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Guidance

LCRM: Stage 2 options appraisal

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You must be a competent person (<https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm/lcrm-before-you-start#competent>) to do an options appraisal.

If you have reached this stage, then a decision has been made to remediate. Remediation is the action required to prevent, minimise, remedy or mitigate the effects of the unacceptable risks.

Follow this stage to establish an appropriate remediation option.

The contaminant linkages identified through risk assessment now become 'relevant contaminant linkages'. They represent the unacceptable risks to the identified receptors.

There are 3 steps to follow.

1. Identify feasible remediation options.
2. Do a detailed evaluation of options.
3. Select the final remediation option.

If you have progressed straight from a preliminary risk assessment make sure you have sufficient information. This includes the detailed information required by the generic and detailed quantitative risk assessments.

For step 1, you will identify and produce a shortlist of feasible remediation options. Make sure the site information is up to date, set objectives and plan for any regulatory controls that may be needed for when remediation starts.

In step 2, you will evaluate the options to decide which are the most suitable for dealing with each relevant contaminant linkage. You use options appraisal evaluation criteria.

You may need to combine options and consider how this would work in practice.

In step 3, you will select the final remediation option. In some cases, selecting only one option may not be practical or sufficient. There may be more than one or different types of relevant contaminant linkages. The final option you select may be single, multiple or combined. These are taken forward to Stage 3 of LCRM, where the remediation strategy is developed.

If you cannot identify options then you will need to reassess.

You will need to produce an options appraisal report. You may decide to use the National Quality Mark Scheme (NQMS) (<https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm/lcrm-before-you-start#NQMS>).

Sustainable approach

You can consider using a sustainable approach when you select remediation options.

Sustainable remediation can provide the opportunity to manage unacceptable risks to human health and the environment. If you use a sustainable approach it can help to ensure that the benefit of doing the remediation is greater than its impact.

Consider the relative ability of each option to achieve the remedial objectives in a safe and timely manner whilst optimising the environmental, social and economic value of the work.

For further detailed guidance on sustainability see SuRF-UK (<https://www.claire.co.uk/projects-and-initiatives/surf-uk>) on the CL:AIRE website.

See also:

- sustainability (<https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm/lcrm-before-you-start#sustainability>) in **LCRM: Before you start**
- BS ISO 18504: Soil quality – sustainable remediation (<https://shop.bsigroup.com/ProductDetail?pid=000000000030275832>).

Step 1: Identify feasible remediation options

Your aim is to identify a shortlist of feasible remediation options that you can evaluate. They must be able to achieve the remediation objectives and criteria you will set for the site.

You will need to:

- decide if sufficient information is available
- identify options appraisal objectives
- set remediation objectives and criteria
- produce a shortlist of feasible remediation options
- select which options are most feasible to assess further

Check you have got up to date and sufficient information. This is important if:

- it is a long time since the risk assessment and site investigation were done
- a generic or detailed quantitative risk assessment were not done

If a generic or detailed quantitative risk assessment were not done, you will need to design and carry out a detailed investigation (<https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm/lcrm-stage-1-risk-assessment#detailed-invest>). This is usually an intrusive investigation.

To effectively evaluate and identify remediation options you may need to do a supplementary investigation (<https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm/lcrm-stage-1-risk-assessment#supplementary-invest>) to collect more data and update the conceptual site model.

Identify options appraisal objectives

Before you can select feasible remediation options you will need to have a clear set of options appraisal objectives in place.

These include:

- management and technical objectives
- remediation objectives and criteria

The overall site objectives were set in the preliminary risk assessment. Make sure these are still correct.

Options appraisal management objectives

Use management objectives to define the required remediation outcome. For example to:

- consider and factor in any regulatory controls that you may need to meet such as the treatment being acceptable
- achieve sustainable remediation considering any reasonable climate change issues
- avoid unacceptable environmental impacts, health and safety issues and minimise long term liabilities
- avoid the requirement for long term monitoring or maintenance, for example if new build is planned
- meet timescales and budgets
- enhance and improve biodiversity and amenity value

Options appraisal technical objectives

Define the technical objectives of the site. For example, to complete the following within an agreed timescale:

- clear all above-ground buildings and structures
- complete infrastructure such as roads, building footprints, site drainage
- regrade the site profile in line with specific site drawings
- complete realignment of the river frontage in line with specific site drawings

Other examples of technical objectives could be to:

- use a phased approach in line with an agreed plant shutdown programme
- create a site compound and access route for the duration of remediation
- provide effluent treatment capacity to support the remediation to comply with regulatory controls and permits
- open up a culverted stream
- minimise disruption to neighbouring receptors

Plan ahead for regulatory controls

When you are looking at the options, you must factor in any required regulatory controls, such as permits. This is your main management objective for all remediation options. You may need to revisit the requirements when you have completed this stage.

