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Guidance

LCRM: Stage 3 remediation and verification

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How to develop a remediation strategy, implement it and verify remediation has worked.

You must be a competent person (<https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm/lcrm-before-you-start#competent>) with training, knowledge and experience in remediation to do stage 3.

From your options appraisal you will have identified the most feasible remediation option (a single, multiple or combined approach) to mitigate the risks of the relevant contaminant linkages.

For stage 3 there are 4 steps to follow.

1. Develop a remediation strategy.
2. Remediate.
3. Produce a verification report.
4. Do long term monitoring and maintenance, if required.

For step 1, you will need to develop and then agree a remediation strategy that can be implemented in practice. You will already have set your remediation objectives and criteria in step 1 of options appraisal. You will need to set monitoring objectives and criteria to track performance of the remediation. The remediation strategy is a record of how you will meet and carry out the remediation objectives.

You will need to produce a verification plan. This will be a part of the remediation strategy. It will need to set out all of the data requirements, including compliance criteria and monitoring details. This will establish a 'lines of evidence' approach which will verify remediation is working or has worked.

When the remediation strategy has been agreed, if you have the correct regulatory controls in place, you can start the remediation.

You must make sure the remedial works do not cause harm to human health or the environment.

You may also need to produce:

- remediation progress reports
- monitoring and maintenance reports

When remediation is complete, you will need to produce a verification report.

Verification demonstrates that the risk has been reduced and that the remediation objectives and criteria have been met. You need to base it on a quantitative assessment of the remediation performance using the lines of evidence approach as set out in your verification plan.

The verification report will need to provide a complete record of all remediation activities and evidence that it has been successful.

If you decided to do long term monitoring and maintenance as the remediation option, or if you need to do post remediation monitoring for further verification, then you will need to do step 4.

The remediation strategy and verification report are part of the final record of the land quality.

As you progress, you will need to produce reports. 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 remediation

It is important to consider a sustainable approach to remediation.

Remediation has the potential to cause environmental, economic and social impacts. You can demonstrate how you have addressed this by showing:

- the benefit of doing remediation is greater than its impact
- you have used a balanced decision making process to select the optimum remediation solution

The remediation can also have adverse effects on climate change if it is not done correctly. If you select a poor remediation design and implementation, the activities may cause greater adverse effect than the contamination it aims to address.

The remediation needs to manage the unacceptable risks in a safe and timely manner. It needs to aim to maximise the overall environmental, social and economic benefits across the whole supply chain.

For further details see the UK Sustainable Remediation Forum (SuRE-UK) (<https://www.claire.co.uk/projects-and-initiatives/surf-uk/77-sustainable-remediation>) on the CL:AIRE website.

Confirm the site information is still valid

You must base the remediation strategy on the latest site information and documentation. This is important if it is a long time since any monitoring, site investigation, risk assessment or options appraisal were done.

Review and confirm the:

- overall site objectives set in the preliminary risk assessment are still valid
- existing physical and chemical conditions of the site are as recorded
- volumes of contaminated material are still correct
- effectiveness of the proposed remediation technologies and if they are still valid and available
- remediation work can be completed in the time available and within budget

You may need to do:

- supplementary investigation, testing and monitoring
- further risk assessment such as detailed quantitative risk assessment predictive modelling
- further options appraisal

Update the conceptual site model where necessary.

You may decide to refine (done as part of the options appraisal) or do new treatability studies (<https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm/lcrm-stage-2-options-appraisal#treatability-studies>). You can use these to ensure a robust detailed design, especially for in situ physical and chemical remediation approaches. Factor in any time and cost constraints associated with this.

Start preparatory work, if applicable

Before you develop the remediation strategy, you can identify, prioritise and subject to regulatory control, start preparatory work. For example, you may be able to:

- establish a site compound
- do baseline monitoring, such as noise, ambient air or water quality
- provide access, for example temporary infrastructure like haulage roads or hardstanding
- decommission and demolish existing buildings or structures – subject to other necessary documentation, for example an asbestos survey
- re-route underground or above ground services
- if suspected or present, deal with non-native invasive plants – you must see stop invasive non-native plants from spreading (<https://www.gov.uk/guidance/prevent-the-spread-of-harmful-invasive-and-non-native-plants>) before you treat, bury, burn or dispose of them
- consult local residents on the type of remediation and the potential for nuisance or disruption during the works – see communicate the risk (<https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm/lcrm-before-you-start#communicate>)

You must not mobilise treatment plants to site unless you:

- hold a relevant permit or deployment
- are operating under the 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>)

You must check with the relevant regulator before you start any activities.

