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The rationale for simple approaches for sustainability assessment and management in contaminated land practice

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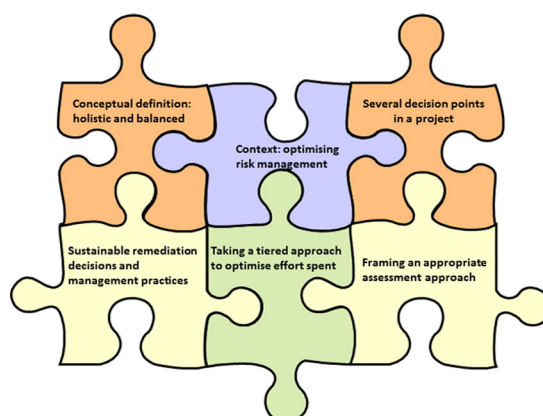
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HIGHLIGHTS

- Sustainable remediation is used to optimise the selection of remediation activities
- Since 2007 SuRF-UK has produced comprehensive guidance on sustainable remediation
- It advocates a tiered approach to minimise cost and complexity in decision making
- A framing process has been developed to support consistent assessment at all tiers
- SuRF-UK guidance is informed by and consistent with international state of the art.

GRAPHICAL ABSTRACT



A distillation of the SuRF-UK approach to sustainable remediation.

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ABSTRACT

The scale of land-contamination problems, and of the responses to them, makes achieving sustainability in contaminated land remediation an important objective. The Sustainable Remediation Forum in the UK (SuRF-UK) was established in 2007 to support more sustainable remediation practice in the UK. The current international interest in 'sustainable remediation' has achieved a fairly rapid consensus on concepts, descriptions and definitions for sustainable remediation, which are now being incorporated into an ISO standard. However the sustainability assessment methods being used remain diverse with a range of (mainly) semi-quantitative and quantitative approaches and tools developed, or in development. Sustainability assessment is site specific and subjective. It depends on the inclusion of a wide range of considerations across different stakeholder perspectives. Taking a tiered approach to sustainability assessment offers important advantages, starting from a

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qualitative assessment and moving through to semi-quantitative and quantitative assessments on an 'as required' basis only. It is also clear that there are a number of 'easy wins' that could improve performance against sustainability criteria right across the site management process. SuRF-UK has provided a checklist of 'sustainable management practices' that describes some of these. This paper provides the rationale for, and an outline of, and recently published SuRF-UK guidance on preparing for and framing sustainability assessments; carrying out qualitative sustainability assessment; and simple good management practices to improve sustainability across contaminated land management activities.

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1. Introduction

Land contamination is recognised as a threat to soil and water quality, and to the wider environment (Van-Camp et al., 2004), and it can also pose significant health, environmental and social pressures (Environment Agency, 2009). Land contamination problems are common around the world. For example, Van Liedekerke et al. (2014) estimated that 2.5 million sites are potentially contaminated across Europe. The management of contaminated land imposes substantial economic costs, amounting to billions of pounds worldwide each year. The scale of land-contamination problems, and of the responses to them, makes achieving sustainability in contaminated land remediation an important objective (Bardos et al., 2011a, 2011b). There is now an active international debate about how best to ensure that land contamination is managed in a sustainable manner (Bardos, 2014). In this context, sustainable remediation is the process of effectively managing contaminated land risks to human health and the environment in a manner that minimises the environmental footprint, maximises societal benefits, and minimises the costs of those remediation activities. Ideally all three outcomes are achieved, but where trade-offs are necessary, the assessment provides a framework to identify and select the best, or most sustainable, remediation solution.

The Sustainable Remediation Forum in the UK (SuRF-UK) is an initiative established in 2007 to support more sustainable remediation practice in the UK by providing guidance based on multilateral inputs from different practitioners and stakeholder interests (CL:AIRE, 2010).