You will need to:

- make sure the options you evaluate and then select can meet any regulatory controls
- confirm these regulatory controls in the remediation strategy that you will produce in stage 3 of LCRM
- make sure these controls are in place for when you start remediation

Planning ahead will avoid delays and save potential costs for when you are ready to start remediation.

You must find out in advance:

- if you can use an exemption or regulatory position statement (RPS)
- if you need a permit and what type
- if the treatment technology is acceptable
- if you need a water abstraction licence
- how you will deal with waste
- how long it takes to apply for a permit, deployment or to get approval
- how long the remediation will take
- if a long term monitoring or verification assessment is needed to show regulators you have met remediation criteria

Allow sufficient time when you apply for any of these.

Types of regulatory controls

If you are using LCRM outside of England, check with the relevant regulator for what is required.

Most land contamination treatment activities will use one of the following:

- standard rules: SR2008 No 27: Mobile plant for the treatment of waste soils and contaminated material, substances or products
(<https://www.gov.uk/government/publications/standard-rules-sr2008-number-27>) and mobile plant permit (MPP2) (<https://www.gov.uk/government/publications/deployment-form-for-land-and-groundwater-remediation>) deployment form
- a bespoke mobile plant permit for the treatment of waste soils and contaminated material, substances or products
- a site based permit

You must allow for some of your activities being time limited, for example, an approved MPP2 deployment is usually limited to 12 months.

For small scale trials or remediation schemes, you must be able to meet the conditions in land contamination pilot trials and small scale remediation schemes: RPS 215 (<https://www.gov.uk/government/publications/land-contamination-pilot-trials-and-small-scale-remediation-schemes-rps-215>).

The 2 waste exemptions most applicable to land remediation activities are:

- U1: use of waste in construction (<https://www.gov.uk/guidance/waste-exemptions-using-waste>)
- T5: screening and blending waste (<https://www.gov.uk/guidance/waste-exemption-t5-screening-and-blending-waste>)

An exemption or exclusion is available for a specified groundwater remediation scheme. This involves the introduction of substances to groundwater to enhance the rate of remediation of contaminants.

See tracer tests and remediation schemes: environmental permit exemption (<https://www.gov.uk/guidance/tracer-tests-and-remediation-schemes-environmental-permit-exemption>).

You must apply for an abstraction licence (<https://www.gov.uk/guidance/water-management-apply-for-a-water-abstraction-or-impoundment-licence>) if you intend to abstract 20 or more cubic metres of contaminated groundwater per day.

Also find out if a:

- surface water discharge or groundwater activity permit (<https://www.gov.uk/government/collections/water-discharge-and-groundwater-activity-environmental-permits>) is required
- groundwater activity exclusion (<https://www.gov.uk/government/publications/groundwater-activity-exclusions-from-environmental-permits>) applies
- consent to discharge trade effluent to foul sewer from the local sewerage undertaker is required

Ahead of remediation, plan for any requirements such as for planning and Part 2A.

If you intend to use the CL:AIRE Definition of waste: development industry code of practice ([DOW COP](https://www.claire.co.uk/projects-and-initiatives/dow-cop)) you can find further details on the CL:AIRE website (<https://www.claire.co.uk/projects-and-initiatives/dow-cop>).

See also our position statement J8 on the [DOW COP](https://www.gov.uk/government/publications/groundwater-protection-position-statements) in the Environment Agency's approach to groundwater protection (<https://www.gov.uk/government/publications/groundwater-protection-position-statements>).

Innovative treatment methods

If you use innovative treatment methods, you may need to do pilot trials or detailed testing such as laboratory or field-scale trials.

