
RICARDO
EMAQ+
Essentials of CLM 5
Reviewing Third Party Reports
January 2025
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RICARDO
EMAQ+
ENVIROCONSULT
Environmental and acoustic consultancy
LQM
Sound science:
Defensible decisions
T.G.
Environmental Consultants
AECOM
SBS
SOUND BARRIER SOLUTIONS
The Scottish Government

Programme of the day

January 2025

Session 1: Reviewing Reports: General

Session 2: Reviewing Preliminary Risk Assessment reports

Session 3: Reviewing Site Investigation Report

Session 4: Reviewing Risk Assessment Reports

Session 5: Reviewing Phase 3 Reports: Remediation Strategy & Validation Report

Session 6: Sources of Information

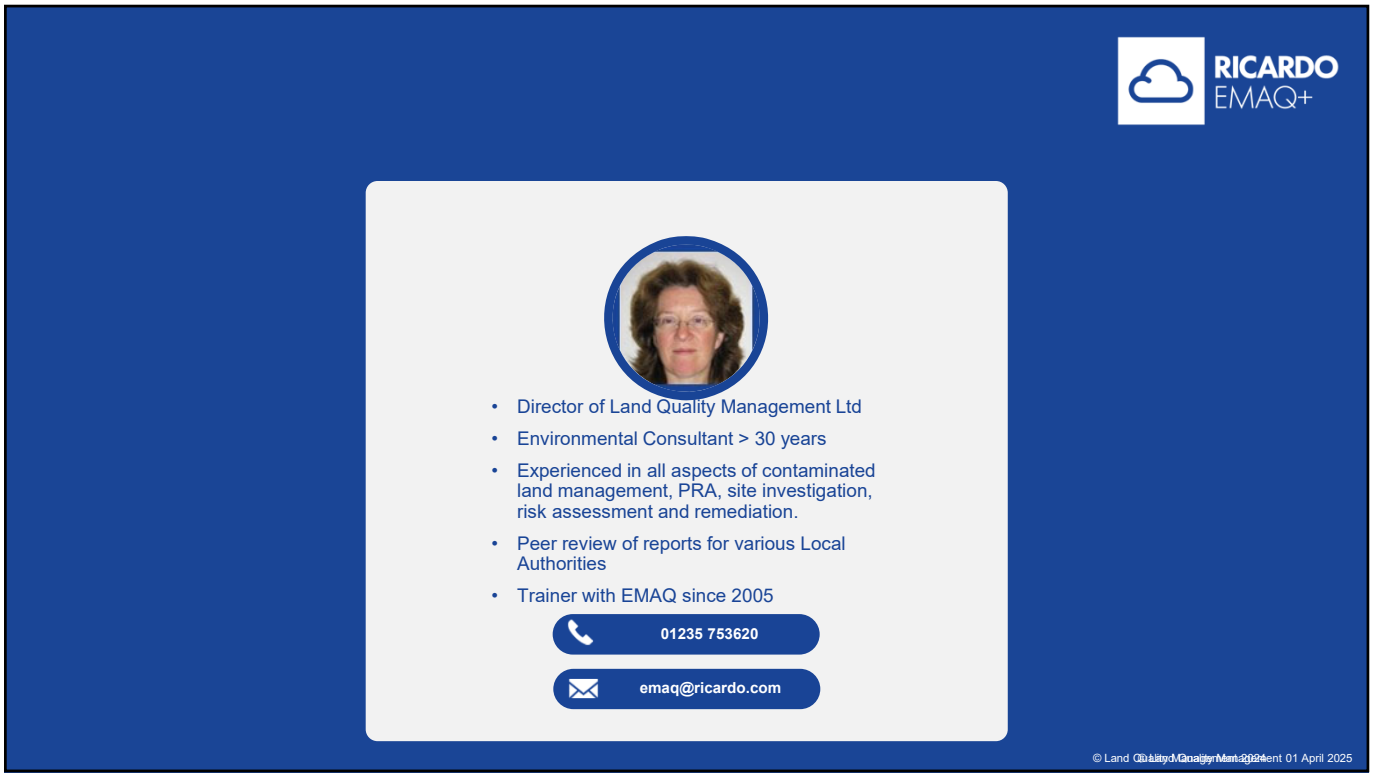
Air Quality Monitoring

At Ricardo we have a dedicated team of AQ specialists and look forward to helping you with any of your air quality challenges:

- ISO 17025 UKAS accredited **QA/QC audits** – required by LAQM TG (22)
- **Data management**, data collection, checking, validation, ratification etc
- **Local site operations**, calibrations/call outs
- **Web reporting**
  http://www.airqualityengland.co.uk/
- **Routine data reporting** – weekly, monthly, quarterly, annual – for example
  http://www.airqualityengland.co.uk/assets/reports/291/KensingtonChelsea_month_2019_01.html
- **Short term monitoring surveys** (site installation/decommissioning through to reporting)
- Long term station hire
- Free advice on station installation and best practice
- Procurement of analysers and installation to LAQM TG (22) or AURN standards
- **Low cost sensor measurements**, network management
- **Real world vehicle emissions monitoring** aiding Action Planning
- **Mobile Monitoring** for point source and concentration contour mapping
- **Diffusion tube surveys**
- **Air quality forecasting** and public dissemination (via sms text, email, web, social media etc.)
- Air quality reporting
- LAQM TG (22) Annual Status Reporting (ASR), Detailed Assessment
- CAZ/LEZ consultancy
- Expert witness and Expert Advice
- Air Quality Modelling

For further information please get in touch with David Madle

07968707279 david.madle@ricardo.com



Essentials of Contaminated Land Management

- 5 “stand-alone” seminars/webinars that, together, comprise a complete ‘Essentials of CLM’ Training Course
- A partnership between an individual and his sponsoring authority or organisation
- Curriculum based on the EMAQ Essentials Syllabus and government guidance
- Combines knowledge with practical experience of contaminated land management to:
  - Provide evidence of an individual’s ability to implement Contaminated Land Management (CLM) requirements;
  - Build the individual confidence to operate effectively.

