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Soil quality — Sustainable remediation

Qualité du sol — Remédiation durable

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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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Foreword

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This document was prepared by Technical Committee ISO/TC 190, *Soil quality*, Subcommittee SC 7, *Soil and site assessment*.

Introduction

This document is intended to provide procedures for sustainable remediation. It contains accepted terminology and understanding of the features of sustainable remediation and of means of assessing the relative sustainability of site-specific alternative remediation strategies. Determining what is and is not sustainable remediation at a specific site will be influenced by many local factors and the governance context. Therefore, this document seeks to preserve local flexibility and freedom of action.

Soil quality — Sustainable remediation

1 Scope

This document provides procedures on sustainable remediation. In particular, it provides:

— standard methodology, terminology and information about the key components and aspects of sustainable remediation assessment;

— informative advice on the assessment of the relative sustainability of alternative remediation strategies.

This document is intended to inform practitioners about contemporary understanding of sustainable remediation. It is not intended to prescribe which methods of assessment, indicators or weights to use. Rather, it is intended to inform consideration of the concept of sustainable remediation in a local legal, policy, socio-economic and environmental context.

The scope of this document is restricted to sustainable remediation — that is demonstrably breaking the source-pathway-receptor linkages — in a manner that has been shown on a site-specific basis under a specific legal context to be sustainable.

The concepts of "green remediation" and "green and sustainable remediation" (so called GSR) that in some parts of the world are conflated with sustainable remediation are neither endorsed nor discussed in this document.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
brownfield
sites which

— have been affected by former uses of the site or surrounding land;

— are derelict or underused;

— are mainly in fully or partly developed urban areas;

— require intervention to bring them back to beneficial use;

— may have real or perceived contamination problems

3.2
environmental justice
combination of environmental rights and environmental responsibilities that asserts that everyone has

— a right to healthy places to live, work, play, learn and enjoy themselves;

— a right to a fair share of nature's benefits and ecosystem services, such as food and water;

— a responsibility to look after the planet for others and for future generations

3.3
indicator
single characteristic that represents a sustainability effect, whether benefit or negative impact, which may be compared across alternative remediation strategies, comprising one or more remediation techniques and/or institutional controls, to evaluate their relative performance

EXAMPLE Greenhouse gas emissions.

3.4
metric
measurement of an *indicator* (3.3)

EXAMPLE Tons/Tonnes CO_2.

3.5
remediation strategy
one or more remediation technologies and associated works that will meet specified contamination-related risk reduction objectives

3.6
remediation technology
technology that pre-processes, processes or post-processes the ground or contaminant as part of risk management

3.7
sustainable development
development that meets the needs of the present without compromising the ability of future generations to meet their own needs

Note 1 to entry: Sustainable development is about integrating the broader expectations of society as a whole of a high quality of life, health and prosperity with environmental justice and maintaining Earth's capacity to support life in all its diversity. These social, economic and environmental goals are interdependent and mutually reinforcing.

[SOURCE: ISO 26000:2010, 2.23, modified — The Note has been modified and the last sentence has been deleted]

3.8
sustainable redevelopment
component of *sustainable development* (3.7) that results in the return to use of abandoned, derelict, underused and potentially contaminated sites in a way that increases their environmental, economic, and social benefits

3.9
sustainable regeneration
component of *sustainable development* (3.7) that reverses the economic, social and environmental decline of places

3.10
sustainable remediation
elimination and/or control of unacceptable risks in a safe and timely manner whilst optimising the environmental, social and economic value of the work

3.11
threshold
limit of acceptability for an indicator that may not be crossed or carries an unacceptable consequence if it is crossed, such as regulatory non-compliance

3.12
unacceptable risk
level of risk that requires remediation

Note 1 to entry: The level of risk could be evaluated by comparison to a numeric threshold or by benchmarking against a narrative definition. Different levels of risk are deemed unacceptable in different countries or even by different laws within a country.

