CL:AIRE

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subr:im bulletin

CL:AIRE's SUBR:IM bulletins present practical outcomes of research by the SUBR:IM consortium which have direct application to the brownfield and contaminated land communities. This bulletin describes indicators and protocols for measuring quality in land remediation.

Quality in Land Remediation: Indicators and Protocols for Brownfield Land

1. INTRODUCTION

Quality is in some ways difficult to define, it has an element of general excellence, but quality management standards create a formality about quality that implies the use of measurement and monitoring in order to ensure a consistent standard of product or service. Much of the current land remediation guidance concentrates on advice on how to carry out certain tasks (e.g. desk studies or borehole sampling), the minimum requirements of those tasks and the expected outcomes. There is less emphasis on ensuring that the processes that are used are correct and will lead to correct decision-making. A quality approach takes a holistic view of the remediation process. The issues that impact on the technical, social, environmental and economic aspects of site remediation need to be considered. The benefits of quality in land remediation are in reduced failures of remediation, greater consistency for clients and stakeholders and for improved decision-making. The quality approach should result in better adherence to time and cost of the project. There is a perception that quality comes at a cost that clients are not willing to pay, however, investment in quality should result in risk reduction and cost savings for all parties in a remediation project.

Quality indicators and a quality protocol have been developed by BRE and University of Manchester as a result of a project in the SUBR:IM research consortium, the Quality in Land Remediation (QUALREM) project. SUBR:IM is a major research consortium funded by the Engineering and Physical Sciences Research Council (EPSRC) under its Sustainable Urban Environments initiative. SUBR:IM aims to produce integrated and sustainable solutions for the development of brownfield land in urban areas (www.subrim.org.uk).

2. WHY QUALITY?

Clients may view quality as something different from a supplier. Matching the expectations of clients with the reality of the product being supplied is essential in any business, including brownfield land redevelopment. Figure 1 shows the relationship between the client and contractor or consultant in brownfield remediation. Quality should be layered across and fully integrated to the site remediation and development.

The principal reason for adopting a quality based approach to remediation contracts is to improve the final remediated land product through the acceptance of quality indicators and quality protocols for land remediation. The quality approach will provide greater confidence for those involved in procuring remediation technologies, including site investigation works, remediation contractors and development activities.

A quality approach to brownfield developments will aim to achieve the following:

- An effective and efficient site investigation and risk assessment based analysis of contamination.
- That the results and data generated from site investigation and risk assessment are reliable and practicable for future use of the site.
- That the final product (remediated land) meets the remediation specification.
- That there is compliance with all legislation, regulations and standards related to site remediation.

A quality approach will ensure that the important strategic, technical or policy decisions for the site are correctly taken. Quality should therefore have a considerable impact on the brownfield remediation activities.

Quality of information

It is important to make sure that the quality of the information gathered throughout the process is fit for the purpose of producing a remediated site. The general parameters that are relevant to assessing quality of information identified in the model procedure CLR11 (Defra and EA, 2004), with the following factors included:

- Relevance - match the required parameters for use of the generic assessment criteria, in particular any specific contaminant type, characteristics of pathways or receptors, or other parameter such as soil type;
- Sufficiency - appropriate number of samples have been taken to enable comparison with the generic assessment criteria;
- Reliability - data were obtained in accordance with appropriate quality standards (e.g. methods of investigation, sample collection);
- Transparency - data are unambiguous, uncertainty is highlighted and preferably quantified, the provenance of data is clear.

Quality management systems

A quality management system provides a structured system to prevent oversights and enhance the output quality. The benefits are not only limited to the clients but the users as well as all the project participants. Table 1 highlights the issues involved in land remediation and the impact of achieving quality or failing to achieve quality. Box 1 highlights some of the known issues that contribute to a failing to achieve quality in land remediation.

It is crucial to develop a proper documented structure for various tasks allowing their appraisal, criticism, refinement and improvement. This document should be capable of confirming the reliability and robustness of the investigation carried out, and the data produced (BS10175, 2001).