Essentials of Contaminated Land Management

RICARDO EMAQ+

KEY ELEMENTS

1. Register and identify a “supervisor”
2. Attend the seminars\webinars
3. Demonstrate an understanding of the seminar\webinar material – via an on-line knowledge check,
   (A CLM credit will then be issued in addition to the CPD certificate that all those attending will receive.)
4. Agree a development programme with a supervisor (or mentor) which, by the end of the five seminar\webinar programme, will show evidence of having satisfactorily undertaken the following practical operations of CLM:

   - Procedural / Legal
   - Practical / Technical
   - Management

   (supervisor to verify attainment)

Essentials of Contaminated Land Management

RICARDO EMAQ+

A Certificate in Contaminated Land Management will be issued to those who have:

- Registered and paid the fee
  - Contact EMAQ for current fee
- Gained all 5 credits
- Successfully sat the on-line ‘Proficiency Test' designed to show a co-ordinated knowledge of all the aspects of CLM programme
- Whose Supervisor has:
  - verified the bona fides of the candidate and that the test was undertaken under the required conditions
  - confirmed that the candidate has had experience of the practical elements of CLM listed in their development plan

Essentials of Contaminated Land Management: Mechanics

- Online: instructions, registration, testing, record updating, certificate production
- Register – via the EMAQ+ website
    - include the name and contact details of supervisor
- Attend live seminars or view webinars on-line
- Obtain CLM credit via on-line 'Knowledge Check' 20 multi-choice questions which are to be completed on-line within one unbroken 2 hour period, gain a pass by getting 75% or more correct
    - Delegates notified of test window; 3 opportunities to pass within a 4 week period
- Proficiency Test, 20 multi-choice questions, drawn from the entire syllabus
    - When logging on, supervisor will be asked first to verify the candidate's identity
    - Supervisor to verify practical experience
    - 20 test questions which must be undertaken within an unbroken two hour period
    - Successful candidates must correctly answer 75% of the questions. Candidates will have 2 opportunities within a 4 week period.

Essentials of Contaminated Land Management: Modules

1. Introduction to Land Contamination Risk Management
2. Site Characterisation
3. Risk Assessment
4. Remediation and Risk Management
5. Peer Reviewing Third Party Reports

Session 1

Reviewing Reports: General

Reviewing reports

- Why and what are you reviewing
- Resources required
- Building blocks of a report

What are you reviewing?

- Different types of land contamination reports:
  - Stage 1
    - Preliminary risk assessment report (formerly Phase 1)
    - Site Investigation/risk assessment reports (formerly Phase 2)
  - Stage 2 Options Appraisal (formerly part of Phase 3)
  - Stage 3 Remediation Strategy and verification reports (formerly Phase 3)
  - Others?
- Purpose of reports
  - Planning: submitted to support an application to discharge planning conditions;
  - Part 2A investigations;
  - Land acquisition, due diligence
  - Internal review
  - Peer review "second opinion"

Who are you?

Council?

Consultant?

Landowner?

Why are you reviewing?

- In what capacity are you reviewing the report?
  - Client
  - Regulator
  - Site owner
  - Warranty/insurance purposes
  - Internal peer review
  - External peer review
    - Incl SQP/auditor
  - Other
- What is the purpose of the review? eg
  - Ensure technical robustness
  - Test legislative compliance
  - Identify potential financial liability
  - Identify potential environmental liability
  - Quality assurance
  - Contractual compliance
  - Other

Mainly reviewing reports under planning

Why are you reviewing?

- In what capacity are you reviewing the report?
  - Client
  - Regulator
  - Site owner
  - Warranty/insurance purposes
  - Internal peer review
  - External peer review
    - Incl SQP/auditor
  - Other

What decision do you need to make?

- What is the purpose of the review? eg
  - Ensure technical robustness
  - Test legislative compliance
  - Identify potential financial liability
  - Identify potential environmental liability
  - Quality assurance
  - Contractual compliance
  - Other

Mainly reviewing reports under planning

Why are you reviewing?
What decision do you have to make?

- Legal context is key!
- Planning
  - Test: Does the report/land meet the requirements set out in the NPPF (for England) and relevant local planning policies?
    - Wider range of receptors
- Part 2A:
  - Test: Does the report/land meet the requirements set out in the relevant statutory guidance?
    - Limited range of receptors
    - Categories 1-4
- Other?
  - Test: ?

Local planning policies: South Somerset

POLICY HG7: GYPSIES, TRAVELLERS AND TRAVELLING SHOWPEOPLE

The accommodation needs of Gypsies, Travellers and Travelling Showpeople will be met by ensuring that they are accommodated in sustainable locations where essential services are available.

