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International Developments in Sustainable and Green Remediation

Session 8A "Sustainable Remediation: International Developments
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Introduction

Sustainable and green remediation concepts and techniques are being developed by international government agencies and consortia at an increasing rate to respond to environmental, social, and economic needs and opportunities. While the terms sustainable and green remediation are often used interchangeably, they differ in their scope and perceived benefits per organization. The purpose of this paper is to characterize the two practices, highlight their synergies and differences, and present information on the evolution of the practices and the recent and future collaborations of international organizations to promote their use.

Sustainable and Green Remediation Defined

The United States Environmental Protection Agency (USEPA) defines green remediation as the practice of considering all environmental effects of remedy implementation and incorporating options to minimize the environmental footprints of cleanup actions. Green remediation efforts are performed in association with the primary goal of remediation, which is to protect human health and the environment. The term Sustainable Remediation is often applied by various parties to the broader concept of balancing of economic growth, protection of the environment, and social responsibility, toward achievement of an improved quality of life for current and future generations. Sustainable remediation, therefore, includes environmental factors, but more broadly also considers social and economic factors.

In August 2009, the USEPA released its Principles for Greener Cleanups, which served to provide the overall agency goals for green remediation, regardless of the regulatory program under which a cleanup is performed. The Principles are not intended to allow implementation of remedies that do not satisfy threshold requirements for protectiveness or other site-specific cleanup objectives, nor are they intended to trade cleanup program objectives for other environmental objectives. A successful green remediation effort is one that helps achieve cleanup objectives by ensuring protectiveness while decreasing the environmental footprint of the cleanup activity itself (i.e., protectiveness will not be bargained against any other benefit).

The Principles described USEPA's approach to conducting greener cleanups through focus on the five following core elements:

Managing and minimizing **material** use and **waste** generation

Reducing **energy** use, increasing energy efficiency, and using renewable energy sources

Protecting the quality of **air** and reducing emissions and greenhouse gases

Conserving, protecting, and restoring **land and ecosystems**

Conserving **water** use and improving the overall quality of water

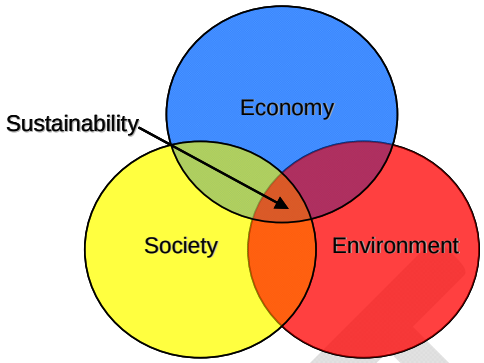
Relationship of Green Remediation and Sustainability

Green remediation integrates environmentally beneficial or neutral practices into decision-making, design, implementation, and operational strategies of a site cleanup and requires transparency of cleanup decision-making, planning and implementation activities for the local community and other stakeholders.

Sustainable remediation integrates environmental, social, and economic factors and seeks to maximize the net benefit of all three in a balanced way. Sustainability cannot be measured in absolute sense. Its assessment draws together individual environmental, economic and social concerns important for a project. For example, environmental concerns might include greenhouse gas emissions and impacts on soil functionality; economic concerns might include a project's direct costs and resilience; and social factors might include the protection of human health and provision of access to green space. An extensive review of indicators sets in various sectors can be found in the document "*A Review of Published Sustainability Indicator Sets: How applicable are they to contaminated land remediation indicator-set development*?"[1]

[1] Contaminated Land: Applications in Real Environments (CL:AIRE) (2009). London, UK, ISBN 978-1-905046-18-8

The figure below illustrates the relationship between environment, economy, and society, wherein the intersection of all three elements forms the basis for sustainability.



A societal belief is that living in a clean environment is crucial to the health and well being of humans and the natural world. Government fulfills society's demands for a clean environment through the implementation of site remediation regulations, guidelines, and implementation efforts. The primary goal of environmental remediation, therefore, is to protect human health and the environment through protective waste management practices and the assessment and cleanup contaminated sites. However, the societal element of sustainability is broader than this, and remediation projects may cause impacts as well as deliver benefits. The Sustainable Remediation Forum in the United Kingdom (SuRF-UK) distinguishes impacts to human health (whether as a result of risks from contamination or as a result of remediation) within the societal element of sustainability; which includes all "people" related consideration. There may also be wider societal benefits from a remediation project, for example the project may support an improved infrastructure as part of its delivery which delivers a benefit beyond the project's remediation goals.

Contaminated sites frequently exist as part of a community, often with people who live, work, or play in areas around the site. It is important, therefore, to ensure that site cleanup achieves protectiveness goals and has minimal impact on the community itself. Advances in technology and best practices provide the opportunity to achieve equal or greater levels of protectiveness and less impact on communities via smaller site cleanup footprints. At the same time, cleanup is most successful when it also meets the current and future needs of the community, such as preparing contaminated sites for productive reuse. From a societal perspective, therefore, while environmental cleanup is primarily intended to result in healthier communities, cleanup can directly contribute to community sustainability.

From an economic perspective, funds spent toward environmental cleanup can be considered an investment in the community. They increase property values, and provide other positive economic impacts such as jobs to local residents and businesses. This enables communities to directly benefit from the economic opportunity associated with the cleanup itself, as well as through the sustained long-term benefits derived from site revitalization. Cleanup may provide a unique platform to build sustainable, lifetime - perhaps life-changing - skills.

Site cleanup also provides an opportunity and mechanism to convert a significant amount of land area back into productive reuse. This is significant because as global populations increase, the quantity of livable space becomes increasingly limited. Urban sprawl and other development and industrial / agricultural pressures continue to claim open, undeveloped (and typically uncontaminated) space. With trends in populations moving to urban areas[2] – it makes sense to focus on redevelopment of urban corridors as a solution. Redevelopment of urban areas with existing transportation, water, power, and other major infrastructure also has a lesser environmental footprint than developing new greenspace. This is what is referred to as "smart growth" and each local site cleanup plays an important role in addressing global sustainability issues.