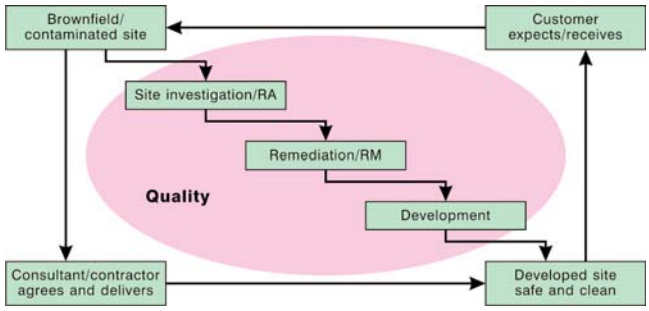

Figure 1. Quality in land remediation

Table 1. Reasons for adopting a quality based approach to remediation contracts

Issues	Consequences of 'good' quality	Consequences of 'poor' quality
Development industry	• Developer makes a profit • Clients are satisfied and happy • Development product is good • Product has long lifetime, good whole life performance • Whole life costs can be planned • H&S risks are low over whole life	• Developer makes a loss • Clients unsatisfied, unhappy and possibly loss making • Product fails • Whole life costs are high and cannot be planned • H &S risks are unacceptable
Property investment	• Significant investment in brownfield property • Investors make profit • Financiers and insurance buy into brownfield work	• Reducing investment in brownfield • Investors make loss • High insurance costs • High costs of borrowing
Decision-making processes	• Correct decisions made • H&S risks are low • Financial risks are low	• Incorrect decisions made based on poor data • Risks are high
Technical solutions	• Correct choice of technical solution, it works • Low risk of failure • H&S risks are low • Profit made by contractors and consultants	• Incorrect choices that do not work • High risk of failure • H&S risks are high • Loss made by all involved
Pollutant linkages	• Pollutant linkages are correctly assessed and risks to receptors fully understood	• Pollutant linkages not understood resulting in risks or over-engineering of technical solutions
Governance	• Governing authorities are correctly informed • Confidence in low risk developments and regeneration work • Encouragement for brownfield development and targets set and achieved	• Incorrectly informed authorities leading to poor decision-making • Regeneration of brownfield viewed as high risk • Avoidance of brownfield

Problems with inadequate attention to quality

There are a significant number of reasons as to why land remediation might fall short of good practice. The main categories of risk to remediation of land are as follows:

- Site investigation and risk assessment

Inadequate site investigation can arise from the following (AGS, 2004):

- a lack of awareness of the importance of the ground investigation;
- inadequate amount or focus of finance;
- insufficient time;
- a lack of geotechnical expertise.

Awareness of good practice information and proper selection skills are equally important to ensuring the correct information is appropriately supported in the report. A plethora of general good practice guidance covering site investigation already exist as well as more specific guidance on risk assessment, but a drawback of too much good practice is that it can confuse those investigating brownfield sites in how to determine which good practice document is the most appropriate. Concerns over liability for future contamination will add to the complexity of selecting the most appropriate guidance.

- Remediation

- Technology - the use of sub-standard technology or the inappropriate choice of technology for a particular site. This might be applied to any aspect of site investigation, the remediation or construction activities.
- Information Analysis - insufficient background information or poor interpretation of background information. This is often the result of an unwillingness of land owners or clients to resource the work sufficiently and the amount of data generated is insufficient from which to make proper decisions.
- Quality - poor quality of specification, workmanship and communication are not appropriate to the site. This is generally a failure of those involved, i.e. a lack of appropriate skills and knowledge, or failure to achieve proper standards.