Step 1: Develop a remediation strategy

You need to develop and produce a single remediation strategy that will deal with the site as a whole.

The remediation strategy needs to include a clear set of remediation activities and how you will implement and verify them. It is a record of how you will meet and carry out the remediation objectives.

It needs to:

- clearly set out how the selected remediation option will mitigate the risks from the relevant contaminant linkages identified in the conceptual site model
- meet the remediation objectives and criteria set in the options appraisal

- meet any regulatory requirements – such as to fulfil a planning condition, a Part 2A obligation or to comply with permit conditions
- be compatible with other areas of work such as redevelopment or geotechnical aspects
- state how it will protect human health, the environment, ecology and other receptors
- provide a sustainable approach
- be practical, achievable, effective, durable and verifiable

As you produce the remediation strategy, you may need to consult with:

- the client
- the relevant regulator
- legal advisers
- remediation contractors
- the contract laboratory
- landfill or waste treatment operators
- a civil engineering consultant
- a project management consultant
- a quantity surveyor
- local residents – this depends on the type of remediation and potential for nuisance, see communicate the risk (<https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm/lcrm-before-you-start#communicate>)

What to include in the remediation strategy

Your remediation strategy needs to include details of:

- the monitoring objectives and criteria you will set for the site
- the remedial actions that will be done
- how you will implement remediation
- how you will verify remediation is working by including a verification plan
- any monitoring and maintenance requirements
- any regulatory controls that need to be in place, such as permits and deployments

It also needs to set out:

- the technical and scientific basis for the choice of remediation technology
- the effectiveness of any combined options
- any constraints and limitations of the selected remediation option
- the timescales for the remediation to become fully effective
- the expected durability of the proposed remediation
- how you will prevent harm or pollution being caused by the remediation activities
- how you will deal with uncertainties and contingency planning – for example, unexpected contamination
- justification for any changes required to previously derived remediation criteria
- a summary of alternative strategies considered
- a description of how it will meet the remediation objectives and criteria

- any sustainable approach used

See also the remediation strategy reporting requirements for a checklist of what to include.

For detailed information on the remediation strategy see INFO-OA3: developing the remediation strategy (<https://www.claire.co.uk/useful-government-legislation-and-guidance-by-country/200-developing-the-remediation-strategy-info-oa3>) on the CL:AIRE Water and Land Library.

Set monitoring objectives and criteria

Include site-specific monitoring objectives and criteria. Use them to:

- demonstrate the ongoing, short and long term performance of the remediation
- track contaminant behaviour and movement, to get an early warning of adverse trends

Examples of monitoring objectives are to:

- verify remediation is working or has worked
- find out if a contaminant plume is spreading or shrinking
- review and clarify any uncertainties

You must use monitoring criteria. These are measures, usually quantitative, against which compliance with the monitoring objectives will be assessed. Examples include:

- derived remedial targets
- remediation evaluation criteria
- environmental quality standards

Provide details of monitoring and maintenance

Provide details of monitoring and maintenance. For example, you may need to:

- demonstrate that remediation is working and for verification purposes
- do post-remediation monitoring and site maintenance for a specified period to meet remediation objectives
- demonstrate that the works have not impacted air or water quality
- ensure that remediation performs as required over a specified design life
- do the remediation option of long term monitoring and maintenance, if decided at the options appraisal stage

The remediation strategy will need to provide details on the extent, frequency and overall duration of the monitoring and maintenance. For example, you may need to:

- identify appropriate intervals to report on verification progress
- agree this frequency with the relevant regulator

For sites that we regulate see chemical testing of soils

(<https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm/lcrm-stage-1-risk-assessment#chemical-testing>) for details of the:

- monitoring certification scheme (MCERTS) requirements
- use of in situ testing and rapid measurement techniques

See monitoring and maintenance reports for a checklist of what you can consider for this section of the remediation strategy.

Justify and confirm within the remediation strategy if monitoring and maintenance is not required.