An innovative treatment approach is outside the scope of the Land contamination pilot trials and small scale remediation schemes: [RPS 215](#) and standard rules permits. You will have to consider Waste management: regulation of trials of new waste management techniques: [RPS 182](#) (<https://www.gov.uk/government/publications/regulating-trials-of-waste-management-operations>) and then obtain a bespoke permit if we find the trial acceptable. This will have time and cost implications.

Set remediation objectives and develop remediation criteria

Remediation objectives and criteria to verify that remediation has worked will be set in stage 3 of [LCRM](#).

Remediation objectives are site-specific objectives that relate solely to the reduction, control or removal of the risks associated with one or more of the relevant contaminant linkages.

Remediation criteria are site-specific measures against which you will assess compliance with the remediation objectives. They are usually quantitative and may be used for regulatory decisions.

Examples of remediation objectives include to:

- decrease contaminant mass, concentration, mobility or toxicity
- break contaminant linkages
- effectively contain the contaminant

- manage the receptor or pathway
- remove the source

To consider sustainability when you set remediation objectives see Stage A of the SuRF-UK framework (<https://www.claire.co.uk/projects-and-initiatives/surf-uk>).

Generic assessment criteria used in generic quantitative risk assessment are sometimes used as remediation criteria. This is not what they are intended for. They are quantitative screening values and you must use them with caution. You must be able to justify why you have used generic assessment criteria as remediation criteria.

You must consider the hazardous thresholds of contaminants when you determine remediation criteria. This is important because for waste, some generic assessment criteria values and other assessment criteria, whilst they will protect human health, are above hazardous waste thresholds for disposing and importing soils.

Waste characterisation of soils may influence the financial viability of a remediation option.

These are examples of remediation objectives and criteria.

Example 1

Remediation objective: to ensure that after treatment, soil will not pose an unacceptable risk to human health.

Remediation criterion: no treated material based on a set testing frequency, as agreed with the regulator, shall contain more than the specific values agreed for residential land use with consumption of home-grown produce.

Example 2

Remediation objective: to remediate a groundwater hydrocarbon plume.

Remediation criterion: compliance with the agreed detailed quantitative risk assessment output from the remedial targets methodology model to be assessed by a monitoring plan within specific timescales.

Example 3

Remediation objective: to design and install an in-ground barrier that protects a receptor.

Remediation criterion: demonstrate performance with permeability testing. For example, testing the slurry materials at pre-defined intervals to demonstrate an agreed hydraulic conductivity.

Example 4

Remediation objective: to ensure an appropriate thickness of a composite surface cover in all affected garden areas.

Remediation criterion: compliance to be measured based on agreed spatial measurements. For example:

- to demonstrate a composite thickness, as agreed with the regulator, of placed cover in all garden areas
- to comply with local authority requirements where clean cover is validated on a plot basis, such as 1 in every 3 garden plots

The clean cover will be fully validated, comply with current guidance and legislation and be suitable for use.

Select the right technical approach

When you decide which technical approach to use consider using established procedures such as best practical techniques.

If you are dealing with a site under Part 2A you must use best practical techniques.

There are 3 main ways to reduce or control the unacceptable risks. You can:

- remove or treat the source
- intercept or break the pathway
- modify the behaviour of receptor

Within each of these categories there may be different technical options. For example, it is possible to remove or treat contaminants using a variety of physical, chemical or biological methods.

Remediation techniques can be applied in situ or ex situ. The meaning of these terms are:

- ex situ – removed from the ground before above-ground treatment, encapsulation or disposal on or off site
- in situ – treated without prior excavation of solid material or water abstraction from the ground

Some approaches to remediation only apply in certain circumstances. For example:

- it is not usually possible to remove a controlled waters receptor – although it may be possible to modify its behaviour or limit its uses
- it may be possible to control an individual's exposure to contaminants by administrative means – such as imposing legal or contractual access restrictions

Identify a shortlist of feasible remediation options

Identify a shortlist of options for each relevant contaminant linkage.

The options must be able to reduce or control the risks to an acceptable level.

You will need to:

- consider any factors that might affect the options you select
- select feasible remediation options which will meet your options appraisal objectives

Aim for more than one option so that you can do a detailed evaluation in step 2. This is to confirm which options are the most suitable.