Site allocations will be made to accommodate at least:

- 23 Residential pitches (from 2013 onwards);
- 10 Transit pitches; and
- 6 Travelling Showpeople plots.

The following criteria will guide the location of sites:

- Significantly contaminated land should be avoided;
- Development should not result in an adverse impact on internationally and nationally recognised designations (for example: Natur… Interest and Areas of Outstanding Natural Be…

POLICY EQ7: POLLUTION CONTROL

Development that, on its own or cumulatively, would result in air, light, noise, water quality or other environmental pollution or harm to amenity, health or safety will only be permitted if the potential adverse effects would be mitigated to an acceptable level by other environmental controls, or by measures included in the proposals. This may be achieved by the imposition of planning conditions or through a planning obligation.

New development should not exacerbate air quality problems in existing and potential AQMA's. This should include consideration of the potential impacts of new developments and increased traffic levels on internationally designated nature conservation sites, and adopt mitigation measures to address these impacts.

No development approved by this planning permission shall commence until a remediation strategy to deal with the risks associated with contamination of the site has been submitted to, and approved in writing by, the Local Planning Authority.

This strategy will include the following components:

(i) A preliminary risk assessment which has identified:
- all previous uses;
- potential contaminants associated with those uses;
- a conceptual model of the site indicating sources, pathways and receptors; and
- potentially unacceptable risks arising from contamination at the site.

(ii) A site investigation scheme, to provide information for a detailed assessment of the risk to all receptors that may be affected, including those off site.

(iii) The results of the site investigation and the detailed risk assessment referred to in (ii) and, based on these, an options appraisal and remediation strategy giving full details of the remediation measures required and how they are to be undertaken.

(iv) A verification plan providing details of the data that will be collected in order to demonstrate that the works set out in the remediation strategy in (iii) are complete and identifying any requirements for longer-term monitoring of pollutant linkages, maintenance and arrangements for contingency action. Any changes to these components require the written consent of the local planning authority. The scheme shall be implemented as approved.

Prior to any part of the permitted development being occupied, a verification report demonstrating the completion of works set out in the approved remediation strategy and the effectiveness of the remediation shall be submitted to, and approved in writing, by the local planning authority. The report shall include results of sampling and monitoring carried out in accordance with the approved verification plan to demonstrate that the site remediation criteria have been met.

Example Planning Condition

Why are you reviewing? What decision do you have to make?

Resources for reviewing reports

- Personnel
- Time
- Cost

- Management
- Decision recording keeping

Resources Required: Personnel

- It is difficult to review a report you could not have written!
- Need adequate experience and competence relevant to the report but Land contamination is:
  - A highly technical area – Reviewers need to keep up to date and informed
  - A multidisciplinary subject - One person may not have all the relevant knowledge
- Staff competence?
  - The requirements of the NPPF “competent person” should also apply to the reviewers
  - Need for ongoing training and development
  - Is external expertise/support required?
- Are the right staff available?

Resources Required: Time

- Don't underestimate how long the process will take.
- Time is needed to:
  - Read and review all relevant materials; **and**
  - Prepare and report comments
- How long will the review take? Dependant on many factors including:
  - Complexity of the Site
  - Stage of the investigation
  - Volume of material submitted
  - Standard of reporting
  - Skill and experience of the reviewer
  - Access to digital, searchable report and data

Resources Required: Costs

- Mainly staff time
  - Including site visit and/or meetings
- Recovering costs?
  - Internal charges – provision of services to other departments?
    - Depends on council's policy and practice
  - Charges for non-statutory reviews
    - Pre-application advice e.g. EA
  - In some cases LA have agreed with developer before or during the project that independent external review will be required
    - Developer pays
    - Both parties agree a suitable 'independent' reviewer
    - Need to maintain independence and objectivity

Resources Required: Management and environment

- Reviewers will be subject to many pressures:
  - Planning timelines
  - Developer's demands
  - Consultants complaints
  - Political pressures
  - Time and resource constraints
  - Ethical dilemmas and personal commitment
- Reviewers need a supportive management and environment to
  - Facilitate training
  - Manage interference
  - Fairly resolve complaints

Resources Required: Decision record-keeping

- Planning decisions are taken by planners but it is important that EH consultees have good records of their recommendations
- Records of the review and its findings need to be documented and retained effectively
  - Legally important documents needed for effective regulation/enforcement
  - Some sites/developments span decades / sites can be subdivided
    - Companies, staff and regulators can all change
- Recording decisions
  - Formal procedure is important
  - Varies between councils
  - Should be kept for suitable period
    - Shredding of files, deletion of emails?

Lack of records can result in problems in later regulation enforcement

Building blocks of a report

- Why what when who where how
- Report Structure
- Document control
- Aims/objectives
- CSM
- Conclusions
- References
- Figures, appendices
- References
- Acronyms
- Uncertainty

I Keep 6 honest serving me
(They taught me all I knew)
Their names are What and Why and When
And How and Where and Who

Rudyard Kipling

Building blocks of a report: Reports should explain

- **Why** has the work been undertaken? Including:
  - Legal context
  - Relevant planning reference and text of relevant condition
  - Clear aim and objectives
- **Who** undertook the work?
  - Are they 'competent'?
- **How** has the work been undertaken?
- **Where** has the work been undertaken?
- **When** has the work been undertaken?
- **What** are the findings?
  - Conclusion must be made and presented
  - Compare with the aim and objectives

Building blocks of a report: General structure

- Title and document control
- Summary - executive or non-technical?
- Contents
  - Introduction – background, legal context, site information, aim and objectives
  - Technical chapters
    - Suitable heading structure
  - Conclusions (and recommendations)
  - References ?
  - Figures, appendices or addendums – may be many!
  - Limitations will be presented somewhere
    - Worth being aware of these!