4 Abbreviations

BTU	British Thermal Units
CBA	cost benefit analysis
CCP	climate change potential
ESTCP	Environmental Security Technology Certification Program
GHG	greenhouse gas
GSR	green and sustainable remediation
LCA	life cycle assessment
MCA	multi-criteria analysis
MNC	multi-national corporation
RBLM	risk-based land management
SuRF	Sustainable Remediation Forum
US EPA	United States Environmental Protection Agency
WBCSD	World Business Council for Sustainable Development

5 Sustainable remediation, (re)development and regeneration

Development that meets the needs of the present without compromising the ability of future generations to meet their own needs[1] is considered to constitute sustainable development. In the case of brownfield sites, remediation is a prelude to physical redevelopment and ultimately socio-economic regeneration. Sustainable regeneration provides multiple benefits. For example, it empowers local communities, provides new employment opportunities, enhances the aesthetics of an area and supports environmental justice.

Since remediation often links into the beneficial redevelopment and reuse of a site, sustainable redevelopment is inherently connected with sustainable remediation.[2] Considering the reuse of a site from the beginning of a remediation project is a fundamental component of sustainable remediation, and therefore sustainable remediation may act either as a natural precursor to, or as a subset of, sustainable redevelopment. Much value may be achieved through successfully integrating remediation into the redevelopment process to exploit synergies while minimizing costs and environmental impacts associated with bringing sites back to beneficial use.

6 Risk-based contaminated land management

The concept of RBLM means integrating decisions on the need for remediation, the timeframe within which it should be implemented and the choice of remediation strategy by considering three components[3]:

— fitness for current/intended land use;

— protection of the environment;

— long term care.

RBLM is intended to assist reaching balanced and informed decisions to achieve sustainable land management. The first decision is whether or not the risk posed by land contamination to human health, ecosystems, property or natural resources is deemed by law or corporate policy to merit intervention. Such remediation should be acceptable to those with an interest in its outcome — stakeholders.

Remediation should be reliable and not breakdown uncontrollably in the future. In addition, remediation should not introduce significant new risks and should be effective over the period in which the contamination risks need to be managed.

Sustainable remediation is about how to manage risks that merit intervention and should not be seen as justification for no intervention in the face of such risks.

There might be non-negotiable boundary conditions, such as legal, corporate policy or regulatory requirements, which have to be taken into consideration. Alternative remediation strategies that meet them may then form the focus for the sustainable remediation assessment.

7 Integrated assessments, metrics and evaluations

7.1 General

There are many ways to integrate various dimensions in order to provide a holistic measure to benchmark against the definition of sustainable remediation. A tiered approach allows application of simple sustainable remediation assessments at less complex sites and more sophisticated, costly and perhaps presently contested assessments at more complex sites.

Meaningful sustainability assessment of alternative remediation strategies is possible and should inform robust and reliable project management decisions. This is despite the fact that sustainability may not be measured in simple units, and that an assessment of the sustainability of remediation strategies is necessarily a subjective process at a given point in time and space. Stakeholders should be encouraged to provide their perspectives on the balance of potential impacts and benefits to facilitate consensus.

Sustainability assessment of alternative soil and groundwater remediation strategies[4]-[7] is improved by:

— being limited to those strategies that are likely to achieve site-specific risk-management objectives (i.e. eliminate and/or control unacceptable risks to human health, property, surface or ground water and the environment);

— following a framework for assessment that is consistent with sustainable remediation (see 3.10) by:

  — considering the environmental, social and economic benefits and impacts associated with each option;

  - identifying which of the remediation strategies being assessed provides the greatest overall benefits;
- comparing alternative strategies against a relevant common baseline, e.g. pump and treat, excavation and off-site disposal or do nothing;
- adopting indicators and metrics that capture all significant benefits and impacts while avoiding double-counting;
- adopting a tiered approach, such that the sustainable remediation assessment is proportional to the scale of the project/problem being addressed;
- taking stakeholder opinions and perspectives into account and, where it is practical to do so, engage directly with stakeholders;
- documenting the activities, data, assumptions and decision points to aid transparency (e.g. see ASTM E2876:2013, Clause 8[8]).

