Increasing Sustainability in Spill Response and Remediation

Dr. Jon Burton, RAW Group

Inland Spill 13, 16 April 2013
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1. What is sustainability?
2. What are the drivers?
3. Are the drivers working?
4. How can we assess sustainability?
5. How can we improve sustainability?
1. What is sustainability?

“Meeting the needs of the present without compromising the ability of future generations to meet their own needs.” (Brundtland, 1987/EA, 2000).
1. What is sustainability?

“...the use of energy and other material resources, and avoiding or minimising adverse environmental impacts in off-site locations, such as a landfill, or on other environmental compartments, such as air and water.” (DEFRA/EA, 2004, CLR11)
1. What is sustainability?

*Sustainable* means ensuring that better lives for ourselves don’t mean worse lives for future generations.

(National Planning Policy Framework, 2012)
1. What is sustainability?

“Sustainable remediation eliminates or controls unacceptable risks in a safe and timely manner, and maximises the overall environmental, social and economic benefits of the remediation work (Sustainable Remediation Forum UK.” (SuRF UK), 2010)
1. What is sustainability?

“Sustainable remediation seeks to manage unacceptable risks to human health and the environment (including groundwater) while optimising the environmental, economic and social impacts.” (EA, 2012).
1. What is sustainability?

(SuRF UK, 2010)
2. What are the drivers?

- Regulatory pressures/Incentives (e.g. LFT)
- Pressure from clients (e.g. CSR/ISO14001)
- Internal pressure to comply with CSR/ISO 14001
- Improved external image
SuRF UK indicates sustainability has the following benefits:

- Cost savings through avoidance of unnecessary or unsustainable remediation.
- Effective management of risks to human health and the environment associated with soil and/or water contamination.
- Minimising the impact of remediation works on the environment and surrounding communities.

2. What are the drivers?
2. What are the drivers?

SuRF UK (contd)

• Positive impact on reputation and public relations, by demonstrating corporate environmental and social responsibility.

• Improving the robustness of remediation decision making.

• Contributing to sustainable development, which now forms a cornerstone of many government and corporate policies.
3. Are the drivers working?

e.g. Landfill Tax (LFT) increases or Soil Disposal vs Soil Treatment and Re-use

Higher landfill tax increases the viability of on and off site treatment options.

From 1 April 2013, LFT now £72 / tonne
The view from HMRC

1) Soils which are contaminated with hydrocarbons are no longer in their naturally occurring state and therefore can not qualify for the lower rate of tax.

2) There are no concentration level thresholds for contaminants present in soils which would qualify disposals for the lower rate of tax. The Landfill Tax (Qualifying Material) order 2011 states that Group 1 materials “comprise only” of the materials listed (see also briefing 18/12 4 & 4.1).
3. Are the drivers working?

Should be great news for remediation contractors as off-site treatment where material goes to landfill (e.g. as daily cover) should be seen as expensive, increasing viability for on-site treatment

BUT...

Many landfills not charging landfill tax and this does not appear to be policed.
3. Are the drivers working?

e.g. Pressure from clients:

• Reporting of waste disposal/treatment
• Requirement to consider Sustainability in ROA
• Demonstrate materials are sustainably sourced
3. Are the drivers working?

Yes...in part...but unless there is a legal requirement or a clear cost benefit to consider sustainability it will not have widespread acceptance.

In reality also easier to consider for planned works but less easy for spill response.
4. How can we assess sustainability?

Commercially available tools (e.g.):
- Golders (GoldSET)
- US Sitewise Tool
- California Green Remediation Tool

UK Guidance:
- Sustainable Remediation Forum (SuRF UK) (specifically avoiding developing a tool)
4. How can we assess sustainability?

Simple vs Complex

(e.g. qualitative vs quantitative)
4. How can we assess sustainability?

Figure 4.1: Tiered approach to assessing the sustainability of remediation.

(SuRF UK, 2010)
### 4. How can we assess sustainability?