Good structure is essential to clear and transparent presentation

Structure should be appropriate to material presented. Each report is unique

"ABC Consultants did not seek to evaluate the presence on or off the site of asbestos, radon gas or radioactive materials"

Building blocks of a report: Document control

- Who has written the report? Who has reviewed the report?
  - Name, company/organisation, position, qualifications
  - You need these details to assess if they are a "competent person"
- Is the report dated?
  - Defines what guidance and standards it should meet
- What is the status of the report?
  - Why review draft reports?
  - Will it be resubmitted for another review?
  - Cost/time and resource?
- What version/issue number?
- HINT: if you have reviewed an earlier version ask for the changes to be highlighted (eg track changes)

Building blocks of a report: Aim and objectives

- Should be clearly identified in any report
- All work described should be needed to meet these objectives
- The conclusions should address the aim
- Is there a copy of the project brief included?
  - Outline agreement between the consultant and client
- The developer may have a wider remit, but take note of any restrictions to the remit of the report:
  - Eg Limited to a specific areas
  - Eg Excludes risks to groundwater or from ground gas

Conceptual Site Model

- Is one present?
- Do you understand it?
  - ? Justification
    - Is it explained?
    - Is it justified by the results presented
  - ? consistency
- Does it show
  - Contaminant linkages
  - Key features on site
  - Subsurface

Building blocks of a report: Conclusion

- The interpretation of data is what consultants are normally paid for
  - It is what they incur liability for
- All reports should contain relevant conclusions (and recommendations, if appropriate) that address the aim
  - Aim: to determine if the land meets the statutory definition of Contaminated land under Part 2a….
  - Conclusion: The land does /does not meet the statutory definition of Contaminated land under Part 2a
- **Do not do the interpretation for them!**
  - Reports that comprise facts/data
  - Interpretive reports which do not interpret some part of the information

Building blocks of a report: Figures and appendices

- Appendices, addendums, annexes and enclosures
- Are all the appendices referred to included?
  - Often missing from electronic documents to reduce file size
  - But a complete copy is needed to review
- **HINT: request searchable PDFs with adequate bookmarks to facilitate navigation to each appendix and section etc.**

Building blocks of a report: References

Culp et al

- References, references, references!
  - Report are both legal and scientific documents!
- Full and specific references should be cited for:
  - All relevant guidance and standards etc.
  - Any research or science papers etc. relied upon
  - It is in the consultants interest to record what they have relied on in preparing the report – they may need to defend it in court years later!
- References can be presented in any suitable manner:
  - Reference section with in text citations or footnotes etc.
- Do you have access to documents referred to in the report?
  - "This report should be read in conjunction with …."
  - "Details of the earlier investigation is reported in …"

Reviewing reports: Terminology and acronyms

- Many terms/words have legal definitions and should be used in the correct context but…
- Terminology differs between guidance documents – more later
  - But also between Companies, offices within companies and even between individuals
- Many complex terms → many acronyms
  - HCV, SSAC, GQRA etc.
  - All acronyms used must be clearly defined within the report
    - Usually the 1st time they are used or in a list of acronyms/abbreviations
- Terminology, wording and acronyms **within** a report should be clear and consistent
  - If unclear - ask for clarification

Reviewing reports: Uncertainty

- Always present! Due to :
  - Natural variability (eg ground conditions)
  - Limited site investigation (sampling and analytical error)
- Uncertainty may be
  - Qualitative – lack information of site history between 1927 and 1954
  - Quantitative – The K_d is assumed to be between 10 and 5000
- What degree of confidence is required?
- All significant uncertainties should be documented
  - Have assumptions been made to deal with these uncertainties
- **Key uncertainties/assumptions that have the potential to effect the conclusions need to be identified and their impact discussed**

Reviewing reports: A good report will..

- Follow a logical structure/format but …
  - There is no standard structure. Different companies use different structures and not all sites will "fit" a standard structure. Reports are site-specific.
- State the aim and objectives
- Follow UK good practice
  - Conceptual model
  - Tiered approach to risk assessment
- Contain enough information to allow you as the regulator/client/other to make decisions
- Provide an interpretation of the results
- Have conclusions which "fit" with the aim and objectives
- Identify and discuss the key uncertainties

Reviewing reports: A good report will.. cont'd

- State the relevant regulatory context
  - Follow any relevant guidance and use appropriate language and terminology
- Planning (Town and Country Planning Acts)
  - Country specific legislation and guidance
    - Eg National Planning Policy Framework (in England) or Planning policy Wales
  - Cite the relevant planning application reference (including relevant conditions)
  - Terminology: "safe", "suitable for use" land contamination
- Part 2A of the Environmental Protection Act 1990
  - Country specific legislation and Statutory Guidance
  - Terminology: significant possibility of significant harm (SPOSH), "detailed inspection" "risk summary" Contaminated Land

Reviewing reports: A good report will.. cont'd

- Reference the relevant guidance and technical standards followed:
  - Government guidance, including
    - LCRM, Environment Agency guidance
  - Local authority requirements
    - Developer Guide
  - British Standards
  - Other
    - CIRIA
    - CL:AIRE
    - SoBRA
    - AGS
    - LQM

These will change over Time!