For detailed information on monitoring see INFO-IMP3: long term monitoring and maintenance (<https://www.claire.co.uk/information-centre/water-and-land-library-wall/41-water-and-land-library-wall/188-long-term-monitoring-and-maintenance-info-imp3>) on the CL:AIRE Water and Land Library.

Provide details of how you will implement remediation

Include:

- information on any regulatory requirements
(<https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm/lcrm-stage-2-options-appraisal#regulatory-controls>)
- the timescales for applying for regulatory approvals and meeting the requirements

You will need to procure a standard form of contract for remediation.

You must have confidence in the personnel you appoint – they will need to have a proven track record and the required expertise. You must define who is responsible for doing what, including the site supervision throughout the whole of remediation.

See the remediation strategy reporting requirements for a checklist of what to include.

To find further detailed information on the design, implementation, optimisation and verification of remediation see:

- INFO-IMP: implementation of the remediation strategy
(<https://www.claire.co.uk/information-centre/water-and-land-library-wall>) on the CL:AIRE Water and Land Library
- the Society for remediation practitioners in the UK (RemSoc) (<https://www.remsoc.org/>) website

Produce a verification plan

You will need to produce a verification plan that:

- provides details of how you will verify remediation is working
- states how you will collect and assess data to demonstrate it will meet the remediation objectives and criteria set in the options appraisal stage

Include the verification plan as part of the remediation strategy.

Set out the requirements for the data you need to collect. Include for example:

- compliance criteria
- analytical data, sampling frequencies and methods
- field monitoring data, level surveys, above and below capping layers
- measurement parameters and analytical suites with limits of detection, bias and precision necessary to demonstrate that remediation objectives are being met

Use the verification plan to:

- establish the required quality standards from data collected on site or produced by laboratories during remediation
- identify records that you need to keep to demonstrate compliance within the remediation specification
- establish a lines of evidence approach for verifying the remediation

Consider any likely verification requirements such as:

- reporting procedures and regulatory requirements, such as approvals
- how you will keep and maintain records to demonstrate compliance
- how you will meet quality standards such as MCERTS
- whether you need additional equipment or to construct monitoring wells

See also remediation strategy reporting requirements for a checklist of what to include in the verification plan.

Use a lines of evidence approach

To verify remediation is working you can use a lines of evidence approach.

You can use it to demonstrate the performance of remediation by collecting data sets for principal parameters.

Include in your remediation strategy how you will:

- collect the data for the lines of evidence
- verify the performance of each

Examples of lines of evidence

Consider these examples of lines of evidence. For each element, decide who will be responsible for carrying out measurements or tests, and at what frequency.

For soil and water testing:

- soil sample tests, such as at defined locations, at set time intervals, per volume of soil excavated, moved or treated
- post treatment tests of water quality samples
- measuring parameters, such as pH, dissolved oxygen, flow rates
- testing of water quality in nearby watercourses or groundwater bodies

For contaminants:

- measuring the rates of reaction, product breakdown, degradation measurements
- measuring quantities of contaminants or contaminated media removed
- regular monitoring of contaminant concentrations and geochemical properties in groundwater to show the effectiveness of active treatments or natural attenuation

For regulatory:

- evidence of compliance with regulatory controls such as permit conditions, abstraction licence volume limits
- results of dust, noise, odour and other monitoring at site boundaries and other agreed locations
- evidence of compliance with a regulatory position statement or exemption
- evidence of meeting the requirements of the CL:AIRE Definition of waste: Development industry code of practice (DoW:CoP) or an end of waste quality protocol (<https://www.gov.uk/government/collections/quality-protocols-end-of-waste-frameworks-for-waste-derived-products>), if used

For ground gases and vapours consider for example:

- verification of gas and vapour protection measures
- visual inspection of gas resistant membranes for evidence of tears or gaps around service entries

These can be in line with industry guidance such as:

- CIRIA 735: good practice on the testing and verification of protection systems for buildings against hazardous ground gases (<https://www.ciria.org/ItemDetail?iProductcode=C735&Category=BOOK>)
- 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>)

For geotechnical:

- representative measurement of physical properties, for example permeability, strength, thickness and level of clay cap or stabilising materials
- compliance tests of stabilised materials

- testing of quality of imported soils or other materials
- measuring the thickness of a capping layer after placement by topographical surveys before and after placement

You can use the lines of evidence along with an evolving conceptual site model to address any uncertainties associated with the remediation.

