



**SLOVENSKI STANDARD**  
**oSIST prEN ISO 24212:2023**  
**01-junij-2023**

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**Tehnike sanacije, ki se uporabljajo na onesnaženih območjih (ISO/DIS 24212:2023)**

Remediation techniques applied at contaminated sites (ISO/DIS 24212:2023)

Sanierungstechniken an kontaminierten Standorten (ISO/DIS 24212:2023)

Techniques de dépollution appliquées aux sites pollués (ISO/DIS 24212:2023)

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**ICS:**

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| 13.020.40 | Onesnaževanje, nadzor nad onesnaževanjem in ohranjanje | Pollution, pollution control and conservation |
| 13.080.01 | Kakovost tal in pedologija na splošno                  | Soil quality and pedology in general          |

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## Remediation techniques applied at contaminated sites

*Techniques de dépollution appliquées en sites et sols pollués*

ICS: 13.080.01

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## ISO/DIS 24212:2023(E)

### Foreword

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This document was prepared by Technical Committee ISO/TC 190, *Soil Quality*, Subcommittee SC 7, *Impact Assessment*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

In the context of contaminated land, if unacceptable risks associated with a site are identified following a risk assessment and need to be managed, remediation is likely to be required to remove or reduce contamination and/or otherwise control risks, i.e. remedial actions are required to prevent, minimise, remedy or mitigate the effects of the unacceptable risks. The choice, implementation and verification of remediation techniques require detailed site characterization and risk assessment.

A remediation strategy will have to be set up encompassing these actions by implementing technical and organisational actions on contaminant source(s), transport and exposure pathways and / or receptors aiming to control the unacceptable impacts and associated risks that have been established following the investigations and risk assessment. Amongst these actions are the implementation of individual, or combinations of, remediation techniques aiming to address contaminants that could be present as free phase or within the soil, water, soil gas or ambient air.

This document provides guidance on key aspects for effective implementation of individual or combinations of in-situ and on-site remediation techniques. It was developed in response to demand for minimum specifications for the selection and verification of remediation strategies to manage the risks from contaminated sites.

It is intended to inform practitioners and stakeholders about the main characteristics of commonly used remediation techniques. It can also help practitioners to select technically feasible approaches within the options appraisal phase, based on the state of the art of remediation technologies. It is not intended to prescribe which technique to use in a specific context. Therefore, it is not a framework that can cover all individual situations.

NOTE 1 Some of the on-site techniques presented in the document can also be used within off-site treatment facilities but the latter are not covered (e.g. incineration on-site is covered but not incineration at a permanent off-site installation).

NOTE 2 There is a continuous development of remediation techniques. It is possible that the standard does not reflect all knowledge that is being gained as techniques are improved.

NOTE 3 Not all available techniques are covered. Those not covered include: electrokinetic methods to remove contaminants or to improve the effectiveness of other methods (e.g. electrokinetic enhanced bioremediation), and phytoremediation.



# Remediation techniques applied at contaminated sites

## 1 Scope

This document provides guidance on key aspects of remediation techniques and their implementation. It briefly describes principles, the main characteristics and the advantages and limitations to be considered in the selection within an option appraisal of individual or combinations of in-situ and on-site remediation techniques, including:

- the type of contaminants to be dealt with;
- current and/or intended site use;
- local legal, policy, socio-economic and environmental contexts

It follows the principles for sustainable remediation in ISO 18504.

The scope of this document is restricted to the remediation of contaminated sites, i.e. where soil, or soil gas, ambient air or groundwater are contaminated. It identifies which phase/matrix can be targeted by a technique, e.g. fluid, (groundwater, gas, non-aqueous phase) or solid and which contaminant it can be applied to. The document also provides information on hazards that can be associated with the implementation of a remediation.