In any legal action, these will help demonstrate competence/negligence

Reviewing reports: Approaches

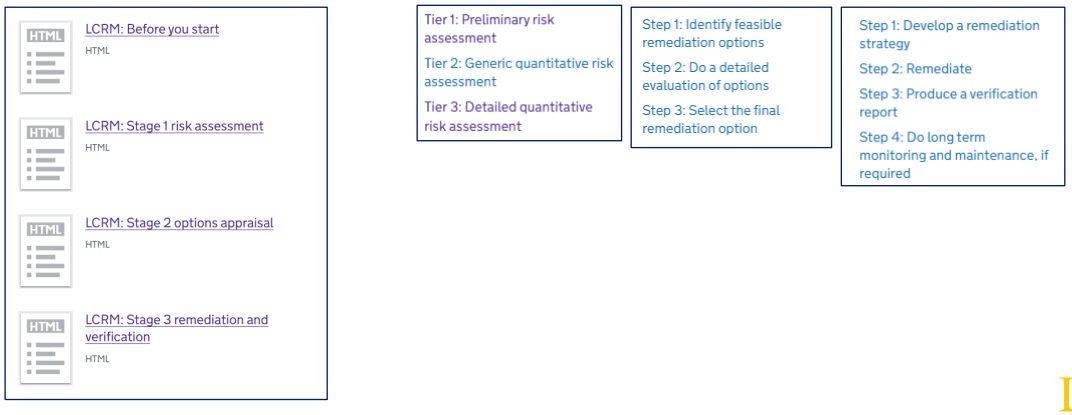
- List what is included in report (e.g. map editions, previous reports)
- **Create your own conceptual mode**l and/or check the conceptual model presented
- Are report objectives/Uncertainties of previous phase met in report conclusions?
- **Check reports against the requirements of Guidance /standards**
  - **Eg BS10175, BS18400 ……..CIRIA, AGS……..**
- **Check report against checkists**

Reviewing reports: Checklists

- Check reports against Checklists
  - is information present/absent
    - LCRM
      - https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm
    - Environment Agency GPLC checklists (controlled waters)
      - https://webarchive.nationalarchives.gov.uk/ukgwa/20140328084622/http://publications.environment-agency.gov.uk/pdf/GEHO1109BRHA-e-e.pdf
- Checklists a guide only;
  - not always necessary to have all the information at each site
  - The list will not always include critical information relating to **your** site
- **Review is always MORE than just a checklist**

Reviewing reports: Evaluation tools

- LCRM



LCRM: Reports

- Stage1: Risk assessment reports
  - Preliminary risk assessment report
  - Site investigation report / Generic quantitative risk assessment report
  - Detailed quantitative risk assessment report – if required
- Stage 2:
  - Feasible options report
  - Detailed evaluation of options
  - Final option selection
  - May only see single OA report
  - NB – CLR11 included this in the Remediation strategy
- Stage 3:
  - Remediation strategy and Verification Plan
  - Remediation progress reports.
  - Verification report.
  - Long term monitoring and maintenance report - if required.

Emphasis on documenting a "Decision record"

LCRM: Competent Person

- A competent person must for example:
  - have a recognised relevant qualification
  - have sufficient experience with risk management and the type of contamination you're dealing with
  - be a member of a relevant professional organisation

https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm/lcrm-before-you-start#use-a-suitably-qualified-competent-professional

NPPF

Competent person

For land contamination and planning you must use and meet the National Planning Policy Framework definition of a competent person given in annex 2.

For all other regimes, we expect you to have appropriate knowledge, skills, experience and qualifications in the:

- specific area of LCRM you are doing
- type of contamination you are dealing with

You may demonstrate this with qualifications and experience in a specific technical or scientific discipline or application, or by multidisciplinary qualifications. These include for example:

- a Suitably Qualified Person (SQP) registered under the NQMS
- the SoBRA accreditation scheme
- a Specialist in Land Condition (SiLC)
- membership of a professional organisation relevant to land contamination
- a specialist in the gas protection verification accreditation scheme (GPVS)
- a proven track record of dealing with land contamination

A proven track record means a regulator or consultant who regularly deals with land contamination. For example, someone with knowledge and experience of the Part 2A regime or someone who regularly deals with the technical aspects of land contamination.

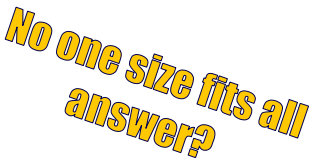
LCRM

National Quality Mark Scheme for Land Contamination Management (NQMS)

- Developed by the National Brownfield Forum, administered by CL:AIRE
- AIM: to improve standard of contaminated land reports
- Reports checked for quality by a Suitably Qualified and experienced Person (SQP)
- SQP can be part of the project team or external
- SQP issues declaration and Quality Mark applied to report
  - Visible evidence of report quality

Reviewing reports: Evaluation is more than a checklist

- Starting point questions
  - What is the aim of the report?
    - Legal context
    - Stage of investigation
  - Have they included all the information?
  - Have they interpreted materials correctly?
  - What are the conclusions and recommendations?
    - Do the answer the objectives?
    - Does the evidence back up the conclusions?
  - Will the missing /'wrong' information impact the outcome?