For detailed information on verification see INFO-IMP2: implementation, verification and monitoring (<https://www.claire.co.uk/useful-government-legislation-and-guidance-by-country/189-implementation-verification-and-monitoring-info-imp2>) on the CL:AIRE Water and Land Library.

Complete the detailed design

The options appraisal may have included an initial design. For example, there may have been some work to establish the feasibility of a particular treatment, such as planning for a permeable reactive barrier.

Use any initial design work to prepare detailed design drawings, specifications and contract documents.

Describe in the specification the work that is needed and the quality standards you aim to achieve.

Make sure the design meets the remediation requirements. For example, your design must not:

- hold up remediation
- cause cross contamination
- result in new pathways (<https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm/lcrm-stage-1-risk-assessment#new-pathways>) such as from piled foundations or new drainage systems

Complete the detailed design and include it in your remediation strategy.

Consider local residents

You will need to consider concerns from local residents. These can include:

- health or other concerns about the type of contamination
- how the remediation works will affect adjoining land and neighbouring properties
- the number of working hours and days per week
- how long it will take to complete the works
- noise, dust and odour nuisance and how this will be managed
- vehicle movements, potential road works, closures, traffic restrictions on roads or footpaths
- the likelihood of the remediation being successful or if further works are required

Consider how you will engage local residents. This could be for example, through site newsletters, notice boards and setting up local groups.

See communicate the risk (<https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm/lcrm-before-you-start#communicate>).

Construction (Design and Management) Regulations

You must ensure design and remediation works meet the Construction (Design and Management) Regulations health and safety requirements. For more information see the Health and Safety Executive (<http://www.hse.gov.uk/construction/cdm/2015/index.htm>) website.

You may also have to meet other health and safety requirements, for example:

- building regulations
- control of substances hazardous to health assessments

Consult, agree and issue the remediation strategy

Communicate and consult with relevant stakeholders, such as:

- the regulator and other organisations, for example Natural England and English Heritage
- professional teams working on other aspects of the project, such as a quantity surveyor, geotechnical engineers
- legal team for contracts, liabilities and warranties
- statutory undertakers for certain developments and highways works
- prospective purchasers, insurers and funders
- local residents, neighbouring properties and local interest groups, such as community or wildlife groups

For detailed project management information on the CL:AIRE Water and Land Library see:

- INFO-PM1: guidance specific to particular industrial or commercial sectors (<https://www.claire.co.uk/useful-government-legislation-and-guidance-by-country/193-guidance-specific-to-particular-industrial-or-commercial-sectors-info-pm1>)
- INFO-PM2: health and safety and quality management (<https://www.claire.co.uk/useful-government-legislation-and-guidance-by-country/191-health-and-safety-and-quality-management-info-pm2>)
- INFO-PM3: communication (<https://www.claire.co.uk/useful-government-legislation-and-guidance-by-country/203-communication-info-pm3>)

The final remediation strategy will need to confirm that:

- it meets the requirements and objectives for the site as a whole
- it will not result in harm or pollution to the environment
- it meets the remediation objectives and criteria

- the remediation can be implemented in a timely, safe, cost-effective and quality assured way
- it has considered sustainability
- the remediation can be verified

Issue the final remediation strategy once agreed by the regulator and stakeholders to all relevant parties.

The remediation strategy is part of the final record of land quality.

Step 2: Remediate

You must not start remediation until you have all the relevant regulatory approvals. You will have considered what might be required in step 1 of the options appraisal stage.

The remediation strategy confirms which regulatory controls you need.

Having produced and agreed the remediation strategy you can now:

- start remediation
- do long term monitoring and maintenance if this was the agreed remediation option

Implement the verification plan

Implementing the verification plan is an iterative process. The process is complete when you can decide to end monitoring or sampling and produce the verification report.

You must collect all relevant data as set out in the verification plan to ensure verification reporting will accurately reflect all works carried out.

You can track if remediation is succeeding by systematically evaluating verification data. This will identify potential difficulties in meeting remediation criteria at an early stage.

For example, your reviews of the data collected will enable you to decide if the:

- data meets the lines of evidence requirements
- remediation objectives and criteria are being met

For the lines of evidence, check the data quality requirements are as set out in the verification plan.

Assess performance against all remediation criteria to ensure that the remediation objectives are being achieved. This may be a complex operation where criteria relate to several remediation activities, phases or timescales.