Support of Sustainable and Green Remediation by the International Community

The advancement of sustainable and green remediation regulations, policies and practices is being supported internationally by governmental agencies, non-governmental organizations, industry, academia, and practitioners. Government agencies are in various stages of establishing regulations, policies and practices to improve human health and the environment through sustainable practices. Non-governmental organizations are seeking to define practices of sustainability and ways to incorporate those practices through technology. Following are examples of government and non-government organizations who are involved in the sustainability movement.

Governmental Agencies

United States – Environmental Protection Agency

The United States Environmental Protection Agency (USEPA) was created in December 1970 and was formed to consolidate federal research, monitoring, standard-setting, and enforcement activities related to environmental protection. In 1980, USEPA's Superfund Program was created to clean up hazardous waste sites and respond to emergencies involving hazardous substances. Today, USEPA is actively evolving cleanup activities associated with investigation and remediation of hazardous waste sites to incorporate green and sustainable practices.

Technologies and practices in the environmental industry started out with the development of very basic approaches to manage or contain contamination. In the 1980s and 1990s, and even into the early 2000s, the industry experienced a revolution in the growth and innovation in the number and types of technologies used to characterize and remediate sites. More recently, the industry has moved from revolutionary developments in technologies and practices to the refinement and enhancement of current technologies and the development of best management practices in applying those technologies to improve remedy effectiveness. Current developments are focused on optimization of existing remedial systems and lowering the environmental footprint of existing and planned remedial efforts through green remediation.

[2] United Nations, Department of Economic and Social Affairs, Population Division (2006). World Urbanization Prospects: The 2005 Revision. Working Paper No. ESA/P/WP/200.

Demands for a cleaner environment and a focus on sustainability created renewed impetus for government to respond to societal needs. On October 5, 2009, President Barack Obama signed Executive Order (EO) 13514 which established "an integrated strategy towards sustainability in the Federal Government and makes reduction of greenhouse gas (GHG) emissions a priority for Federal agencies." EO 13514 serves as a driver for the greening of management of all federal programs. In September 2009, the Principles for Greener Cleanups were issued which describe USEPA's Office of Solid Waste and Emergency Response (OSWER) approach to greener cleanups. These principles provide a framework for all cleanup programs managed by USEPA, such as the Superfund, Brownfields, Underground Storage Tank, and State Voluntary Cleanup Programs. The Principles indicate that a footprint analysis will be performed for all sites requiring environmental remediation and that actions will be taken in order to reduce the environmental footprint. The Principles help to support USEPA's goals which are identified within the 2006-2011 USEPA Strategic Plan; specifically, Goal 5 which indicates that "EPA will accelerate the pace of environmental protection by taking compliance and enforcement actions that produce environmental results, by preventing pollution at the source and advancing other forms of environmental stewardship, and by embracing the tools of innovation and collaboration."

To further the adoption of green and sustainable remediation practices, USEPA provides site technical support; develops and facilitates technology transfer through publications, internet resources and conference presentations; and develops and delivers specialized training.

More information on USEPA's green and sustainable remediation initiatives and resources can be found via the following websites:

- www.cluin.org/greenremediation
- www.epa.gov/superfund/greenremediation
- www.epa.gov/sustainability

Canada – Environment Canada

Environment Canada (EC) was established in 1971. It is responsible for coordinating environmental policies and programs as well as preserving and enhancing the natural environment and renewable resources. EC's mission is to protect the environment, conserve Canada's natural heritage, and provide weather and environmental predictions. In support of this, EC objectives include repairing past environmental damages, assembling and disseminating information, and developing, applying, and enforcing policies in order to prevent future environmental injury.

Between 2000 and 2002, a policy framework was established for the management of Canada's contaminated federal sites. It consisted of polices and best practices including:

- Federal Contaminated Sites and Solid Waste Landfills Inventory Policy
- Federal Contaminated Sites Management Policy
- Policy on Accounting for Costs and Liabilities Related to Contaminated Sites

In 2006, the Federal Contaminated Sites and Solid Waste Landfills Inventory Policy and Federal Contaminated Sites Management Policy were replaced with the Treasury Board Policy on the Management of Real Property. This new policy sought to manage the land in a sustainable and financially-responsible manner throughout its lifecycle and perform the activities through efficient and cost-effective government programs.

The Federal Contaminated Sites Action Plan (FCSAP) is a cost-shared program that was initiated in 2005 to help federal departments to address contaminated sites for which they are responsible. The primary objective of this program is to address the risks that these sites pose to human health and the environment and to reduce the associated financial liability. Other program objectives include supporting other socio-economic outcomes, such as training and employment of Canadians and promotion of innovative technologies.

In March 2010, the Sustainable Development Office within EC released a consultation paper called "Planning for a Sustainable Future: A Federal Sustainable Development Strategy for Canada" which includes environmental sustainability as an integral part of the Government of Canada's decision-making processes. The three key elements of the strategy include:

- integrated, government-wide actions to achieve environmental sustainability;
- linking the planning and reporting of sustainable development with the government's expenditure planning and reporting system;
- establishing measurement, monitoring, and reporting in order to track and report on progress.

More information on EC's sustainable development initiatives remediation initiatives and on the Federal Contaminated Sites Action Plan can be found via the following websites:

- www.ec.gc.ca
- www.federalcontaminatedsites.gc.ca

Non-Governmental Organizations

EURODEMO+

EURODEMO, European Co-ordination Action for Demonstration of Efficient Soil and Groundwater Remediation, was a 36-month project created to compile demonstrations of innovative remediation technologies. It was established in relation to the Sixth European Union (EU) Environment Action Programme and the EU Environmental Technology Action Plan (ETAP), which emphasized the sustainable use of natural resources, in particular that the consumption of resources should not exceed the carrying capacity of the environment, and defined the goal of de-coupling of resource use and waste generation from economic growth. EURODEMO+ has been established as a follow-up network in order "to promote and encourage the use of soil and groundwater remediation technologies through demonstration, with emphasis on the use of sustainable and cost-effective remediation practices." The network also aims to integrate to new policy drivers like the EU Thematic Strategy on the Sustainable Use of Natural Resources, which sets out for integrating life

cycle thinking to sector policies, and the European "20-20-20" EU climate and energy targets to meet the challenge of transforming the EU into a highly energy-efficient, low carbon economy (http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0030:FIN:EN:HTML).