Sound science: Defensible decisions

Reviewing reports: Evaluation is more than a checklist

- Professional judgement will be required
- Professional responsibility
  - Keep up-to-date
- Recognise your limitations
- Don't second guess
  - What does the report say - not what do you think it should say
- You can ask for
  - clarification
  - further information
  - submission of data

Sound science: Defensible decisions

Presenting your findings

- Be clear and concise
  - Refer to legal requirements or good practice guidance, whenever possible
- Where there is a critical lack of clarity or uncertainty, seek clarification
  - Eg inconsistent or imprecise terminology
  - Eg lack of internal consistence with respect to important facts – site name, assessment criteria etc.
- Where conclusions are presented
  - Do you agree or disagree
- Document your decision-making
  - Remember you (or a colleague) may need to revisit this work in the future
  - Is there an auditable document trail?

Document your decision-making

Section/page no	Issue/Query	Response	Councils view on response

Presenting your findings

- Don't being overly prescriptive and taking on liability!
  - Do: "Further justification is required. The currently proposed borehole locations do not appear to be in line with current guidance in …"
  - Don't: "An additional borehole is required to the north of the processing area to intersect the contaminant plume"
  - Do: "The application of statistics in Section 5.4.5 does not appear to be inline with current good practice and it is unclear how outliers have been dealt with."
  - Don't: "The outliers should have been retained within the analysis and the resulting UCL of 7.675 mg/kg exceeds the assessment criteria"
- Avoid making assumptions
  - Do: "The nature of the assessment criteria used is not clearly specified, and so we are unable to confirm the validity of the assessment presented".
  - Don't "Assuming that the assessment criteria used are the C4SLs for the residential land use, we agree that no remediation with respect to PAHs is required".

Is it reasonable?

- All sites are different – what is applicable on one may not necessarily be applicable on another
- The various phases of work may be undertaken by different organisations and there may be considerable time lapses
- "Don't sweat the small stuff"
  - Concentrate on what's important – but this is very hard to achieve
  - Is this issue serious enough to change the conclusions?
- Find time to keep up to date
- Use opportunities to see work in operation
  - Site investigation & remediation

Pause to reflect

- Thinking about reviewing reports
  - Write down some things that struck you in the presentation that you think would be helpful to you when reviewing reports

Make a list

Create a mind map

Sound science: Defensible decisions

Session 2

Reviewing Preliminary Risk Assessment reports

Sound science: Defensible decisions

Preliminary risk assessment reports: Desk Study and Site Walkover

- There should be PRA for every site
- Should cover
  - Basic Site Details
  - Comprehensive set of information
    - LCRM, BS10175
  - Initial CSM
  - Possible pollutant linkages
  - Appropriate Interpretation
  - Uncertainties/SI objectives/Next steps

Preliminary risk assessment reports: What should be included

- In addition to the general information for all risk reports (ie aim, legal context..)
  - Site history
  - Environmental setting
  - Information from regulatory authorities & other bodies
  - Information from previous reports
  - Walkover findings. *Visit the Site*!
  - Conceptual model
  - Interpretation
- Contents are recommended in:
  - LCRM
  - BS10175, 18400 ….

Preliminary risk assessment reports: LCRM

- In addition to the general information for all risk assessment reports:
  - details of the desk study and site walkover
  - details of any previous historic ground investigations done on the site
  - potential pollutant linkages
  - outline conceptual model
  - details of the qualitative risk screening
  - identification and justification of what pollutant linkages do not present a risk or if further information is required
  - indication of potentially unacceptable risks, including the degree of confidence
  - conclusions and next steps

https://www.gov.uk/guidance/land-contamination-how-to-manage-the-risks/reporting-requirements

Preliminary risk assessment reports: Site Details should include:

- Site location plan
  - Clearly defined boundaries
  - Part 2A context this may not be the physical boundary of the site
- National Grid Reference
- Site area (units)
- Site layout plans
  - Direction arrows
  - scale
- Planning – details of future use & current status
- Part 2A – details of current use

Preliminary risk assessment reports: Documentary sources

- Can be many & varied
  - Many will include information from commercial suppliers e.g. Landmark Envirocheck, Groundsure, Findmaps + others
  - This should be include as part of the Stage 1 report
- But Remember this alone does not constitute a Stage 1
  - Interpretation is required
- Other sources may be critical
  - Gas works → Gas Works Archives
  - Military sites – not marked on OS mapping until ~1990
  - Local history societies/libraries
  - Aerial photography

Preliminary risk assessment reports: Previous Reports

- Has any previous work (site investigation, remediation etc) been carried out on the site?
- If So
  - Are all previous reports referenced?
  - Are results of previous reports summarised?
  - Are results of previous reports taken into account?
  - Are previous reports available for your review?
    - If not why not?