You will need a contingency plan to identify what action to take if results fall outside of acceptable limits. This is important if there is concern that the remediation objectives are unlikely to be met.

You may need to review the remediation objectives and criteria and modify the remedial process or consider other options.

Data that may lead to a further review include a:

- change in conditions such as temperature or pH
- decline in contaminant concentrations not as predicted
- contaminant plume that does not shrink or stabilise as predicted during monitored natural attenuation (MNA) or in situ treatment
- diminishing return in efficiency for example, in soil vapour extraction, air sparging or pump and treat
- change in groundwater flow or head up gradient of a slurry wall or permeable reactive barrier
- failure to prevent the migration of ground gases for example, by passive venting, containment or active abstraction

Justify, record and agree any changes to the verification plan, particularly where they lead to a change to the remediation objectives.

You must continue to review and update the conceptual site model. Include it in the verification report, to demonstrate that the remediation objectives have been met.

During remediation

You will need to:

- ensure remediation is done in line with the remediation strategy and regulatory controls for example, a standard rules permit and a mobile plant permit deployment form (MPP2)
- react to testing results or monitoring data promptly
- manage unexpected contamination
- allow time to get and interpret the data without delaying progress
- use a different solution or contingency measure if the data shows that the remediation is not working
- ensure any method statements are correct and kept up to date

You may need to provide remediation progress reports where appropriate or if required.

For sites that we regulate see chemical testing of soils

(<https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm/lcrm-stage-1-risk-assessment#chemical-testing>) for details of the:

- MCERTS requirements
- use of in situ testing and rapid measurement techniques

Step 3: Produce a verification report

You will need to:

- demonstrate that the risk has been reduced and the remediation objectives and criteria have been met
- provide a quantitative assessment of the remediation performance using the lines of evidence approach in your verification plan
- produce a verification report to show that remediation has been successful

- create a final record of the land quality

It must include, if applicable, details of any unexpected contamination and how this was dealt with.

You will normally produce the verification report once the remediation work is complete. If remediation is phased you may need to produce separate verification reports for each phase.

Agree any phased verification with the relevant regulator.

For example, following installation of a permeable reactive barrier, treatment of groundwater will continue to operate for many years. You will:

- use your lines of evidence to demonstrate that it is performing as expected
- produce monitoring reports at appropriate intervals to verify continuing efficiency
- confirm that down-gradient contaminant concentrations are decreasing
- need to establish when treatment can finish and when the final verification report can be produced

See verification reporting requirements for a checklist of what to include in the verification report.

For detailed information on verification see INFO-IMP2: implementation, verification and monitoring (<https://www.claire.co.uk/useful-government-legislation-and-guidance-by-country/189-implementation-verification-and-monitoring-info-imp2>) on the CL:AIRE Water and Land Library.

If required, you can supplement the verification report with monitoring and maintenance reports.

If monitoring and maintenance is not required you can now conclude stage 3.

Conclude stage 3

At the end of this stage you must decide if the remediation has:

- been successful
- has met the remediation objectives and criteria
- been verified

If remediation has not been successful you may need to:

- re-evaluate and go back to previous stages
- collect further information through a supplementary investigation
- do post remediation monitoring and maintenance for further verification

Your decision that remediation is acceptable may need approval or agreement from the relevant regulator. For example, approval of a Part 2A obligation or to satisfy a planning condition.

Create a final record of the land quality

When remediation is complete you will need to create a final record of the land quality. The landowner and any other relevant parties must hold copies of the:

- remediation strategy
- verification report
- long term monitoring and maintenance reports, if applicable
- health and safety information
- contract documents, as built drawings and specifications

For Part 2A, recording these details is a statutory requirement.

Step 4: Do long term monitoring and maintenance, if required

You may need to do:

- long term monitoring and maintenance if this was agreed as the remediation option
- post remediation monitoring and maintenance for further verification

Use the monitoring objectives and criteria you set in the remediation strategy.