This document does not provide:

- an exhaustive list of remediation techniques;
- guidance on sites contaminated with radioactive substances, pathogenic or infectious agents, or “pyrotechnic devices (e.g. unexploded ordnances)”;
- guidance on ex-situ techniques that are set up off-site;
- a framework that covers all individual situations; or prescribe which technique(s) to use in a specific context.

## 2 Normative references

The following document is referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 18504:2017, *Soil quality — Sustainable remediation*

ISO 11074:2015/amd 2020, *Soil quality – Vocabulary*

ISO 21365:2019, *Soil quality — Conceptual site models for potentially contaminated sites*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11074 and the following apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

**ISO/DIS 24212:2023(E)****3.1****contaminant linkage**

presence and relationship established between contaminants, preferential pathways and receptors

**3.2****engineering-based technique**

civil engineering technique (e.g. excavation, containment, hydraulic control) used to remove the contaminant source or soil material or to modify pathways without necessarily removing, destroying, or modifying the source

Note 1 to entry: Some of these techniques can be considered when implementing protective measures.

[SOURCE: ISO 11074:2015, 6.2.1, modified – Note 1 to entry added]

**3.3****environmental medium**

soil, underlying material, sediments, surface water, groundwater, soil gas, and ambient air that can contain contaminants

[SOURCE: ISO 21365:2019, 3.4, modified – "ambient" added before "air"]

**3.4****ex-situ treatment technique**

treatment technique applied to medium to be treated (e.g. soil, groundwater) after extraction from the ground

[SOURCE: ISO 11074:2015, 6.2.2, modified – "method" replaced by "technique"]

**3.5****hazard**

property of a substance or material or situation that in particular circumstances could lead to harm or pollution

[SOURCE: ISO 11074:2015 5.2.15]

**3.6****in situ treatment technique**

treatment technique applied to medium to be treated (e.g. soil, groundwater) without extraction from the ground

Note 1 to entry: The remediation installation is built on-site and the treatment of the contaminants is applied directly to the subsurface.

[SOURCE: ISO 11074:2015, 6.2.3, modified - "method" replaced by "technique" and Note 1 to entry added]

**3.7****off-site treatment**

treatment applied away from the site to be remediated

[SOURCE: ISO 11074:2015, 6.2.4]

**3.8****on-site treatment**

treatment applied on the site being remediated

Note 1 to entry: In the case of contaminated ground, treatment is applied after extraction of environmental medium material from the ground.

[SOURCE: ISO 11074:2015, 6.2.5, modified – Note 1 to entry added]

### 3.9 remediation

process of dealing with contaminated soil, groundwater, or site to eliminate, reduce or control risks to human health or the environment

Note 1 to entry: A remediation can rely on individual remediation technique or combination of remediation techniques.

[SOURCE: ISO 11074:2015, 6.1.17, modified – "reduce" after "to eliminate" and Note to entry 1 added]

### 3.10 remediation strategy remedial design

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

Note 1 to entry: The choice of methods might be constrained by a variety of site-specific factors such as topography, geology, hydrogeology, underground services propensity to flood, and climate.

[SOURCE: ISO 18504:2017, 3.5, modified – "remedial design" and Note 1 to entry added]

### 3.11 sustainable remediation

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

[SOURCE: ISO 18504:2017, 3.10]

### 3.12 risk

combination of the probability or frequency of occurrence of a defined hazard and the magnitude of the consequences of the occurrence

[SOURCE: ISO 11074:2015, 5.2.24]

### 3.13 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.

[SOURCE: ISO 11074:2015 5.2.24]

## 4 Abbreviations

|       |  |
|-------|--|
| BTEX  | Benzene Toluene Ethylbenzene Xylene-isomers          |
| CHP   | Catalyzed H <sub>2</sub> O <sub>2</sub> Propagations |
| COD   | Chemical oxygen demand                               |
| DNAPL | Dense Non Aqueous Phase Liquid                       |
| DPLE  | Dual Pump Liquid Extraction                          |
| ECH   | Electric conduction heating                          |
| EHS   | Environment Health and Safety Environment            |