Preliminary risk assessment reports: Walkover

- Topography
  - Obvious signs of contamination may/may not be present
- Areas of potential contamination identified?
- Consideration of surrounding area?
  - Potential contamination
  - Sensitive receptors
- Photographs
- Interviews
- Interpretation in the context of the historical information

Preliminary risk assessment reports: Conceptual Site Model

- Has an appropriate & robust conceptual site model been included?
  - May be more than one CSM eg if zoned
- Have all potential sources been identified (including off-site)?
- Have all appropriate receptors been identified (including off-site)?
- Have all relevant exposure pathways been identified?
  - Land use
  - Contaminant behaviour
- Is the justification clear where potential linkages have been discounted?
- Overall, Is the conceptual model justified by the information presented?

Preliminary risk assessment reports: What about potential future changes..

- Likely changes to contamination levels
  - Degradation
  - Plume migration
- Possible new contamination routes
  - Services
- Climate change
  - NPPF, Sobra CWRA

Preliminary risk assessment reports: Other useful references

- British Standards Institute - BS 10175:2011+A2:2017 Investigation of potentially contaminated sites.
- DoE (1994) CLR2 "Guidance on Preliminary Site Inspection of Contaminated Land", Volumes 1 and 2.
  - https://claire.co.uk/projects-and-initiatives/38-costar/index.php?option=com_content&view=article&id=194&catid=41&Itemid=256
- Association of Geotechnical and Geoenvironmental Specialists (AGS)
  - http://www.ags.org.uk
  - Various relevant publications
- BS 18400:202

Being Updated

This document provides guidance on the design and execution of preliminary investigations comprising desk studies and site reconnaissance, and where appropriate, preliminary risk assessment. It is applicable whenever sampling exercises or investigations are to be carried out to determine soil quality

Coming Up Next:

Practical – Review the excerpt from a PRA

Video - Model Answer

Session 3

Reviewing Site Investigation Reports

Tier 2 (&3) Reports

- Based on the initial Conceptual model, consultants will
  - Design and conduct a site investigation
  - Assess the risks from each potential contaminant linkage
- Site investigation Report (covered in this session)
  - Factual element, including the raw data
  - (Data analysis)
- Risk assessment report (covered in the next session)
  - Interpretative element
  - (Data analysis)
  - Risk estimation & evaluation
    - GQRA (Tier 2); and/or
    - DQRA (Tier 3)
  - Conclusions
  - Recommendations

May be combined in 1 report, but often separate or in appendix

Both parts need careful review

Site investigation report: Site characterisation

- Normally Site characterisation is needed to collection of sufficient, relevant and reliable data to enable:
  - an assessment of the risk (GQRA or DQRA)
  - a reduction in uncertainty
- But may also be needed in relation to options appraisal, remediation design or verification etc.
  - Several site investigation reports may be produced for a single site
- Gathering data to characterise the potential risks
  - Soils, gases, vapours and waters may be presented in one or separate reports
- Always based on a pre-existing CSM:

LCRM = Field investigation reports

Site Investigation reports: General Considerations

- In addition to the general information for all risk reports (ie aim, legal context..)
- Initial CSM
- Sampling and analytical strategy
  - Linked to existing conceptual site model
  - Justification of any deviations from strategy during field work
- Summary of results
  - Ground Conditions
  - Contamination
  - Groundwater …
- Summary tables of monitoring and testing data
- Ideally: Data summaries and graphical presentations
- Raw data
  - Logs
  - Field testing
  - Laboratory certificates
  - Chain of custody records
- Maps and plans eg
  - sampling locations
  - Contamination results
- (Interpretation)
  - (Risk assessment)
  - (Conclusions and recommendations)
  - (Post SI and RA CSM)

Site investigation report: LCRM

- Where relevant, should include:
  - The phase, stage and tier it relates to
  - Who commissioned it and why
  - Sampling and fieldwork conducted
    - Incl sampling equipment used and calibration records
    - monitoring and sampling locations
    - on-site observations (eg staining or odours)
    - details of all testing scheduled
- Ground conditions encountered
  - incl groundwater regime and surface water features
  - Descriptions of soils and rocks to BS 5930
  - Incl borehole and trial pit logs
  - cross-sections showing site strata and groundwater
- summary tables of monitoring and testing data
- Maps, plans, photographs, geophysical surveys
- Certificates for all laboratory and geotechnical testing

https://www.gov.uk/guidance/land-contamination-how-to-manage-the-risks/reporting-requirements

Site investigation report: Report remit

- Do you know the remit?
  - particularly important for SI reports
- Are the aim and objectives stated?
- Is a copy of the brief between the client and the contractor included?
- Example:
  - Gas risks may be very important at a site but you review an SI report that did not collect any relevant data
  - If gas data was excluded from the remit, the report is reasonable
  - The developer still needs to provide gas data and risk assessment
    - Perhaps from a separate specialist consultant

Site investigation report: Initial Conceptual Model

- The CSM forms the basis of the **site investigation design**
  - Investigation of potential contaminant linkages
  - Investigation of uncertainty
- Review questions:
  - Has a preliminary risk assessment been undertaken and CSM produced?
    - Should be referenced in the Site investigation report
  - Are the objectives of the site investigation clearly stated?
  - Are the objectives clearly anchored to the linkages and uncertainties in the CSM?

Site investigation report: Site Investigation Design

- Normally comprises of a:
  - **Sampling strategy, and**
  - **Analytical strategy**
- Will be influenced by a range of factors including:
  - CSM and resulting objectives
  - Nature of the anticipated strata
  - Presence of obstructions
  - On-going activities, access
  - Anticipated use of the data and resulting data quality objectives
  - Time and Budget etc.