You will need to:

- confirm who will carry out the work
- report your results
- decide and get agreement when monitoring or maintenance can stop

Consider the frequency, scope and reporting requirements of the monitoring and maintenance. Make sure that:

- this is acceptable with regulators and stakeholders
- there are plans in place if monitoring criteria are not met
- access to carry out the work is still acceptable – for example, redevelopment may have changed access to plant or monitoring points
- any specialist skills for ongoing maintenance are in place if it cannot be done routinely
- there are adequate provisions for replacing consumables such as treatment chemicals
- power supplies are guaranteed and if emergency back-up is required
- any maintenance work items are fully specified, including actions, frequency, responsibility and the standard you aim to achieve
- there are reactive maintenance measures in place to deal with unexpected events such as emergencies, breakdowns, vandalism or accidents

See monitoring and maintenance reporting requirements for a checklist of what to include.

After you have confirmed the details:

- make sure that the work is carried out and reported on as agreed
- make sure that any reactive maintenance measures are done

- regularly review and revise if monitoring criteria are not met or if there are unexpected results
- give copies of all reports to the stakeholders

If you cannot meet monitoring criteria you can:

- check equipment and calculations are correct to verify the monitoring data
- consider the effect of seasonal variations
- consider any spatial variation in monitoring data – you could add extra monitoring points
- increase the frequency of monitoring locally or across the whole site
- consider introducing continuous monitoring or an alarm system
- modify the remediation to improve effectiveness

Record these contingency plans and actions in your monitoring and maintenance report.

For detailed information on verification see INFO-IMP2: implementation, verification and monitoring (<https://www.claire.co.uk/useful-government-legislation-and-guidance-by-country/189-implementation-verification-and-monitoring-info-imp2>) on the CL:AIRE Water and Land Library.

Conclude step 4

You will need to:

- confirm that long term monitoring and maintenance objectives have been met
- produce a monitoring and maintenance report that proves monitoring objectives and criteria have been met
- verified and got agreement that remediation is complete

If the objectives have not been met, do further monitoring and maintenance.

Your decision may need approval or agreement from the relevant regulator.

Issue the final report to stakeholders. For example, to the landowner and the regulator.

You can now create a final record of the land quality to conclude stage 3.

Remediation and verification 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 remediation and verification reports.

You will need to produce the following.

1. Remediation strategy.
2. Verification report.

You may also need to produce:

- remediation progress reports
- monitoring and maintenance reports

Include details of any further assessment, supplementary investigation and monitoring results.

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

For large, complex sites, or if you are phasing remediation works or intrusive site investigation, you may need to produce individual reports.

You can use these checklists to find out what reports you need to produce and 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>).

Remediation strategy

You can break the remediation strategy down into relevant sections. Include an introductory and background section and details of how you will:

- implement remediation
- verify remediation – through a verification plan
- meet remediation monitoring objectives and criteria

Where applicable, include any updated results and explain how you developed the remediation strategy.

Basic site details

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

For the introductory section include:

- a summary of the site explaining why remediation is needed
- the overall site objectives set in the preliminary risk assessment
- the remediation objectives and criteria set in the options appraisal stage
- a summary of the proposed remediation
- any legal and regulatory requirements such as Part 2A or planning conditions
- the roles and responsibilities of all parties involved in the remediation

Include:

- any caveats and assumptions used when you developed it
- how you reached agreement with regulators and stakeholders

For the environmental setting include:

- a summary of ground conditions
- information on the hydrogeology, hydrology and other receptors

For site assessment include:

- a review and summary of the previous reports for the site
- a summary of the risk assessment stage
- a summary of the options appraisal stage and selection of the final feasible options
- details of any combined options
- details of any supplementary investigation or assessment
- any recent monitoring results
- any requirements for long term monitoring and maintenance

For remediation include:

- the initial and updated conceptual site model
- details of the relevant contaminant linkages
- planned remedial actions
- information on costs and benefits
- expected durability of the remediation
- details of any planned sustainable remediation practices to be applied during the remediation
- a plan to deal with invasive plant species, if applicable
- any communication with local residents

Explain how the design of the remediation will:

- protect human health and the environment
- meet health and safety requirements such as the Construction (Design and Management) Regulations

You can include any design statement.