<table>
<thead>
<tr>
<th>Options Summary</th>
<th>Do nothing</th>
<th>Monitoring Natural Attenuation (MNA)</th>
<th>Soil Vapour Extraction (SVE)</th>
<th>Combined SVE and Chemical Oxidation</th>
<th>Excavation and disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work involved</td>
<td>NA</td>
<td>Monitoring of 60 weeks or over a period of time to establish decreasing concentrations of kerosene hydrocarbons to acceptable levels.</td>
<td>Application of vacuum extraction to treat contaminated soils and reduce kerosene hydrocarbons to acceptable levels.</td>
<td>Injection of proprietary remediation into contaminated area in order to destroy hydrocarbon contamination for enhanced removal by vacuum extraction.</td>
<td>Excavation and disposal of kerosene contaminated soils in the insured property. Disposal of approximately 6-10 tonnes of material would be required with underpinning.</td>
</tr>
<tr>
<td>Technical Feasibility</td>
<td>Low</td>
<td>It is technically feasible to do nothing.</td>
<td>It is technically feasible to monitor this site.</td>
<td>The soils on-site are sufficiently permeable for combined chemical oxidation and SVE to be effective at treating the shallow and deeper soils. The installation of a significant network of extraction points. Occupants will be able to remain in the property whilst the works are carried out.</td>
<td>It is technically feasible to do nothing.</td>
</tr>
<tr>
<td>Budget cost estimate for reinstatement (£)</td>
<td>£3,000 to £10,000</td>
<td>£5,000 to £10,000</td>
<td>£10,000 to £15,000</td>
<td>£15,000 to £20,000</td>
<td>£25,000 to £35,000</td>
</tr>
<tr>
<td>Estimated Timescale to completion</td>
<td>2-3 years</td>
<td>2-3 months</td>
<td>6 months</td>
<td>2-3 months</td>
<td>1-2 months</td>
</tr>
<tr>
<td>Environmental Sustainability</td>
<td>Moderate to low sustainability as no further works proposed but contamination will remain.</td>
<td>Moderate to low sustainability as no further works proposed but contamination will remain and there are emissions associated with repeated mobilisation to site.</td>
<td>Moderate to high sustainability owing to the in-situ technology and little disposal required.</td>
<td>Moderate to high sustainability owing to the in-situ technology and little disposal required.</td>
<td>High sustainability due to excavation and disposal of materials and the use of new materials for reinstatement.</td>
</tr>
<tr>
<td>Post Works Residual Risk to Human Health</td>
<td>High residual risk to human health from irritation of kerosene contaminated near surface soils.</td>
<td>High residual risk to human health from irritation of kerosene contaminated near surface soils.</td>
<td>Low residual risk to human health as contaminated soils treated to acceptable levels.</td>
<td>Low residual risk to human health as contaminated soils treated to acceptable levels.</td>
<td>Low residual risk to human health as contaminated soils removed from site.</td>
</tr>
<tr>
<td>Post Works Residual Risk to Structures</td>
<td>High residual risk to building structures due to location of spill within main property.</td>
<td>High residual risk to building structures due to location of spill within main property.</td>
<td>Low residual risk to building structures as contaminated soils treated to acceptable levels.</td>
<td>Low residual risk to building structures as contaminated soils treated to acceptable levels.</td>
<td>Low residual risk to building structures as contaminated soils removed from site.</td>
</tr>
<tr>
<td>Post Works Residual Risk to Environment</td>
<td>High residual risk to the environment owing to presence of a major aquifer beneath the site and sandy soils allowing the lateral and vertical migration of the kerosene contamination.</td>
<td>High residual risk to the environment owing to presence of a major aquifer beneath the site and sandy soils allowing the lateral and vertical migration of the kerosene contamination.</td>
<td>Low residual risk to the environment as contaminated soils treated to acceptable levels.</td>
<td>Low residual risk to the environment as contaminated soils treated to acceptable levels.</td>
<td>Low to Moderate residual risk to the environment from contamination as near surface soils removed but deeper contamination may be present that acts as an ongoing source for groundwater contamination.</td>
</tr>
<tr>
<td>Post Works Residual Risk to Third Parties</td>
<td>High residual risk to the third parties having already been impacted and the presence of sandy soils allowing the lateral and vertical migration of the kerosene contamination.</td>
<td>High residual risk to the third parties having already been impacted and the presence of sandy soils allowing the lateral and vertical migration of the kerosene contamination.</td>
<td>Low residual risk to third parties as contaminated soils treated to acceptable levels will stop the lateral and vertical migration of the kerosene contamination.</td>
<td>Low residual risk to third parties as contaminated soils treated to acceptable levels will stop the lateral and vertical migration of the kerosene contamination.</td>
<td>Low residual risk to third parties due to removal of contaminated soils to acceptable levels which will stop the lateral and vertical migration of the kerosene contamination.</td>
</tr>
<tr>
<td>Overall Suitability Rating</td>
<td>Low (Low suitability owing to high residual risk to human health, structures, the environment and third parties)</td>
<td>Moderate-High (Moderate-High suitability as residual risks are all low, however, timescale for treatment could be protracted)</td>
<td>High (High suitability as residual risks are all low and reduced timescale compared to Option 3)</td>
<td>Low-Moderate (Low-Moderate suitability owing to excessive costs associated with underpinning of the property and allocation to the insured)</td>
<td>Moderate-High (Moderate-High suitability as residual risks are all low, however, timescale for treatment could be protracted)</td>
</tr>
</tbody>
</table>