EURODEMO+ understands eco-efficiency as an important component of the overall sustainable development picture. Sustainable development comprises three elements: society, economy, and environment. Eco-efficiency is an economic and ecological (environmental) analysis of processes and products aiming at economic and environmental optimization. Eco-efficiency is a ratio between a specific value (financial, ecological benefit, or social welfare) and environmental impacts, or the inverse of this ratio. Depending on the denominator for expressing a ratio of economic vs. ecological aspects, results may indicate environmental productivity, environmental intensity, environmental improvement costs, and/or environmental cost-effectiveness. It links to some policy visions like "decoupling" or more popular "Factor 4", doubling the service but halving the impacts.

EURODEMO+ European activities include: 1) the support and production of peer-reviewed publications regarding quality sustainable demonstrations; 2) maintenance of a directory of European demonstrations; 3) monitoring the use of remediation technologies across Europe; 4) assisting the development of documentation in order to enable comparative information; and 5) providing individual support such as providing existing demonstration protocols and technical guidance documents. On the transnational level, EURODEMO+ activities include presentations, training workshops, and networking in order to maintain the information exchange.

More information on EURODEMO+ can be found via the following website - www.eurodemo.info.

Sustainable Remediation Forum (SURF)

The Sustainable Remediation Forum (SURF) was created in 2006 in the United States with 12 participants and has expanded to over 75 members and 350 participants. SURF became a non-profit corporation in 2010. SURF serves as a forum for the collaboration, education, advancement, and development of consensus on the application of sustainable concepts to remediation. The organization seeks to evaluate these concepts of sustainable remediation throughout the lifecycle of the remedial process.

Because branches of SURF have been created in other countries, this SURF is commonly referred to as SURF US. SURF US defines concepts of sustainability from the viewpoint of remediation practitioners and includes members from the USEPA, state regulatory agencies, industry, consulting, Department of Defense (DoD), Department of Energy (DOE), and academia.

SURF US released the document "*Sustainable Remediation White Paper—Integrating Sustainable Principles, Practices, and Metrics Into Remediation Projects*" which describes the understanding and incorporation of sustainability into the remediation process by SURF

members. The white paper reviews current sustainable remediation practices within the U.S. and includes both advantages and disadvantages of sustainable remediation. Current projects for SURF US include: 1) the development of guidance for how to use lifecycle analysis within remediation; 2) the mapping of metrics for sustainability; and 3) the development of a framework which is a compilation of U.S. efforts towards sustainability.

More information on SURF US can be found via the following website - www.sustainableremediation.org.

SuRF United Kingdom

SuRF-UK is a United Kingdom-based initiative inspired by SURF US which was formed in 2007 and consists of regulators, industry, academics, and consultants. SuRF-UK is completely independent of SURF in the US. It includes strong input by all UK sectors (regulatory, industry, service provider, and academic). SuRF-UK is currently being led by CL:AIRE which is a not-for-profit organization dedicated to the regeneration of the United Kingdom's contaminated land through the use of sustainable remediation technologies. Open forum meetings are held which typically consists of 50 to 60 delegates.

Because of the regulatory landscape in the UK, SuRF-UK can consider sustainability from a more fundamental level than SURF US, looking at sustainable development and its involvement within policy, spatial planning, the land development cycle, and approaches to risk-based contaminated land management decision-making. SuRF-UK developed a framework in order to evaluate the sustainability of soil and groundwater remediation and to incorporate balanced decision making in the selection of the remediation strategy in order to address land contamination as an integral part of sustainable development. This framework is the first of its kind in the UK. The next step for SuRF-UK is to test the framework with real case studies, which will be taking place through the spring of 2011, to investigate indicator categories, and to benchmark assessment methods for the same sites.

More information on SuRF-UK can be found via the following website - www.claire.co.uk/surfuk.

SURF Netherlands

A second initiative inspired by SURF US, SURF Netherlands (NL), was just recently presented during the National Soil Congress in 2009 and was well received. Currently, there are 15 organizations supporting SURF NL. SURF NL's goals include the communication, integration, and balance of sustainability within soil quality management in the Netherlands. SURF NL is interested in sustainability not only on a site level, but on a larger area-wide scale. They also hope to establish a decision-support framework which is based on existing frameworks of the Dutch ROSA and Risk, Environmental Benefits, and Costs (REC) tools. These decision-support tools consider sustainability in the process of setting and selecting remediation goals and technologies.

At the time this paper was written, SURF NL was yet to be established in NL thus no website is provided for reference.

Network for Industrially Contaminated Land in Europe (NICOLE)

Established in 1995, the Network for Industrially Contaminated Land in Europe (NICOLE) is a forum on contaminated land management in Europe. NICOLE currently has over 400 members from the industrial, consulting, academic, and regulator areas. The organization supports collaboration and consensus on the development and use of sustainable technologies amongst academia, industry, and practitioners. Its objectives include: 1) providing a European forum for the sustainable remediation of industrial and commercially-contaminated land; 2) defining research requirements and encouraging joint research to identify, assess, and address contaminated sites within Europe in a more cost-effective and efficient manner; and 3) coordinating with international networks to account the various stakeholders and interest groups.

In October 2008, the Sustainable Remediation Working Group was created which consists of 20 active members and has five subgroups: 1) Communication; 2) Risk Management; 3) Economics; 4) Indicators, and 5) Case Studies.

In 2009, NICOLE issued a questionnaire about sustainable remediation to its members. Survey results confirmed that sustainable remediation is a new concept which is used in many different ways across Europe. Results also indicated that the use of a cost-benefit analysis for risk assessment is not an accepted tool in all countries and within remediation projects, economic and social impacts are not widely considered.

NICOLE has created a roadmap for sustainable remediation across Europe that is still being finalized. A guidance document is being developed that describes how the roadmap was created, discusses the economics, indicators, risk assessment for sustainable remediation, and includes case studies. A pilot test of the roadmap will be performed upon completion of the document.