Include practical matters such as:

- details of appropriate environmental permits, regulatory controls and other permissions relevant to the proposed remediation
- integrated waste handling
- record keeping such as quality management systems for the systematic planning, organisation and control of documents

Provide details of how you will implement remediation

Include:

- details of any preparatory works already done, or that are planned for, such as demolition or provision of temporary infrastructure
- any proposed site zoning and phasing of remediation – how you will plan the remediation to avoid interruption, delay or error
- the scope of work and anticipated timescales – the programme of works include when remediation will start and likely completion
- any constraints on preparation and operations
- details on environment protection – such as emissions, noise, odour, nuisance control
- any mitigation measures to avoid impact to local residents
- any post contract maintenance needs and costs such as additional monitoring or permanent structures
- how remediation plant will be protected for example, from accidents or vandalism
- completion and handover actions
- construction details of any monitoring boreholes
- details of how you will get agreement from the regulator that remediation can start

Provide maps, plans and photographs to show the:

- site boundary
- areas for remediation, including in relation to any proposed development
- proposed locations and phasing of remediation works
- storage areas
- monitoring points

For the monitoring content of the remediation strategy you can use the checklist in monitoring and maintenance reporting.

Verification plan

Include in the verification plan:

- the specified critical performance criteria to achieve remediation for each part of remediation
- the lines of evidence that will be used
- how it will meet the remediation objectives and criteria set in the options appraisal
- what data you will collect, how you will collect it and how often
- how you will assess the different types of data
- time required to achieve effectiveness
- proposed response actions if the remediation technology does not produce the expected results
- how decisions will be made on replacing or upgrading the remediation treatment technology if it becomes ineffective
- an indication of when the verification report can be produced

Include details of how you will meet the remediation monitoring objectives and criteria. For example:

- monitoring, such as frequency, duration, location, analysis and acceptance criteria
- sampling and testing criteria, such as measurement parameters, analytical suites with limits of detection, bias and precision
- quality control
- any need for additional equipment or facilities, such as monitoring wells

State who is responsible for:

- each part of remediation and managing the measurements and tests
- reporting requirements for all data, including analytical report sheets, quality control information
- any waste and permitting requirements

Include any regulatory controls such as the:

- acceptance by regulators that remediation objectives are being met
- criteria for allowing permits to end or for the discharge of planning conditions
- compliance with any MCERTS, in situ testing or rapid measurement techniques requirements

Include a contact list of who you must issue the verification data to.

Remediation progress reports, if required

Typical information includes:

- basic site details
- progress of activities compared to the planned programme and any potential delays
- results of ongoing verification testing against remediation objectives
- results of environmental monitoring against agreed standards
- evidence of compliance with permits or other regulatory controls
- any changes to site supervision and site works related to site monitoring and testing
- any requirements to modify remediation
- details of any reported health and safety breaches
- details of any environmental accidents or incidents
- details of site visits made by regulators
- photographic records
- spend compared to the planned budget
- forecast of future spend and implications for the budget

Verification report

Where remediation is phased or if long term monitoring and maintenance is required, you may need to produce monitoring and maintenance reports to supplement the verification report.

For background information include:

- basic site details
- overall site objectives set in the preliminary risk assessment
- brief summary of former use, previous investigations, ground conditions, hydrogeology and hydrology and other receptors
- details of the project and the roles and responsibilities of those involved – such as owner, contractors, developers

Include any statutory and regulatory requirements information, such as:

- details and compliance with regulatory controls and permits
- discharge of planning conditions
- compliance with a remediation notice or remediation statement

Provide details of any:

- waste carrier and disposal records such as waste transfer and consignment notes
- third party agreements such as covenants, wayleaves and contractual warranties

For details of the remediation include:

- a general description of remediation – include the conceptual site model and relevant contaminant linkages
- remediation objectives and criteria that you set in your options appraisal
- the sequence of activities
- what represents completion

For details of verification provide:

- a clear description of how the remediation was verified
- volumes and characteristics of material treated
- volumes and characteristics of water or liquid waste treated or disposed of
- rate of contaminant mass reduction or removal
- volumes, source and quality of any imported material
- details of any sustainable remediation

Include brief details of the DoW.CoP or other end of waste quality protocols, if used.

Include details of any:

- encapsulation – include depth and thickness of capping layers
- installation of gas protection measures
- gas venting
- permanent treatment installations
- zone of influence for in situ venting or sparging systems
- variations in for example, optimum air injection, extraction rates, flow rates

Include emissions control monitoring information to:

- demonstrate compliance with regulatory, health and safety or environmental requirements
- provide evidence that any mitigation measures have worked or are continuing to work effectively
- confirm the efficiency of air-scrubbing systems – such as percentage efficiency in removing volatile organic compounds

Provide details of chemical and physical testing information, such as the:

- chemical testing during the remediation to demonstrate achievement of remediation objectives
- physical testing and measurements during the remediation to demonstrate achievement of engineering objectives on backfilled or reused material

For ongoing monitoring you need to include results of groundwater, soil-gas or surface water monitoring. This is to assure the effectiveness of the remediation measures after completion.