**Assessment of:**
- Feasibility
- Costs
- Timescales
- Residual Risks

Qualitative comment on sustainability based on factors including landfill vs treatment, transport, leaving contamination in-situ.
4. How can we assess sustainability?

(Screenshot: SitewiseTM)
4. How can we assess sustainability?

<table>
<thead>
<tr>
<th>Category</th>
<th>Issues that you may need to consider</th>
<th>Cross-reference to other Indicators</th>
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</table>
| SOC 1 Human Health & Safety     | - Risk management performance of the project (long term) in terms of delivery of mitigation of unacceptance human health risks  
                                 |   - Risk management performance of project (short term) in terms of duration of remediation works, incl. consideration of:  
                                 |   - Site workers, site neighbours and the public  
                                 |   - Remediation works and ancillary operations (incl. process emissions such as bioaerosols, allergens, PM10, impacts from operating machinery/traffic movements, excavations, etc)  
                                 |   - Consider both chronic and acute risks  
                                 | ENV 1 for issues related to e.g. dust which do not relate to effect on humans  
                                 | SOC 3 for issues affecting humans (not related to health concerns e.g. amenity)                  |
| SOC 2 Ethics & Equality         | - How is social justice and/or equality addressed?  
                                 |   - Is spirit of ‘polluter pays principle’ upheld with regard to distribution of impacts/benefits?  
                                 |   - Are the impacts/benefits of works unreasonably disproportionate to particular groups?  
                                 |   - What is the duration of remedial works and are there issues of intergenerational equity (e.g. avoidable transfer of contamination impacts to future generations)?  
                                 |   - Are the businesses involved operating ethically (e.g. sustainability of supply chains for inputs to remediation work, lack of transparency in procurement processes)?  
                                 |   - Does the treatment approach raise any ethical concerns for stakeholders (e.g. use of genetically modified organisms, illegal labour, bribery or corruption issues)?  
                                 | None                                                                                           |
| SOC 3 Neighbourhood & Locality  | - Impacts/benefits to local areas (tangible amenity changes), including:  
                                 |   - Effects from dust, light, noise, odour and vibrations during works and associated with traffic, including both working-day and night-time/weekend operations  
                                 |   - Wider effects of changes in site usage by local communities (e.g. reduction in antisocial activities on a derelict site)  
                                 |   - Changes in the built environment, architectural conservation, conservation of archaeological resources  
                                 | ENV 1 for issues related to e.g. dust which do not relate to humans  
                                 | ENV 4 for impacts of light, noise & vibration on ecology  
                                 | SOC 1 for anything related to human health considerations  
                                 | SOC 4 for changes to way community functions & services they can access                          |
| SOC 4 Communities & Community Involvement | - Changes in the way the community functions and the services they can access (all sectors – commercial, residential, educational, leisure, amenity)  
                                 |   - Quality of communications plan  
                                 |   - Effect of the project on local culture and vitality  
                                 |   - Inclusivity and engagement in decision making process  
                                 |   - Transparency & involvement of community, directly or through representative bodies  
                                 |   - Compliance with local policies/spatial planning objectives  
                                 | SOC 3 for tangible changes to neighbourhoods & regions  
                                 | ECON 2 for compliance with national policies, legislation, regulatory standards, best practice |
| SOC 5 Uncertainty & Evidence    | - Robustness of sustainability appraisal for each option considered  
                                 |   - Quality of investigations, assessments (incl. sustainability) and plans, and their ability to cope with variation. Accuracy of record taking and storage  
                                 |   - Requirements for validation/verification  
                                 |   - Degree to which robust site-specific risk-based remedial criteria are established (justified & realistic CSM versus unnecessarily conservative and/or precautionary assumptions/data)  
                                 | None                                                                                           |