More information on NICOLE can be found via the following website - www.nicole.org.

Common Forum on Contaminated Land in the European Union (Common Forum)

The Common Forum on Contaminated Land in the European Union (Common Forum) was created in 1994 from members of 16 national governmental and European Union (EU) member state agencies involved with contaminated soil and groundwater resources. Its mission is to facilitate information exchange on international projects in order to create a forum for discussion on policy, research, and technical and managerial concepts of contaminated land and to support European Commission and European networks with expert information.

In 2000 the CLARINET project developed the Risk Based Land Management Concept which introduced sustainability approach in Contaminated Land Management, integrating: (i) the perspective of protection related to the impact of contamination; and (ii) the spatial planning perspective which takes into consideration the way land is used.

Some European Countries (e.g., The Netherlands, France, etc.) decided to modify their legal framework related to Contaminated Land Management by implementing sustainable solutions, which will restore the usability and economic value of the land. These solutions can be characterised by three elements:

1. **Suitability for use:** This is achieved by reducing human health risks and ecological risks as necessary to permit the safe (re)use of the land. It is focused on quality requirements of the land for uses and functions.
2. **Protection of the environment:** For example, preventing further spreading of pollution by surface water and groundwater. Environmental protection of soils as a resource may also lead to policies favoring redevelopment of brownfields over greenfields.
3. **Long term care:** Sustainable solutions minimize the burden of aftercare. Endless pump and treat solutions or containment walls that require control and maintenance forever may be less desirable in view of the amount of aftercare required.

The ***"Risk Based Land Management"*** approach provides a framework for the integration of two assessments:

- The timetable for remediation: Priority setting based on current risks or society's needs to change the use of contaminated land.
- The design of the solution: The best strategy to meet all requirements in a sustainable way, including environmental side effects, available space and facilities, local perceptions and other issues.

More information on the Common Forum can be found via the following website - www.commonforum.eu.

International Collaboration Efforts

International collaboration efforts on the development and promotion of sustainable and green remediation have already begun, with more events planned for the future. The following are but a few examples involving the organizations described herein.

US and EU Perspectives on Green and Sustainable Remediation, July 12, 2010

This interactive Internet Seminar was hosted as a primer to the Special Session 8A "Sustainable Remediation: International Developments" being presented during ConSoil 2010. The seminar was open to the public and over 170 people from 16 nations participated. International leaders of sustainable and green remediation initiatives discussed their organizations' drivers, goals and constraints, as well as the impacts of drivers and constraints on their efforts. The panel of speakers included representatives from the USEPA; EC; SURF US, SuRF-UK, and SURF NL; EURODEMO+; NICOLE; and the Common Forum.

Speakers were requested to address key questions of their organizations' perspectives and actions on green and sustainable remediation. These questions are identified within Attachment A as well as each organization's response to the questions. After the speaker portion of the seminar,

an open forum was held after the presentations during which participants were able to submit questions to the speakers. A transcript of the questions and answers derived from the open forum is provided within Attachment B. An archived version of the internet seminar, including the audio portion of the seminar, is available at www.cluin.org/consoil.

ConSoil 2010 - Special Session 8A "Sustainable Remediation: International Developments;" September 22-24, 2010, Salzburg, Austria

This paper has been prepared as a primer for this session and provides preliminary information on international organizations involved in the sustainable remediation arena.

More information on the session can be found at www.clu-in.org/consoil.

ConSoil 2010 - USEPA Special Training Session on Innovative Practices in Site Assessment and Cleanup

The USEPA will provide five 90 minute training sessions on current best practices in the area of environmental cleanup optimization. Four training sessions will focus on optimization conducted at specific project cleanup phases, and one session will focus on how to effectively leverage a variety of US-based information resources to support optimization efforts. The training courses include:

- Investigation Process Optimization
- Green Remediation Footprint Reduction
- Design Optimization Through Independent Design Review
- Remedy Optimization Through Remedial System Evaluation
- U.S. Information Resources

Abstracts for each of these training sessions can be found at www.clu-in.org/consoil.

Post ConSoil 2010 Internet Seminar

The authors anticipate that an Internet Seminar will be held as a follow-up to ConSoil 2010, the purpose of which will be to continue to identify and address challenges associated with green and sustainable remediation of contaminated soil and groundwater. The seminar will be open to the public.

For more information, visit www.cluin.org/consoil or www.clu-in.org/training/#upcoming.

References/Resources

- 2006-2011 USEPA Strategic Plan (www.epa.gov/ocfo/plan/2006/entire_report.pdf)
- CL:AIRE 2009. A Review of Published Sustainability Indicator Sets: How applicable are they to contaminated land remediation indicator-set development? CL:AIRE, London, UK, ISBN 978-1-905046-18-8 (www.claire.co.uk/surfuk)
- Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, and the Committee of the Regions - 20 20 by 2020 - Europe's climate change opportunity (http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0030:FIN:EN:HTML)
- Environment Canada website (www.ec.gc.ca)
- Federal Contaminated Sites Webpage on the Government of Canada website (www.federalcontaminatedsites.gc.ca)
- Planning for a Sustainable Future: A Federal Sustainable Development Strategy for Canada (www.ec.gc.ca/dd-sd/9E362EF7-74F6-4189-8AAF-B966EB2F9157/Planning_for_a_Sustainable_Future_a_Federal_Sustainable_Development_Strategy_for_Canada.pdf)
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- United Nations, Department of Economic and Social Affairs, Population Division (2006). World Urbanization Prospects: The 2005 Revision. Working Paper No. ESA/P/WP/200 (www.un.org/esa/population/publications/WUP2005/2005wup.htm).
- United States Executive Order (EO) 13514 (www.fedcenter.gov/Bookmarks/index.cfm?id=13641)
- U.S. Environmental Protection Agency Participation at ConSoil 2010 Webpage on the CLU-IN website (www.cluin.org/consoil)
- USEPA Green Remediation Webpage on the CLU-IN website (www.cluin.org/greenremediation)
- USEPA Principles for Greener Cleanups (www.epa.gov/oswer/greencleanups/principles.html)
- USEPA Superfund & Green Remediation website (www.epa.gov/superfund/greenremediation)
- USEPA Sustainability website (www.epa.gov/sustainability)

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Attachment A

US and EU Green and Sustainable Remediation Internet Seminar
Question and Answer Summary

Note that SURF Australia did not present during the seminar.