7.2 Tiered assessments

A tiered approach may be used, in which simple qualitative approaches are the default and most commonly used tier, and more complex quantitative tiers are applied only when necessary or otherwise justified.

Simple or relatively clear-cut problems require only simple sustainable remediation assessment. As a general rule, the simplest form of sustainable remediation assessment that allows a robust decision to be made should be adopted. On projects where the decision depends on a small number of indicators that can be measured, a more quantitative approach to sustainable remediation assessment may be necessary to help reach a robust and reliable decision.

7.3 Tiered assessment frameworks

A tiered approach to sustainable remediation assessment illustrates how a simple qualitative, semiquantitative or fully quantitative approach may be taken to a given project. In all tiers the initial considerations are the same:

- confirm the project objectives: what question is the assessment being completed to answer?
- confirm the shortlist of remediation strategies: likely to be effective in meeting project objectives;
- identify the relevant stakeholders: who could affect or be affected by the project?
- identify project boundaries: temporal, spatial and lifecycle limits to the assessment;
- select sustainable remediation indicators: agree on the indicators that will form the basis of the sustainability assessment;
- determine how each indicator will be characterized or measured: agree on the metrics;
- agree the assessment techniques: sustainable remediation assessment techniques that will be applied (i.e. the tier and method).

Once these initial issues have been considered, and background information and data collated, the sustainable remediation assessment proceeds using the agreed assessment technique.

7.4 Sustainable remediation assessment techniques

7.4.1 General

Various qualitative, semiquantitative or quantitative techniques may be used to undertake a sustainable remediation assessment, either in its entirety, or partially (Table 1). The boundaries between the

tiers are fuzzy. While there may be some overlap between the techniques applied under these three headings, they serve as a useful classification to emphasize that valid assessments may be completed using simple, intermediate or more complex approaches. In general, the effort involved increases in going from qualitative to quantitative assessments. However, users should beware of the danger of focusing on only those parameters that can (easily) be measured. The inherent flexibility of qualitative methods means they are easier to apply in a comprehensive manner.

Table 1 — Examples of techniques that may be useful for sustainable remediation assessment

Qualitative (simple but comprehensive)	Semiquantitative	Quantitative (complex but partial)
Narrative analysis	Pair-wise comparison	CBA
Non-parametric ranking	MCA	LCA
		(Environmental) Footprint Analysis
		Cost effectiveness analysis NOTE This is strictly an economic analysis.

7.4.2 Qualitative

Qualitative approaches do not attempt to put numbers to different remediation strategies within an assessment. Instead, non-parametric or even narrative alternatives to metrics may be used:

— ranking of one alternative against others as being "better", "neutral" or "worse" for a specific indicator;

— a narrative drawn from discussions between stakeholders where alternative remediation strategies are considered and a preferred option selected based on performance against a range of sustainable remediation indicators.

It is generally possible to consider a wide range of sustainable remediation indicators qualitative; but, quantitative data that may be readily accessible for some indicators is not used to its full extent.

Alphanumeric terms may be used in rankings (e.g. 1, 2, 3 or a, b, c) and may be helpful in rapidly identifying patterns, and median rankings may then be considered. However, these labels should not be confused with semiquantitative or quantitative data where some form of estimation (and weighting) has taken place.

7.4.3 Semiquantitative

"Semiquantitative" approaches quantify some, but not all, indicators or they place values and weightings on all options but without fully monetising and quantifying every aspect, for example:

— MCA using scores (i.e. relative performance of an option against a sustainable remediation indicator) and weightings (i.e. stakeholder view on the importance of a particular sustainable remediation indicator) to rank a number of options — typically, an overall rank is derived from the sum of all weighted scores, when compared to other options;

— quantitative analysis of a number of aspects may be applied alongside more qualitative assessment of other factors such as quantitative assessment of the CO_2 footprint and remediation direct cost combined with qualitative consideration of ecological impact and social aspects within a holistic assessment;

— pair-wise comparison involves comparing the relative performance for a given indicator of each candidate strategy against each other and aggregating the outcomes to allow an overall judgment of the alternatives to be made.