(SuRF UK, 2011)
4. How can we assess sustainability?

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| ECON 1 Direct Economic Costs & Benefits | • Direct financial costs and benefits of remediation for organisation  
  • Consequences of capital and operation costs, and sensitivity to alteration e.g.:  
    o Costs associated with the works (incl. operation and any ongoing monitoring, regulator costs, planning, permits licences)  
    o Uplift in site value to facilitate future development or divestment  
    o Liability discharge | None |
| ECON 2 Indirect Economic Costs & Benefits | • Long term or indirect costs and benefits, e.g.:  
  o Financing debt  
  o Allocation of financial resources internally  
  o Changes in site/local land/property values  
  o Fines and punitive damages (e.g. following legal action, so includes solicitor and technical costs during defence)  
  o Financial consequences of impact on corporate reputation  
  o Consequences of an area’s economic performance  
  o Tax implications | SOC 4 for compliance with local policies/spatial planning objectives |
| ECON 3 Employment & Employment Capital | • Job creation  
  • Employment levels (short and long term)  
  • Skill levels before and after  
  • Opportunities for education and training  
  • Innovation and new skills | None |
| ECON 4 Induced Economic Costs & Benefits | • Creating opportunities for inward investment  
  • Use of funding schemes, ability to affect other projects in the area/ by client (e.g. Cluster) to enhance economic value | None |
| ECON 5 Project Lifespan & Flexibility | • Duration of the risk management (remediation) benefit, e.g. fixed in time for a containment system)  
  • Factors affecting chances of success of the remediation works and issues that may affect works, incl. community, contractual, environmental, procurement and technological risks  
  • Ability of project to respond to changing circumstances, including discovery of additional contamination, different soil materials, or timescales  
  • Ability to respond to changing regulation or its implementation  
  • Robustness of solution to climate change effects  
  • Robustness of solution to altering economic circumstances  
  • Requirements for ongoing institutional controls | None |

(SuRF UK, 2011)
### 4. How can we assess sustainability?