If you cannot create a shortlist, review all the objectives for the site. If necessary, re-evaluate, collect more data and re-establish the remediation objectives for each relevant contaminant linkage.

Initial screening of options

You may be able to quickly eliminate some options. For example, if they will not:

- meet legal or regulatory reasons
- result in a positive environmental outcome
- meet options appraisal objectives
- be practical, durable and effective
- meet costs and timescales
- be sustainable
- provide any additional benefit

Factors to consider when you select feasible remediation options

After your initial screening, assess in more detail the advantages, disadvantages and limitations of the remaining options. For these consider the site characteristics, stakeholder views, timescales and wider factors.

Site characteristics and practical factors include:

- site setting – could be densely populated or remote
- practical constraints such as site size – smaller sites may have limited capacity for using large-scale plant
- current status – derelict, open, in use or physical constraints such as large numbers of buildings
- how accessible the site is and security arrangements
- site services – such as availability of power and water

Consider stakeholder views. For example, from:

- regulators
- the site owner, funder, insurer or insolvency practitioner
- neighbouring owners and occupiers

Consider timescales, in terms of:

- the nature of risk – if there is an immediate or long term risk to receptors
- any short and long term commercial or funding constraints
- how long it will take to meet the remediation objectives

Wider factors include:

- if the option is durable – can the remediation continue to reduce or control unacceptable risks to a defined level over a period of time

- if it is effective – will the remediation successfully reduce or control unacceptable risks to a defined level
- the environmental impact – will the remediation effect the quality of the environment during or afterwards
- the cost – is it reasonable and affordable, given the available resources
- if the option offers a sustainable approach
- how well it meets other environmental objectives, such as the use of energy and other material resources
- any indirect benefits – will it enhance the amenity or ecological value of an area, remove blight or encourage regeneration
- legal, financial and commercial context of the site, including any specific legal requirements the remediation has to comply with

Part 2A requirements

For Part 2A sites, you must refer to section 6 of the contaminated land statutory guidance (<https://www.gov.uk/government/publications/contaminated-land-statutory-guidance>). This states that decisions must be based on reasonableness and the use of best practical techniques.

The regulator for Part 2A will consider whether the remediation option:

- is practicable, effective and durable – all criteria must be treated equally
- has an impact on health and the environment
- is financially viable
- has benefits
- can meet the aims of the remediation required

Select the most feasible remediation options

You can use the remediation option applicability matrix (<https://www.gov.uk/government/publications/land-contamination-remediation-option-applicability-matrix>) to help select which options are most feasible.

The matrix contains information on the potential applicability of a range of common remediation options to particular contaminant-media type combinations.

It covers a range of:

- common methods that are generally available
- applicable media – soils, made ground or sediments, groundwater or surface water
- organic and inorganic contaminants

The matrix:

- indicates the broad capabilities of a remediation option
- indicates where a pre-treatment step may be necessary or if case study information is required

You can regularly check the current technical literature to keep up to date.

If you are planning to use any of these, you must only use the list of acceptable treatments given in:

- Land contamination pilot trials and small scale remediation schemes: RPS 215 (<https://www.gov.uk/government/publications/land-contamination-pilot-trials-and-small-scale-remediation-schemes-rps-215>)
- standard rules permit: SR2008 No27 - mobile plant for the treatment of soils and contaminated material, substances or products (<https://www.gov.uk/government/publications/standard-rules-sr2008-number-27>)

To find detailed information see INFO-OA1: identification of feasible remediation options (<https://www.claire.co.uk/useful-government-legislation-and-guidance-by-country/190-identification-of-feasible-remediation-options-info-oa1>) on the CL:AIRE Water and Land Library.

For ground gases and vapours you could look at the options for protection measures such as a structural barrier, ventilation or membranes. However, this is a specialist activity so you will need to follow more detailed guidance, for example:

- INFO-RA2: assessing risks associated with gases and vapours (<https://www.claire.co.uk/useful-government-legislation-and-guidance-by-country/212-assessing-risks-associated-with-gases-and-vapours-info-ra2-4>)
- BS 8485: Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (<https://shop.bsigroup.com/ProductDetail?pid=000000000030377237>)
- BS 8576: Guidance on investigations for ground gas – permanent gases and volatile organic compounds (<https://shop.bsigroup.com/ProductDetail?pid=000000000030248027>)
- CIRIA C665: assessing risks posed by hazardous ground gases to buildings (<https://www.ciria.org/ItemDetail?iProductCode=C665&Category=BOOK&WebsiteKey=3f18c87a-d62b-4eca-8ef4-9b09309c1c91>)

You may need to include the remediation option of long term monitoring and maintenance. Evaluate this along with other options in step 2.