Can you expand on why the European Soil Framework Directive is hindering sustainable remediation of contaminated land?

Environment Agency Austria: The European Soil Framework Directive does not hinder sustainable practices but it hinders the shift of the general focus of discussions. The ongoing policy debate (e.g., inventories, soil/site status reports) is blocking and does not allow a shift towards sustainability.

The social dimension of sustainability is often overlooked. How does SURF recommend incorporating social dimension of sustainability into remediation protection?

SURF US: Assuming that the remediation project is in the early stages, there will be certain outcomes and impacts that are more important depending on consideration of the site, community, land use, and stakeholder concerns. Some social considerations include efforts to minimize traffic in the local neighborhood and reducing emissions to protect on-site workers and the local community. Community interest should also be considered in the planned reuse of the land. Their ideas should be incorporated and prioritized with other environmental and economic considerations during initial planning. However, social impact may also be considered throughout the duration of the remediation project.

SuRF-UK: Social impacts have equal weight with economic and environmental considerations. Social issues are included in a more "soft" view of sustainability. There are six broad elements of sustainable remediation including human health and safety which considers not only the performance of the remedy in the long term but also in the short term such as risk to on-site workers and nearby residents during the actual performance of the remedy. Issues of equity and ethical consideration are also important. There is a concern about remediation projects that take place in areas that are occupied by underserved portions of the population. Remediation response may have both negative and positive impacts to the community. Negative impacts include dust, noise, traffic, etc. Positive impacts for some sites including removing blight through remediation of the site.

USEPA: Community input on remedy decisions is required by law under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

There is a very robust community involvement program in Superfund. In addition, any impact the remedy has on those communities such as air quality should be considered. Action taken to reduce impacts such as emissions will immediately benefit the surrounding community.

Common Forum on Contaminated Land in Europe: There are several court cases in the UK regarding issues on the impact of the remediation on future land use. To avoid future problems, it is important to consider social dimensions during the initial planning stage.

Is USEPA considering any changes in policy or guidance that relate to criteria used to select remedies under CERCLA that specifically address consideration of green and sustainable remediation and does this include safety concerns with implementing remedy?

USEPA: The USEPA is working on clarifying guidance on green remediation and the nine criteria used to select remedies. However, no significant changes are being made. Guidance will clarify how green remediation can be considered within the nine criteria. The goal is to clarify what authorities USEPA has to expend public dollars to take green remediation actions and what it can do in terms of cost recovery for PRP sites.

Safety concerns are addressed in both CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (National Contingency Plan or NCP). USEPA is determining the best way to clarify and reinforce work safety concerns in CERCLA. Clarifications are needed on topics such as training, work and health safety plans, auditing processes, the role of OSHA, etc.

How are Canada and European Union groups working with regulators at the project management level to overcome skepticism of alternative, less energy-intensive technologies and ease the learning curve burden?

USEPA: The USEPA believes that no one remedy is greener than another. The remedy should be evaluated with the cleanup objective and end-use goals. While some remedies are not resource or energy intensive, these may be best-suited for the site to achieve the end-use goals. Green remediation focuses on how the remedy is implemented. There are always opportunities to green the remedy despite how resource intensive it may be.

Common Forum on Contaminated Land in Europe: The Forum is trying to better inform and train members. They recently produced a joint statement with NICOLE on innovative technologies and how to implement them at contaminated sites.

NICOLE: NICOLE believes that the key is to assess the overall goals and objectives at the beginning of the project to gain maximum sustainability. There is better chance to obtain desired outputs if sustainable practices are considered early in the remedy design process.

SuRF-UK: This is an important part of the discussion in SuRF-UK. Good case studies and training should be used to increase knowledge and decrease skepticism.

Are you considering soil services and functions in sustainable remediation and if so, how?

USEPA: Ecosystem services are one of the core elements of USEPA's definition of green remediation. There is a lot of ongoing work within the U.S. to develop tools to quantify the footprint of a remedy. The U.S. Air Force has developed a sustainable remediation tool. In addition, Battelle has developed a tool adopted by the Army and Navy. These tools include a protocol for quantifying environmental footprint at remedial sites. One area that is weak right now is ecosystem services especially in regards to soil services.

EURODEMO+: Ecosystem services are recognized as an upcoming field. The organization believes it should be considered in sustainable remediation.

SuRF-UK: Ecosystem services are one of the sustainable indicators. Ecosystem services are becoming more and more part of the criteria to determine what is sustainable and what is not. It's is an upcoming issue that is impacting the view of sustainability.

What is the panels' thought on the time or cost required for a site to obtain certain cleanup target?

SuRF-UK: Time and cost are key criteria in decision making and also form part of the sustainable remediation debate. Some stakeholders are worried that very conservative risk assessment GENERIC criteria and assumptions may lead to fundamentally unsustainable solutions that do not consider site specific factors. On the other hand, there are also concerns that sustainability should not be used as an excuse to reduce the stringency of environmental and public health protection.

USEPA: The question comes into a broader sustainability discussion of should we remediate a site to the point where any end use is possible. The increasing population demand on types of land-use may increase the need to redevelop Brownfield sites versus creating greenspace. There is an incorrect perception that all sites should be cleaned up to background levels. However, institutional controls are widely-implemented at cleanup site. This indicates that the USEPA is using all methods to make the site protective of the environment

NICOLE: Once a decision is made regarding the end use of the site, there is still an opportunity to assess and revise the end use goals if necessary. This is important in France's management of cleanup sites and a usefully strategy to come up with solutions that are appropriate for the site.

Sustainability assessments may suffer from different perspectives and views by the stakeholders. How important is it to define boundaries and undertake sensitivity analysis?

NICOLE: Defining boundaries are critical during the planning stages of the project. However, it is not seen as a difficult issue. Regarding sensitivity analysis, it is part of

what is required for the management of remediation projects. It should not be prescriptive but it is something that is needed to build trust and consensus among stakeholders.