Box 1. Some issues that contribute to a failing to achieve quality in land remediation

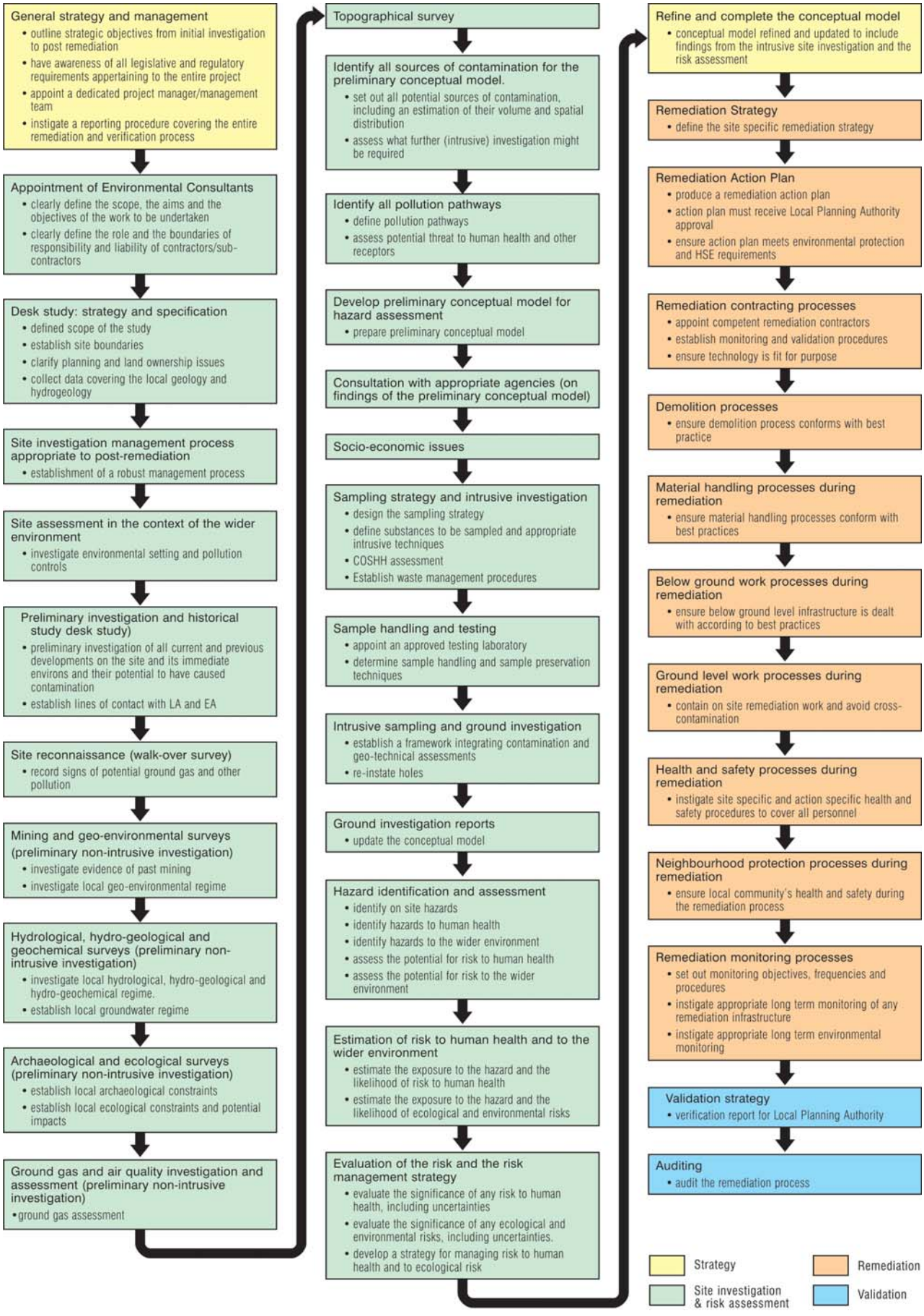

Figure 2. Quality Indicator flow chart

Risk assessment should determine the likely harm to humans, the environment, water courses and receptors such as buildings (BRE, 1994; EA, 1999) as well as the likely nature and extent of the harm caused if the predicted event was to occur. However, the risk assessment requires good data to be generated from the site investigation, this could include data that accurately reflect the site conditions and are accurate in spatial and temporal dimensions. This requires those involved in the site investigation activities to be sufficiently knowledgeable and qualified.

3. IMPLEMENTING GOOD QUALITY

Indicators of quality and protocols covering all aspects of land remediation projects from their inception through to their final remediation and verification strategy ensure that quality becomes a key feature of regeneration projects.