You now have a shortlist of potential options so you can do a detailed evaluation of them in step 2.

If you only have one option, go back and review the remediation objectives and criteria you set at the start of the options appraisal stage. Following this review, if you can still only identify a single feasible remediation option you can proceed to stage 3 remediation and verification (<https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm/lcrm-stage-3-remediation-and-verification>). To do this you may need to get agreement from the relevant regulator.

Monitored natural attenuation of groundwater

For groundwater contamination, for certain readily degradable contaminants, natural processes of degradation and attenuation may be suitable for managing the relevant contaminant linkage. It will need to be achieved within an acceptable time period as agreed with the relevant regulator.

You will need to do comprehensive long term field monitoring and modelling to support this decision. This remediation option is known as monitored natural attenuation (MNA).

You may need to get agreement from the relevant regulator to do MNA as a remediation option.

Find detailed guidance on the assessment and monitoring of natural attenuation of contaminants in groundwater – see INFO-OA1: identification of feasible remediation options (<https://www.claire.co.uk/information-centre/water-and-land-library-wall/41-water-and-land-library-wall/190-identification-of-feasible-remediation-options-info-oa1>) on the CL:AIRE Water and Land Library.

Long term monitoring and maintenance as a remediation option

You may need to consider the remediation option of long term monitoring and maintenance. For example, this may be:

- due to the location of the contaminants – it may not be practical to do effective remediation
- to allow for natural attenuation
- to show stability of source or monitor potential increasing risks off site

Evaluate this along with other options in step 2.

Get agreement from the relevant regulator and stakeholders if you want to do long term monitoring and maintenance as the remediation option.

You will need to:

- follow stage 3 of LCRM and produce a remediation strategy
- set monitoring objectives, methods and criteria
- consider the need for any management controls such as land use or access restrictions
- consider the requirement for long-term maintenance – for example, where the construction of permanent structures need ongoing maintenance to make sure they continue to work

Provide details of the monitoring and maintenance requirements in your options appraisal report. See also monitoring and maintenance (<https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm/lcrm-stage-3-remediation-and-verification#step-4>).

Conclude step 1

At the end of step 1 you will have:

- identified options appraisal management and technical objectives
- set remediation objectives and criteria
- considered the regulatory controls that may be required
- produced a shortlist of feasible remediation options that you can evaluate in step 2

If you only have one option go back and review the remediation objectives and criteria.

Following this review, if you can still only identify a single feasible remediation option you can proceed to stage 3 remediation and verification. To do this you may need to get agreement from the relevant regulator.

If you have not been able to select feasible options then you will need to reassess and look at alternatives.

Record your decisions in your options appraisal report. See options appraisal reporting requirements for a checklist of what to include.

Step 2: Do a detailed evaluation of options

For this step you will need to decide which options are the most suitable for dealing with each relevant contaminant linkage.

You will need to:

- assess the limitations, advantages and disadvantages of each option
- develop and use options appraisal evaluation criteria to assess the merits of each option
- establish which options are most suitable – singularly or in combination
- include any proposals for combining options
- get detailed information on the technical aspects of each option, including the cost

Options appraisal evaluation criteria

Options appraisal evaluation criteria are formal attributes or factors against which the ability of different remediation options to meet site-specific objectives are measured.

The level of detail required will depend on different site circumstances.

Your evaluation will to take account of the best practical environmental option.

You can use these examples of evaluation criteria when you select a potential option or options.

Regulatory and stakeholder requirements

The option you select must be acceptable to relevant stakeholders. These include, the regulator, client, site purchaser and other interested parties such as local residents.

For Part 2A, the criteria for practicality, effectiveness and durability all have equal weighting.

Consider:

- any regulatory requirements such as a planning or a Part 2A obligation
- the feasibility of getting and being able to comply with any regulatory permits or controls within the required timescale

Sustainability

To consider sustainability you can use Stage B of the SuRF-UK Framework (<https://www.claire.co.uk/projects-and-initiatives/surf-uk>). You can use this to differentiate the remediation options against environmental, social and economic indicators taking into

account any relevant climate change issues.