This paper describes SuRF-UK's latest guidance on preparing for and defining ('framing') the sustainability assessment and for a simple qualitative 'entry-level' to sustainability assessment in remediation projects (CL:AIRE, 2014a). It also presents suggested 'sustainable management practices' for application across all phases of contaminated land activities from planning and procurement, site investigation through to implementation and verification of remediation works (CL:AIRE, 2014b).

2. Historical context

For the past decade the prevailing international consensus, at least across much of Europe, has been that risk assessment is the most rational approach for determining remediation need and urgency (CLARINET and NICOLE, 1998; NICOLE and Common Forum, 2013; Vegter et al., 2002). Risk assessment provides a means of understanding which receptors might be affected, and how severely. It evaluates both the magnitude of any consequence and likelihood of the consequence. On this basis decisions can be made on behalf of society about how to best allocate scarce resources. In many countries risk assessment takes into consideration the proposed use of the site following remediation (Nathanail et al., 2013), so that more sensitive end-uses require more stringent remediation goals than less sensitive uses.

The importance of sustainability in this discussion is manifold, but is related to the effective delivery of whatever risk management is necessary to protect human health or the wider environment (Hou and Al-Tabbaa, 2014; Holland et al., 2013; Plant et al., 2015):

- Some technical means of delivering remediation may be more beneficial than others, or have fewer negative impacts;
- In some cases the use of generic risk management thresholds may lead to an over-design of the remediation leading to unacceptable impacts elsewhere, for example compared with a site specific approach;
- There may be opportunities for synergy, for instance with renewable energy, green building, and waste recycling where remediation processes could deliver multiple benefits (e.g. biomass production as well as risk management, from phytoremediation (Licht and Isebrands, 2005));
- The potential negative outcomes of delivering a particular set of remediation goals may suggest reconsideration of the design of site-use originally envisaged;
- There may be opportunities to make sustainability gains by considering remediation as part of an overall land management planning process, for example taking into account a mosaic of land uses or changes in approach to the design and layout of buildings;
- Potentially developments in policy and legislation, combined with the limited availability of public funds, provide a major opportunity to shift the policy focus for contaminated sites from management of costs and liability, to value creation.

It could be argued that suitably professional project designers should already have many of these ideas in mind. However, explicit consideration of sustainability puts these considerations into a systematic structure, and perhaps widens the range of available considerations to allow for a more holistic assessment. Properly executed sustainability assessment also allows for these considerations, their assumptions and their evidence to be more effectively discussed across stakeholder interests, transparently recorded, properly documented and ultimately verified (CL:AIRE, 2010).

Since the mid-1990s a broad range of tools have been developed for or applied to the assessment of the wider impacts, or latterly the sustainability, of remediation measures. One of the first was a system developed by TNO in The Netherlands called STEPS in the early 1990s (Aelmans et al., 1993; van Veen et al., 1997; Ferdinandy and Weenk, 1999). This evolved into the 'REC' tool from The Netherlands which provides three indices related to risk reduction effectiveness, cost and 'environmental merit' (Beinat et al., 1998) to support choices in remedial method selection. Both were derived from life cycle assessment (LCA) concepts, as was the 'Sinsheim' tool developed in Germany (Bender et al., 1998). REC and other LCA based tools continue to be researched as tools for remediation decision-making (Cappuyns and Kessen, 2013). Around the same time the German Federal Environmental Protection Agency was promoting a semi-quantitative approach to support option appraisal for brownfields development. This was based on three indices calculated on the basis of a prescribed series of categories and weightings, intended to be related to monetary value: 'site potential index', 'exploitation potential index' and 'site value' (Grimski et al., 1998). In 2000 the Environment Agency of England and Wales published a review of approaches for understanding the 'wider environmental value' of remediation which suggested a more qualitative approach (Environment Agency, 2000a). Around the same time the Environment Agency also published approaches for cost benefit analysis and cost effectiveness analysis for remediation (Environment Agency, 1999 and 2000b).

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