduction**
  - preventing unacceptable human health risks
  - reducing environmental impacts and limiting risks
  - appropriate time frames
- **local/regional development** (spatial planning)
  - supporting economic development
  - improving environmental quality with regard to capacities of the natural system
- **wider environmental policies**
  - e.g. 20-20-20-targets

What we need to Enhance

MANAGING "LAND" (soil & groundwater)

- matching human needs to natural resources and capacities
- crossing geographical and time scales (site to globe and back; short-, mid- and long-term)
- promoting synergies, avoiding irreversibility

Concluding remarks (1/2)

- Different pieces of EU legislation, with different basic principles (hazards for waste, risks for soils)
  - Recognise the efforts already done
  - Existing Common Ground for managing CS
- Need of real integration for more sustainability
  - 1st step: Joint Statement with NICOLE (European industry network)
- Real need for technical work for transposition

Concluding Remarks (2/2)

- ICCL action plan
  - Expertises for contributing to site projects/ demands (third expertise?, operational cell?)
  - Information / Knowledge Transfer Platform
    - Promotion of best practices / recommended roadmap, links to existing tools, success stories, experts database
    - Consistent capitalizations
  - Development of a common framework / Roadmap for CLM
  - Identification of gaps to be addressed in the future (RTD, policy?)

- Thanks for your attention!

- More information on
  www.commonforum.eu
  www.iccl.ch