You can also use BS ISO 18504: Soil quality. Sustainable remediation (<https://shop.bsigroup.com/ProductDetail?pid=000000000030275832>).

Cost

Assess the affordability. Include both total cost and cash-flow considerations. Base your assessment on the available resources and the likely cost of verification and remediation.

To estimate the cost you can use:

- recent or previous experience
- information from remediation contractors
- technical literature

Along with the preparatory, start-up and actual remediation costs also consider:

- any uncertainties around the actual ground conditions
- contingency plans for additional costs due to inclement weather such as hire for plant costs and standing time
- the likely commercial climate at the time remediation will start – especially if it is likely that there will be a long time before remediation can start
- costs and time involved with further site investigation and studies

Timescales

Consider:

- how long it will take to complete remediation and the ability to meet timescales
- any likely requirements for post remedial monitoring
- any future obligations that may be required such as the need for post-remediation or long term monitoring and maintenance

Practicability

Practicability is the extent to which it is possible to implement and operate a remediation option or strategy given practical constraints.

Consider:

- how practical the option is given the site location, size, access, layout and maintenance needs
- the ability to fulfil operational needs such as working space, support services, plant and equipment needs
- compatibility with other site works such as planned infrastructure, ongoing construction or new build
- if it can be combined with other options to deal with the site as a whole
- if a single method can deal with multiple relevant contaminant linkages

Effectiveness

Effectiveness is the extent to which a remediation treatment successfully reduces or controls unacceptable risks to a defined level.

Consider:

- the effectiveness in meeting the remediation objectives within a practical timescale
- how applicable the option is to the relevant contaminant linkages
- to what extent effectiveness can be demonstrated through the verification process

Durability

Consider durability. This is the extent to which a remediation treatment is likely to be effective in reducing or controlling unacceptable risks to a defined level over a period of time.

Environmental impact

Consider the effect that the remediation will have on the quality of the environment during and after it is complete.

Include this in the evaluation if you are not doing a separate sustainability assessment. Otherwise you can assess it as part of your sustainability assessment. Also take climate change issues into account.

Consider if the technique will provide for a remediation strategy that delivers direct and indirect benefits.

Track record

Look at evidence of other successful remediation using your chosen approach. Consider how the option:

- works at full scale rather than just pilot scale
- has dealt with similar contaminants, sites and ground conditions such as geological and hydrogeological conditions

Availability

Find out about the availability of the technique or method. Include the resource need for implementing remediation for example, the need for specialist contractors or specific reagents.

Health and safety requirements

Consider the level of requirements to address health and safety issues associated with each option.

For information on the technical basis of selected remediation methods see:

- INFO-OA2: detailed evaluation of remediation options (<https://www.claire.co.uk/useful-government-legislation-and-guidance-by-country/78-options-appraisal-info-oa/201-detailed-evaluation-of-remediation-options-info-oa2>) on the CL:AIRE Water and Land Library
- contaminated land guidance tool for references (<http://contamlanddb.ciria.org/>) on the CIRIA website

Treatability studies

You may need to use treatability studies. These are laboratory or field-scale trials that provide a means of determining the practicability and likely effectiveness of remediation.

You can use treatability studies to:

- establish how particular options are likely to perform in practice for example, to provide the data needed to support the design of a full scale in situ remediation strategy
- estimate the timescales required to achieve the remediation objectives

Laboratory and field-scale treatability studies can be expensive and time consuming to do. They are usually only considered for remediation options that, on the basis of existing information, are most likely to be selected.

You may want to check that you can meet the conditions of Land contamination pilot trials and small scale remediation schemes: [RPS 215](https://www.gov.uk/government/publications/land-contamination-pilot-trials-and-small-scale-remediation-schemes-rps-215)

(<https://www.gov.uk/government/publications/land-contamination-pilot-trials-and-small-scale-remediation-schemes-rps-215>) if you are considering using it.

See also innovative treatment methods.