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| ENV 1 Air         | - Emissions that may affect climate change or air quality, or considerations that may allow overall reduction in impact on climate change, e.g.:  
  - Greenhouse gases (e.g. CO₂, CH₄, N₂O, O₃, VOCs, ozone depleting substances, etc.)  
  - NOₓ, SOₓ  
  - Particulates (especially PM5 and PM10)  
|                   |                                                                                                                                                                                                                                      | SOC 1 for issues associated with human health  
|                   |                                                                                                                                                                                                                                      | SOC 3 for issues affecting humans  
|                   |                                                                                                                                                                                                                                      | (not related to health concerns)  
| ENV 2 Soil & Ground Conditions | - Changes in physical, chemical, biological soil condition that affects the ecosystem function, goods or services provided by soils (these may be improvements OR deteriorations). May include:  
  - Soil quality (chemistry)  
  - Water filtration and purification processes (incl. sediment generation or reduction)  
  - Soil structure and/or organic matter content or quality  
  - Erosion and soil stability (incl. drainage)  
  - Geotechnical properties (incl. compaction)  
  - Impact/benefits to sites of special geological interest e.g. SSSIs and geoparks  
|                   |                                                                                                                                                                                                                                      | ENV 4 for Ecology within this ecosystem  
| ENV 3 Groundwater & Surface Water | - Changes in the release of contaminants (including nutrients), dissolved organic carbon and/or silt/particulates (these may be improvements OR deteriorations), affecting:  
  - Suitability of water for potable or other uses (based on long-term protection of available water resources)  
  - Legally binding environmental objectives e.g. Water Framework Directive  
  - Biological function (aquatic ecosystems) and chemical function  
  - Mobilisation of dissolved substances  
  - Marine, brackish/transitional, freshwater waters  
  - Effects/benefits of water abstraction resulting from the remediation process or its outcome, e.g. Changing river levels or water tables  
  - Issues associated with flooding (e.g. increase risk of, or protection from, flooding)  
|                   |                                                                                                                                                                                                                                      | ENV 4 for Ecology within this ecosystem  
|                   |                                                                                                                                                                                                                                      | ENV 5 for any water abstraction use or disposal issues  
| ENV 4 Ecology     | - Effects on ecology (excluding ecological impacts considered in ENV 2 and 3), including effects on the following (these may be benefits OR impacts):  
  - Flora, fauna and food chains (esp. protected species, biodiversity, SSSIs, alien species)  
  - Significant changes in ecological community structure or function  
  - Effects of disturbance (e.g., light, noise and vibration) on ecology  
  - Use of equipment that affects/protects fauna (e.g. bird/bat flight, or animal migration)  
|                   |                                                                                                                                                                                                                                      | ENV 2 & ENV 3 for soil and aquatic ecosystems  
|                   |                                                                                                                                                                                                                                      | SOC 3 for impacts of light, noise & vibration on humans  
| ENV 5 Natural Resources & Waste | - Impacts/benefits for:  
  - Land and waste resources  
  - Use of primary resources and substitution of primary resources within the project or external to it (including raw and recycled aggregates)  
  - Use of energy/fuels taking into account their type/origin and the possibility of generating renewable energy by the project  
  - Handling of materials on-site, off-site and waste disposal resources  
  - Water abstraction, use and disposal  
|                   |                                                                                                                                                                                                                                      | ENV 3 for issues associated with Groundwater and Surface Water not linked to abstraction use or disposal  

(SuRF UK, 2011)
5. How can we improve sustainability?

Some of the steps we are taking:

- Developing sustainability assessment tool
- Reducing material sent to landfill
- Sourcing sustainable materials/products
- Seeking to maximise recycling
Chemical injection containerised system:

Container for controlled mixing and distribution of chemicals

SVE containerised system:

Integral SVE pumps extract air/vapour from a number of pre-drilled boreholes. This unit has the capability of pumping a continuous vacuum from numerous locations at a maximum vacuum of 300mb with a flow rate of up to 2400m3/hr.
6. Closing Remarks

- Requirement to consider Sustainability will increase.
- But until legal requirement or cost benefit to consider uptake likely to be limited.
- Drivers should seek to increase on-site treatment and re-use of material.
- Disposal still too cheap particularly as landfill taxes not properly policed.
6. Closing Remarks

- Better guidance and tools needed (or...opportunity to develop in house tools).
- Can be difficult to apply to emergency spill response rather than planned works.
- Can source materials/products sustainably and maximise recycling.
- Increase in-situ and ex-situ treatment capabilities.
Thank you for your attention!

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References

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- SuRF UK (2010) A Framework for Assessing the Sustainability of Soil and Groundwater Remediation. Published by CL:AIRE