USEPA: The USEPA is assessing the footprint methodology to determine how to best identify 20 percent of activities that are targeting 80 percent of the site. In addition, sensitivity analysis will help avoid issues of green washing where someone claims that they took action to address one part of the remedial action but ignored other large parts.

SuRF-UK: SuRF-UK believes that boundary and sensitivity analysis are important to dictate the results at the site. If you don't clearly consider the boundaries, then it will be more difficult to obtain the desired result. It is important to consider life-cycle boundaries of the project.

Sensitivity analysis can be a tool to help stakeholders reach a consensus. If there are multiple groups involved and one is holding out for a set of different indicators, then a sensitivity analysis can be run to determine the overall impacts of each set of indicators.

Attachment B
US and EU Perspectives on Green and Sustainable Remediation Matrix

Organization (Speaker)	Constituency			Drivers		
	Who are your members	Who are you seeing to influence	What do you want to achieve	Policy	Regulatory	Market
US EPA (Carlos Pachon)	US federal and state government	US and global citizens	The US EPA's definition of green remediation was released in 2008 in a primer on Green Remediation. The practice of green remediation is the consideration of all environmental effects of all remedial options and incorporating option to minimize the environmental footprints of cleanup actions. The focus is on contaminated sites and includes all the work needed to protect human health and the environment from contaminants and where possible to prepare these sites for reuse. The goal is to consider the environmental impacts during environmental remedy selection, implementation, and completion.	The concept of green remediation is a priority at many levels. 1) OSWER Policy: Principles for Greener Cleanups 2) EPA Strategic Plan: Goal 5 Compliance and Environmental Stewardship 3) EO 13514: Federal Leadership in Environmental, Energy, and Economic Performance Work is also underway to develop voluntary green cleanup standards and certification systems, which will be a robust tool to foster green remediation. There are also quite a few EPA Regional initiatives. In addition, some of the other federal agencies including DoD and DOE are taking their own initiatives to reduce footprint of the cleanup of their sites.	There are several regulatory frameworks including RCRA corrective action, Superfund, Brownfields UST, voluntary state programs. OSWER Principles for Greener Cleanups apply to these programs managed by the EPA.	Between 2004 and 2033, 294,000 sites will require environmental cleanup actions costing $209 Billion. The environmental footprint for a cleanup project will vary depending on the size of the site. Based on greenhouse gas estimate on the footprint of a medium sized site, data indicates that there is a significant greenhouse footprint. Looking forward, any improvements made to the operation today will have a long payback.
EURODEMO+ (Dietmar Mueller)	From 2004 through 2006, Eurodemo+ has been a European co-ordination action. It was a project funded by the European Commission. Since 2008, it has grown into a voluntary network of four national/regional demonstration platforms seeking to exchange information. and 18 partners from nine European countries.		Eurodemo+ assists and connect stakeholders on "good quality" demonstration practices across Europe and promotes innovation for sustainable and cost-effective remediation processes. Innovation should be triggered by sustainability practices.	European Policy: - Environmental Technology Action Plan (inclusive of a wide variety of technologies) - Thematic Strategy on the Sustainable Use of Natural Resources - Climate and Energy targets (20-20-20-target) with the goal of reducing greenhouse gas emissions to increase the use of renewable energies	Regulatory: None (hindering: draft European Soil Framework Directive)	The main windows of opportunity are through redevelopment.
Environment Canada (Chantale Côté)	Federal departments and consolidated Crown corporations.	Program partners including members, remediation industry and academia.	Develop and implement a framework to support the use of sustainable approaches to remediation that considers the environmental and socio-economic effects of a remediation strategy, resulting in an optimization of benefits. The sustainable framework that is proposed will provide site managers with tools and training to identify optimal solutions on a site-by-site basis.	- Federal Sustainable Development Act (June 2008) - Federal Government Policy on Management of Real Property that calls for sound management practices to ensure long-term sustainability.	None	None
SURF US (Stephanie Fiorenza)	Members are drawn from communities including academia, consulting, industry, and government. There are over 75 members at present. Most members come from science and engineering but SURF is seeking to expand diversity.	SURF is a non-profit corporation and professional society and refrains from activities that would be in conflict with its tax-exempt status, such as lobbying or exerting influence.	Primary goal is to serve as a forum to collaborate, educate, advance, and develop consensus between industry, government, environmental groups, consultants, and academia on applying sustainability concepts throughout the lifecycle of remediation projects, from site investigation to closure.	- Member-driven desire to improve remediation as historically practiced - Inconsistencies in environmental and sustainability policies have created conflicting objectives	Need to integrate sustainability into different regulatory programs at US Federal and State levels.	- Increased focus on sustainability for corporations and governmental entities such has DoD has increased interest in and practice of sustainable remediation, along with a desire to reduce GHGs. - Need to increase value of remediation expenditures by integrating sustainability, aligning with stakeholder goals and demonstrating that burdens are not merely shifted among impact categories.