You may also need general information on:

- likely noise restrictions – some remediation techniques may need to control noise levels
- baseline ambient air quality
- baseline groundwater and surface water monitoring
- likely weather conditions during remediation – it is important to factor in seasonal variations in water levels and potential for flooding
- odour management plans
- stakeholder engagement

Combine options

If you have identified more than one relevant contaminant linkage needing multiple remediation options, consider if you can:

- combine options
- use an integrated approach
- select a different option that will address the site as a whole

Consider how combined options will work in practice

Consider how any combined options will work in practice. Include for example:

- any efficiency and cost savings you can make
- any sustainability benefits
- how to coordinate combined options – the number of contractors likely to be involved and who will be responsible for the different work packages or phases
- if there is any flexibility around the timing of the work to maximise the site's capacity, such as mobilisation or demobilisation of plant, provision of storage space, provision or capacity of site services
- if and how combining elements of different remediation options affect technical performance or efficiency – for example, use of extraction wells and pumping protocols to extract contaminants that have different distributions and physical properties
- how to contain working areas to minimise recontamination of completed work, especially where work is zoned or phased
- how you will comply with the Construction (Design and Management) Regulations

To manage ancillary works to achieve efficiency and cost savings, consider for the different work packages or phases:

- how you will handle residues, such as storing, treating or the disposal capacity of solid and liquid waste
- what monitoring you need to carry out for compliance, such as ambient air quality monitoring, monitoring of discharges to sewer
- how you will verify remediation

Integrated approach

An integrated approach is a sequence of remediation treatments needed to achieve the remediation objectives.

You may need to address more than one relevant contaminant linkage which need different types of treatment. For example, for groundwater you may be able to use the combined approach of in situ chemical oxidation and monitored natural attenuation.

Alternatively you may need to install and operate different remediation techniques in different parts of the site or at different times. You can use an integrated approach as a single ongoing remediation process.

Focus on the relative merits of both the single and combined approaches against the options appraisal evaluation criteria.

These are examples of combined options.

Example 1

Excavate hotspots of hydrocarbons in soil and biologically treat them using a system of ex situ biopiles. Remove the free phase hydrocarbons in groundwater using a dual phase extraction system.

Example 2

Physical removal of light non-aqueous dissolved liquids or high dissolved phase concentrations of total petroleum hydrocarbons. This is followed by bioremediation or monitored natural attenuation.

Address problems with combined options

If it is too difficult to combine options you will need to:

- select a single option
- go back to step 1 of this stage and re-evaluate
- reassess the combined approach that will form the remediation strategy
- do a cost-benefit analysis based on revised cost estimates

For cost and benefit analysis references see INFO-OA2: detailed evaluation of remediation options (<https://www.claire.co.uk/useful-government-legislation-and-guidance-by-country/201-detailed-evaluation-of-remediation-options-info-oa2>) on the CL:AIRE Water and Land Library.

You may need to:

- use more detailed options appraisal evaluation criteria to assess the likely effectiveness and limitations of each combined option
- investigate the site in more detail
- use laboratory or field-scale test data to assess effectiveness under site-specific conditions

Conclude step 2

At the end of step 2 you will have:

- assessed which remediation options are the most feasible for each relevant contaminant linkage
- decided if any options can or need to be combined

Record your decisions in your options appraisal report. See options appraisal reporting requirements for a checklist of what to include.

Step 3: Select the final remediation option

You have assessed what the most feasible options are. You now need to decide which one is the most suitable. This may be a single option, multiple options or a combined approach. It will need to meet the:

- overall site objectives set in the preliminary risk assessment
- options appraisal management and technical objectives
- options appraisal remediation objectives

When you select the final option you can revisit your options appraisal evaluation criteria you used in step 2.

You may have to choose between a:

- well-established technique with a proven track record for addressing the risks over a particular time period
- cheaper, less established technique that may require post remediation monitoring for further verification

Example of a decision

Method A is a well-established technique that is used routinely and offers a good long term solution. Remediation can easily be completed within the required timescale. The estimated cost is £1 million.

Method B is less established but does have a track record of successful use in similar applications. A reasonable number of remediation contractors can offer it. Method B is likely to pose fewer short-term health and safety and environmental risks compared to method A. However, it is more uncertain that method B will meet remediation objectives within the required timescale. It is also likely that some post-remediation monitoring will be needed. The estimated cost of method B is £500,000. From a sustainability assessment, method B offers a more sustainable approach than method A.