Identify any post treatment management needs, such as any:

- ongoing or planned monitoring and maintenance required to establish long term effectiveness
- confirmed future restrictions on land use, maintenance and other building operations
- constraints on future activities for example, to avoid damage to capping layers

Include supporting information, such as:

- photographic records
- plans, maps and diagrams – show areas remediated, and any areas of residual contamination or sub-surface structures
- monitoring locations
- test results – in situ, on-site and laboratory test results for all materials that are part of the remediated area, including any imported materials
- details of any MCERTS requirements and in situ testing or rapid measurement techniques, if used
- remediation progress reports if done
- relevant correspondence
- any site visits by regulators before, during and after remediation
- technical literature references
- health and safety procedures

Include details of the long term monitoring and maintenance, if applicable.

Include a description of the final site condition at completion and the final extent of remediation, such as:

- the implications of the final site condition on the future use of the site

- the lines of evidence used to verify remediation – include how remediation objectives and criteria have been met
- an updated conceptual site model to demonstrate that all relevant contaminant linkages have been mitigated

Identify the regulators or other organisations that you need to consult with on the verification report, such as:

- local authorities
- Environment Agency
- other UK regulators
- Health and Safety Executive
- Natural England
- English Heritage

Monitoring and maintenance reporting

You can use this section:

- for any monitoring requirements such as to fulfil a planning condition, or as part of the site investigation
- for what to include in monitoring and maintenance section of the remediation strategy
- if you are doing post remediation monitoring for further verification purposes
- if you are doing long term monitoring and maintenance as the remediation option

The general section can include:

- basic site details
- the scope of monitoring and maintenance work
- who will do the work and how it will be funded
- the format and frequency of reports
- who you will issue the reports to
- how records will be kept
- how you will agree changes with stakeholders and regulators if needed
- criteria for working out when monitoring and maintenance can stop

The monitoring section can include:

- the monitoring objectives and criteria as set out in the remediation strategy
- assessment of compliance against the monitoring criteria
- frequency, analytical methods and reporting standards
- monitoring schedule – for example, plumes, gas concentrations, surface water or groundwater quality and visual inspection of the surface condition of capping layers

You may also need to include:

- if more monitoring or changes are needed or whether they can be combined with the original scope

- contingency plans if the monitoring results do not meet agreed criteria
- results and actions taken in response to unexpected results
- recommendations for future monitoring and any variations to the agreed monitoring programme

For sampling data you can include the:

- methods used to collect, preserve and transport samples
- details of the sampling, laboratory analyses and testing schedules, methods and reference standards
- monitoring results – summary and full analytical results
- details of MCERTS, in situ testing and rapid measurement techniques, if applicable
- quality control and retention of samples
- certificates of analysis and chain-of-custody records
- confidence limits and evaluation of data against the overall site objectives and the conceptual site model
- supporting information such as toxicity test data for detailed quantitative risk assessment, if applicable

Include:

- location and construction of monitoring points
- borehole logs

For maintenance reporting you can include:

- fully specified maintenance work, including actions, frequency, responsibilities and standards you aim to achieve
- schedule of the regular maintenance activities, such as vegetation clearance, equipment calibration and servicing, installation of replacement parts
- elements which will need maintenance to ensure the remediation continues to function effectively
- any regular maintenance activities already done
- condition of the remediation plant
- details of specialist skills, if required
- if maintenance of the remediation can be combined with other site maintenance
- information on use of consumables and energy
- how the supply of consumables will be adequate, such as treatment chemicals
- how power supplies will be guaranteed, for example by providing emergency back up

Consider:

- how reactive maintenance, such as breakdown or vandalism will be dealt with and any unexpected maintenance will be done
- any requirements to action repairs or to service plant
- how decisions will be made on replacing or upgrading the remediation treatment technology if it becomes ineffective

- any recommendations for future routine or unexpected maintenance
- forecast of future expenditure for maintenance works

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