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Organization (Speaker)	Constraints			Impact of Drivers and Constraints			Additional Information	Websites
	Policy	Regulatory	Market	On scope	On how it is presented	On the platform		
US EPA (Carlos Pachon)				- Principles for Greener Cleanups - common policy position for all U.S. EPA cleanup programs - Superfund Green Remediation Strategy: "Operationalizing" the Principles in the Superfund Cleanup Program - Voluntary Green Cleanup Standards & Certification System: Robust tool for fostering greener cleanups in various cleanup programs - RE-Powering America's Land: Renewable energy on contaminated lands - Climate change strategies - Policy and guidance development, etc.	Resources are available at www.epa.gov/superfund/greenremediation and www.clu-in.org/greenremediation regarding the topics in: - Guidance Documents - Special Issues Primers - Technical Bulletins - Fact Sheets / Case Studies - Technology Descriptions - Internet Resources		EPA has defined green remediation as having 5 main core elements. They help understand the environment footprint and prioritize actions to reduce footprint. Each site cleanup project will have a unique set of drivers depending on the location, contaminants, media, and the treatment process selected. The footprint elements listed below are common to most construction projects and are borrowing concepts already in use. The core elements of Green Remediation are: - Energy: Reduction, Efficiency, and Renewable - Air: Protect Air Quality; Reduce Greenhouse Gases - Water: Improve Quality; Decrease Quantity of Use - Land & Ecosystems: Conserve, Protect, and Restore - Materials & Waste: Minimize, Reuse, and Recycle	www.cluin.org/greenremediation www.epa.gov/superfund/greenremediation www.epa.gov/sustainability
EURODEMO+ (Dietmar Mueller)			Compared to US, the European sector is a bit more innovation-resistant and sensitive regarding inconsistencies. There is also a decrease in public funds and decreasing awareness and willingness to act or pay. As a result, there are some limitation preventing the adoption of new sustainable technologies.	Improve decision-making by providing tools, training and indicators that assess the impacts of various remediation options on sustainability. Emphasis towards relations of economic and ecological aspects: eco-efficiency.	Raise understanding and confidence regarding innovate technologies and strategies by explaining the eco-efficiency compared to current technologies. Encourage stakeholders for voluntary actions (voluntary network asks for commitment; missing monetary background limits activities)	- Asks for commitment - Missing monetary background limits activities		www.eurodemo.info
Environment Canada (Chantale Côté)	- Potential misuse of sustainable approaches. There is lack of consideration of risk and liabilities. - Property transaction: low levels of uncertainties and time constraint. - Demonstration of costs and savings associated with sustainable approaches. There are case studies that need to be communicated more widely across the community.	None	Availability and market sensitization of sustainable technologies, approaches and best practices could represent a contraint.	Improve decision-making by providing tools, training and indicators that assess the impacts of various remediation options on sustainability. Also need to develop suitable metrics to measure performance.	Voluntary framework for federal managers to encourage consideration of sustainable practices	- Sustainability principles - Voluntary framework - Incentives: eligible costs, awards. - Greener procurement practices.	Proposed framework for a sustainable approach to federal contaminated sites. Key conditions for successful implementation include training, guidance, advice to site managers, and showcasing successful sustainable remediation projects.	www.federalcontaminatedsites.gc.ca www.ec.gc.ca
SURF US (Stephanie Fiorenza)	Biggest constraint is seen as knowledge. There is a lack of understanding of subject, unfamiliarity with metrics and life cycling thinking. in addition, there is limited availability of data and tools for analysis. Finally, there is also a lack of case studies documenting benefits.	Rigid cleanup process at state and federal level.	- Private tools for application and analysis are not widely available. - Lack of experience in balancing trade-offs between costs and sustainability benefits.	The drivers to improve remediation are what led to initiatives that SURF are undertaking.	Emphasis is multidisciplinary and multi-stakeholder.	Constraints indicate where SURF need to focus effort (e.g., education, training modules, guidance to use life-cycle analysis in remediation, development of a framework, and mapping of metrics).		www.sustainableremediation.org

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	Who are your members	Who are you seeing to influence	What do you want to achieve	Policy	Regulatory	Market
SuRF-UK (Paul Bardos)	- Established in 2007, following the lead of SURF. - UK-based collaboration of regulators, industry, academics and consultants. It holds a number of open forum meetings with 50 to 60 delegates. - Independent co-ordination by CL:AIRE (www.claire.co.uk/surfuk). CL:AIRE is a non-profit company that coordinates demonstrations and learning activities related to contaminated management.		-To develop a framework for assessing sustainable remediation through effective, practical, regulatory acceptance. - To conduct preliminary work to understand indicators of sustainability. Not just looking at selecting the best remediation technology, but how it can contribute to land use planning and better project design. Focus on holistic sustainability assessment of: - remediation input to high-level land-use planning - remediation input to overall site / project design ('Better by design') - remedial strategy selection and remediation technology selection - remediation implementation and verification SURF-UK's definition: 'the practice of demonstrating, in terms of environmental, economic and social indicators, that the benefit of undertaking remediation is greater than its impact and that the optimum remediation solution is selected through the use of a balanced decision-making process.	Industry has number of drivers related to good practice and business ethics, sustainable procurement, CSR. SAGTA is an organization of problem holder from the public and private sector and is one of the supporters of sustainable remediation.	- Regulation consideration of appropriate and reasonable solutions for sustainability. - Soil framework Directive (draft) - describes for remedy selection to take in environmental, Economic, and social impacts. - Water framework Directive (EU wide legislative) - Sustainability considertaions are included in the Water-based management legislation. - Planning in the UK requires several criteria for Sustainability that needs to be met. - Sustainability tests in Planning applications - Sustainablity criteria in regional and local spatial Planning	Response to worldwide interest: - EU (NICOLE, SURF-UK, SURF-NL, EURODEMO+) - USA (e.g., SURF, US EPA "green remediation", ASTM) - Canada, Australia
SURF NL (Laurent Bakker)	Initiative of Hans Slenders (Arcadis), Laurent Bakker (Tauw) and Elze-Lia Visser (WMA) started during workshop at NICOLE WS. Funding request SKB (Dutch Foundation on Soil Quality Management) in February 2010. 'Positive' response from MT SKB, but still under negotiation.	Initiative presented on National Soil Congress in NL in 2009 ('Bodembreed'). About 15 organizations are interested.	- How to express, embed and balance sustainability in the field of Soil Quality Management in the Netherlands. Sustainability practices should be implemented early during the response actions. - Case based versus regional approach. - Interaction and communication with SURF-UK, SURF-US and NICOLE Sustainability WG - Setting up decision support framework based on the Dutch ROSA (and REC) tool	- Need for Soil Quality Management. Soil is a common good and want to use of all soil functions in both rural and urban areas. - Sustainable sourcing and procurement at governmental organizations - CO2 reduction and energy saving programs are important: e.g. Integrated Groundwater management for implementation of ATES systems	EU WFD: Approach for large scale groundwater contamination.	Market Industry: - Costs savings - Sourcing and procurement as driving forces for sustainable business for the industry (image building)