In this example, method B was selected as the most appropriate option. The difference between the 2 methods on technical grounds was not significant. Method B was more sustainable, offered potential cost savings and lower operator health and safety risks. Some of the cost savings can be used for the required monitoring to verify that the remediation objectives have been met.

If you cannot select a final remediation option

It may be difficult to identify a remediation option that meets some or all of the remediation objectives completely.

For example, the remediation option:

- cannot provide certainty on reducing or controlling the risks
- cannot be achieved within the required timescale
- is not practical, due to the site size, location, access or topography
- is too expensive even if it is the most effective, practicable and durable solution

You may also have identified that a technical or engineering solution cannot deal with the unacceptable risks.

Stakeholders may have different views on what is required, for example:

- the regulator, to meet regulatory and legal requirements – this is likely to be your most important consideration
- the site owner on what they consider sufficient
- neighbouring property owners

You may need to review the remediation objectives. Or you may be able to:

- agree a lower standard of remediation, such as by changing the layout or use of the site
- make adjustments in other areas, such as providing additional health and safety protection

- look at alternative remediation options such as new technology or approaches and use Waste management: regulation of trials of new waste management techniques: RPS 182 (<https://www.gov.uk/government/publications/regulating-trials-of-waste-management-operations>) – you will need to discuss this with us
- carry out long term monitoring and then re-evaluate, particularly if the site has complex contamination

Conclude options appraisal

At the end of the options appraisal stage you will have:

- selected the final remediation option
- assessed how a combined or integrated approach will work in practice
- decided what action to take if feasible options could not be identified
- decided and got agreement to do long term monitoring and maintenance or MNA as a remediation option

Confirm that the selected remediation option will:

- manage the risk effectively
- be verifiable at stage 3 of LCRM

Record and justify your decisions in your options appraisal report.

You can now progress to Stage 3: remediation and verification.

Options appraisal reporting requirements

You must be a competent person (<https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm/lcrm-before-you-start#competent>) to produce an options appraisal report.

You need to report on each step of options appraisal.

1. Identify feasible remediation options.
2. Do a detailed evaluation of options.
3. Select the final remediation option.

Unless the site is complex you will normally produce a single options appraisal report.

Include any additional information you collected such as a supplementary investigation and monitoring results.

Your report will need to include both factual and interpretative information. Keep factual and interpretive information separate.

You can use the following checklists to find out what type of information to include.

You may decide to use the NQMS (<https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm/lcrm-before-you-start#NQMS>).

General information requirements

Include these basic site details:

- site name and address
- site ownership and current status
- location, national grid reference and general description of the site
- site plan
- size of site
- contact details for relevant organisations

Include for example:

- the overall site objectives
- the characteristics of the site and its setting
- a brief summary of the stage 1 risk assessment reports
- the options appraisal technical and management objectives
- details of any likely regulatory controls needed such as a permit and deployment, abstraction licence
- a clear statement of what the remediation needs to achieve
- the remediation objectives and criteria – explain how these were developed and why
- a clear statement of how compliance with remediation objectives will be met
- the conceptual site model – updated where applicable
- the nature, amount and distribution of contaminants identified
- any updated or revised information – including site investigation and reference to any literature based research
- any constraints such as time or cost
- a summary of the legal, financial and commercial context

Explain how decisions were made.

Step 1: Identify feasible remediation options

Set out a:

- summary description for each relevant contaminant linkage
- shortlist of feasible remediation options

Explain how you selected feasible remediation options, including:

- any constraints on how the options were selected
- the methods used to collect information
- justification for selection of the options – why some were kept and others rejected
- details of how sustainability was considered, if applicable
- any caveats and assumptions used

Step 2: Do a detailed evaluation of options

Include:

- a list and summary description of your options appraisal evaluation criteria
- the characteristics of remediation options
- any additional information collected, such as a supplementary investigation, treatability studies or pilot trials
- if the options have been ranked using a sustainability assessment, include details of the approach and findings from the assessment

Step 3: Select the final feasible remediation option

Include:

- details of the most appropriate options identified
- which options are to be combined, if relevant

To justify the selection of the final option include:

- reasons for choosing the option
- rationale for combining options where appropriate
- any caveats and assumptions used

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