The aim of the **Quality Indicators (QIs)** is to provide a framework for the application of best practice and quality principles. The use of the QIs in the land remediation process will help to achieve the following:

- meet clients objectives
- evaluate the quality of the remediation
- provide a system for monitoring quality.

QIs of land remediation and management can be described as key performance indicators (KPIs). KPIs are used widely in businesses and sectors of the UK construction industry. KPIs can be applied at project level in order to benchmark within a company or to achieve specified targets. The use of QIs in land remediation activities can set specific targets for remediation activities.

The QIs are specific to the various stages of a remediation project, ranging from development of the strategy and the initial site investigation through to the actual remediation of the site and the verification process. In some cases QIs can be quantified and measured whilst in others it may be sufficient to ensure that an activity or task has been carried out properly.

QIs include all essential elements in the site investigation and remediation processes sequentially. They are designed to augment existing guidance by providing specific pointers to best practice logically and succinctly.

The QIs themselves may be qualitative or quantitative, i.e. in some cases they may simply set a requirement for an activity, in others they may require measurement of properties on characteristics of some aspect of redevelopment to a defined level.

In this project the QIs were developed based upon progression through the stages of site investigation and remediation work. Reference was made to the good practice guidance given in BS10175 and CLR 11 with regard to the approach. This approach has resulted in a list of qualitative and quantitative QIs that are shown in Figure 2.

Cross-reference can be made between the stages of land remediation and the QIs in Figure 2.

Quality protocols (QPs) are a means of ensuring that the quality indicators are incorporated into a contract between the client (an owner or developer) and a consultant or contractor. The QP provides a mechanism by which the QIs can be used effectively. The QP is a simple statement, in effect an agreement to take a quality approach to the brownfield redevelopment work which can be incorporated into a contract. A QP can take the form of a simple contract supplemented by a schedule of QIs (Box 2).

As a result of the different types of projects and forms of contracts that can be found in land remediation work it is essential that the QPs are flexible. However, the success of the QP and the associated QIs will depend on commitment from all relevant parties. It is recommended that one party is responsible for implementing the QIs as far as is reasonably practical. This may be the client who appoints a member of staff with appropriate experience, or it may in some circumstances be the consultant who takes responsibility. The QP should become integral to the work of a remediation project as opposed to being seen as an add-on or additional expense. Progress against each of the QIs should therefore be assessed on a regular basis by all members of the project team, including the client.

Generic Quality Protocol for Brownfield Development			
Client		Responsible person:	
Contractor/Consultant		Responsible person:	
The parties detailed above agree to enter into this Quality Protocol with respect to the brownfield development project for the site below.			
Site Name			
Site Address/Location			
By making this agreement we agree to: 1. use the Quality Indicators as set out in the attached Quality Indicators schedule for the site. 2. measure and monitor the Quality Indicators by the appointment of a single party or a team of appropriate staff who are competent and responsible for the work. 3. meet on a regular basis to monitor progress with respect to the Quality Indicators, involving senior level project staff. 4. take action when there is a failure to reach the requirement of a Quality Indicator. 5. record all decisions taken as a result of the use of the Quality Indicators. 6. ensure all parties and staff are aware of the Quality Indicators for the project and appropriate training is given where and when required.			
Signed and dated for client		**Signed and dated for Contractor / Consultant**	
Signature:		Signature:	
Date:		Date:	

Box 2. A generic Quality Protocol for brownfield development

In some circumstances the remediation may be undertaken in distinct parcels of work with different parties being involved. In order to effectively use the QP and QIs on any particular project the approach can be split by taking for example only those QIs relevant to the site investigation, then those relevant to the remediation and so on in distinct stages. However, a written record should be kept at each stage in order to inform subsequent stages.

The research has been supported by a steering group of those involved in the business of land remediation, which includes consultants, contractors, regulators and local authorities. The developed QIs and QPs have been peer-reviewed by the steering group members and input has been made through various routes to their development.

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Potential users of the quality indicators and quality protocol would be advised to seek further information from BRE by contacting Dr Stephen Garvin:
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