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SuRF-UK (Paul Bardos)		Working on the basis of a voluntary code.	- Working to find a code that is consensus based. - The sustainability framework has achieved this; however, it may be more difficult as during the development of guidance on tools and indicators that cut across existing interests (e.g. existing offerings from service providers)		Six key principles that underpin sustainable rremediation. These principles optimize risk-management based on consideration of social, environmental and economic factors, but always ensure: Principle 1: Protection of human health and the wider environment Principle 2: Safe working practices Principle 3: Consistent, clear and reproducible evidence-based decision-making Principle 4: Record keeping and transparent reporting. Principle 5: Good governance and stakeholder involvement Principle 6: Sound science		The SURF-UK framework indicates that sustability perofrmance can be achieved through proper remedy selction; however, greater sustainability can be obtained through consideration of remedial objectives and goals during remedy design. SURF-UK Phase 2: Objectives: - Trial the framework with real cases studies - Investigate the indicator categories further - Benchmark different assessment methods for the same site(s) - Timescale: April 2010 to April 2011	www.claire.co.uk/surfuk
SURF NL (Laurent Bakker)	- There are still conflicting interests. There are sectorial approaches for redevelopment. In addition the verification of plans is very sectorial. - Re-evaluation of the holistic approach environmental benefits of soil remediation is needed. - Impact of soil remediation not considered. - What is the balance between risk reduction and environmental benefits?	There are conflicting needs for the use and protection of soil. Common dilemmas in Soil Quality Management: - Exploitation vs. protection - Individual vs. common good - Short term vs. long term - Fast vs. slow - Set free vs. secure - Centralized vs. decentralized - Ratio vs. heart Need to protect the soil because it is a natural resource.	Soil remediation business is fading out too soon.	- There is a 'will' but no consensus. - There a lot of opportunities but difficult to 'score' especially due to sectorial approach. - However, there are some good examples available.		- Discussion needed on the dilemma's and existing approaches. - Let sustainable assessments be a forerunner of sustainable legislation. - Adaptation of strategies from other disciplines to help implementation. - Look at all the functions of the soil system. - Integrated management of contaminated groundwater bodies = revaluation of contaminated sites.		

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NICOLE (Olivier Maurer)	NICOLE is a European network of site remediation professionals (approximately 100 members) including industry, consultants, academics, and regulators There are regular workshops each year. In October 2008, a steering group launched a dedicated work group on sustainable remediation. The work group consists of about 20 active members, five subgroups: Communication, Risk management, Economics, Indicators, Case studies		- Provide a working definition of sustainability applied to remediation. - Describe how sustainability thinking can be applied to remediation projects. - Leverage other Think Tanks. - Guidance Document, to support remediation projects of any size.	- Confirms sustainable remediation is a new concept. - SR principles are currently referred to and used across Europe in very different ways. - Legislation refers to sustainable principles to varying degrees across the European countries. - Risk assessment is widely-used and referred to in Europe.		Communication is the number one barrier and enabler.
Common Forum on Contaminated Land in Europe (Dominique Darmendrail)	- Network is comprised of contaminated land policy experts and advisors from federal and regional levels. - Ministries and Environment agencies from 16 countries. - Guests / research networks including international networks and community unions.	- MS Governments - European Commission - Other stakeholders (Industries, Communities) - Researchers	- 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. - Build a new concept for an efficient policy based on risk management and sustainable remediation at national and European levels.	- The policy drivers are mainly what exist at the national level. - EU level: "Risk" around the Soil Protection Directive. There is no sustainable criteria included currently.	EU Directives (IPPC, Waste, ELD, Renewable Energies) have soil provisions. However, they are not consistent currently and need to be integrated.	Not really of concern.

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NICOLE (Olivier Maurer)	- Cost benefit analysis (or equivalent) is an accepted tool only in some countries. - Economic and social impacts are not widely considered in remediation projects.		Communication is Number one barrier and enabler.	Presentation includes Sustainability Management Road Map and Sustainability Assessment Roadmap (both under finalization). The goal of the sustainability road map is to help decision makers early in the remedial process. It is currently in draft form but is expected to be finalized soon. The road map describes the consideration of sustainability practices during spatial planning, project design site uses, remediation design, and implementation. A 4-page booklet on the roadmap will be developed Fall 2010 with links to full document, which will include chapters on - Introduction, NICOLE's objectives, SRWG methodology, definition. - Separate Chapters. - Economics, check list of tools, guidance, references. - Indicators, check list, guidance, references. - Risk assessment. - Illustrations with Case studies (web-based, dynamic). Pilot testing of road map to be conducted (duration TBD).			NICOLE's Position - Sustainable remediation (SR) is about building consensus from stakeholders on the solution that benefit the best considering environmental, social and financial factors. - The earlier the stakeholders agree on a project's goals, scope, boundary conditions and performance indicators, the more opportunity it generates for sustainable gain. - Green remediation is a component of sustainable remediation, typically focusing on the remedial option appraisal once a strategy has been adopted by stakeholders. - Measuring performance throughout the execution of a SR project is key to build trust and consensus. Guidance document will provide a list of tools and indicators used by the profession. - Not a technical issue. - Communication is the number one barrier and enabler. - Conflicting interests between Liability Management, or Risk Assessment, and SR. - Favor a"Bottom-up" approach. Objective - start implementing on small-size project, then training community of professionals.	www.nicole.org
Common Forum on Contaminated Land in Europe (Dominique Darmendrail)	- Is an EU policy really required? Climate change and land planning issues need to be addressed. The land market is The key driver for sustainable remediation in Europe. - Need integration of current policies.	Several levels of legislation/regulations in member states. i) Systemic approach focused on soil contamination. ii) Risk assessment approach. Most European countries are at this point. iii) Risk based land management (Netherlands and France). Integrates protection of the environment and land use changes. Integration of these differing systems is a constraint.	Need more exchange and common tools for expanding new concept. Increased acceptance and training are crucial.	- Integration of sustainable remediation in new generation of policy/regulation (i.e., in NL). - Bottom-up approach should be used to develop policy to help increase acceptance.	Show the bigger/greener objectives and the savings. Need to increase the understanding the global context of incorporating sustainable practices.	More discussion for a better consensus on the concept. Need to balance stakeholder, industry and regulator points of view.		www.commonforum.eu