Site investigation report: Sampling Strategy

- Is the sampling strategy sufficiently clear?
  - May not be obvious
  - Targeted or non targeted?
  - If non targeted, check approach is appropriate.
- Is all *the sampling and monitoring justified in relation to the CSM?*
  - *e.g. types, location & depth*
- Is there a consideration of how the data will be used?
  - Sample collection techniques should have due regard to the data quality objectives
- Quality control will increase confidence in the data
  - Will any duplicates, field or trip blanks be tested?

Site investigation report: Analytical Strategy

- Is the analytical strategy sufficiently clear?
  - May not be obvious
- Is all *the analysis and monitoring justified in relation to the CSM?*
  - Have all potential contaminants of concern been considered?
  - If not, why not? Targeting Risk drivers?
- Have appropriate analytical methods been selected?
- Is there a consideration of how the data will be used?
  - Analysis methods should have due regard to the data quality objectives
  - eg Are the Limits of detection appropriate for the anticipated assessment criteria?

Site investigation report: Description of field work

- Was sampling undertaken as laid out in the sampling plan?
  - *If not, why not, e.g. obstructions?*
- Are **all** sampling locations clearly marked on a site plan?
- Were the relevant sampling protocols followed?
  - Prevent cross contamination
- Has a proper chain of custody procedure been followed?
- Where reinstatement procedures appropriate?
  - Prevent creation of new pathways
  - Comply with relevant guidance

Site investigation report: Testing: in the field

- What field tests have been carried out?
  - *e.g. hydrogeological, chemical, gas testing*
- What equipment was used?
  - Is this appropriate and was it calibrated?
- What was the testing procedure/method?
- Have results been reported adequately?

Remember : any limitations of the method need to be recognised and the resulting uncertainty discussed in the interpretive report

Site investigation report: Testing: in the laboratory

- How many samples were submitted?
  - *List numbers, types and depths of tests*
- What laboratory(s) was used?
- What testing was scheduled?
- How were the samples collected?
  - Where appropriate containers used?
  - Is cross contamination possible?
- How were preserved and transported?
- Are the Certificates of Analysis presented?
- Was there any unexplained delay in analysing the samples?
  - Check the sample date, date received and analysis date
  - Any deviating samples

Remember: any limitations of sample preparation or analytical methods need to be recognised and the resulting uncertainty discussed in the interpretive report

Site investigation report: Monitoring Programmes

- For linkages involving gases, vapour and controlled waters trends over time need to be identified
- Is time series data available or only single measurements (unlikely to be sufficient)
- Monitoring plan should include:
  - Purpose/aim of the monitoring should be identified
  - Duration & frequency stated
  - Field and/or analytical data to be collected
- Have additional influences been considered in the design
  - Seasonal changes
  - Tidal effects

Remember: any limitations of the monitoring programme need to be recognised and the resulting uncertainty discussed in the interpretive report

BS8485 - 8485:2015+A1:2019

Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings

- Checklist – adequacy of SI – Table1
- Many common points with not gas SI
  - PRA? Site geology? …….
- Highlights gas focused issues
  - Were sources of gas generation identified?
  - Was the mechanism of gas generation identified?
  - Appropriate response zones
    - Identify gas source
    - Identify migration pathways
  - Sufficient monitoring to characterise the gas regime

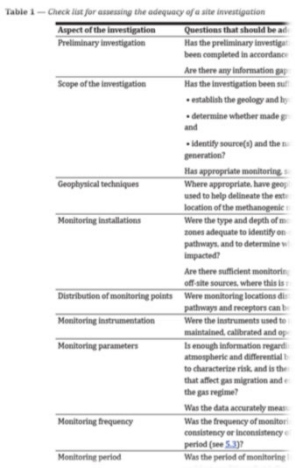


Table 1 — *Check list for assessing the adequacy of a site investigation*

Aspect of the investigation	Questions that should be ad
Preliminary investigation	Has the preliminary investiga been completed in accordanc Are there any information ga
Scope of the investigation	Has the investigation been ru • establish the geology and h • determine whether made g and • identify source(s) and the n generation? Has appropriate monitoring,
Geophysical techniques	Where appropriate, have geop used to help delineate the ext location of the methanogenic
Monitoring installations	Were the type and depth of m zones adequate to identify on pathways, and to determine w impacted? Are there sufficient monitorin off-site sources, where this is
Distribution of monitoring points	Were monitoring locations di pathways and receptors can b
Monitoring instrumentation	Were the instruments used to maintained, calibrated and op
Monitoring parameters	Is enough information regardi atmospheric and differential h to characterize risk, and is the that affect gas migration and e the gas regime? Was the data accurately mean
Monitoring frequency	Was the frequency of monitor consistency or inconsistency e period (see 5.3)?
Monitoring period	Was the period of monitoring

Site investigation report: Ground conditions

- Any soil sampling etc. will involve suitable methods to access the ground
- What type of method/equipment was used
  - Trial pits, rotosonic or cable percussive drilling, window sampling rig etc.
- Full details of the ground conditions encountered should be reported
  - Trialpit/borehole logs, as a minimum
  - Photographs?
  - But generally a summary of ground conditions is also presented

Site investigation report: Logs

- Logged to an appropriate standard
  - BS 5930:2015+A1:2020
  - Consistent terminology/symbology
- Have the locations been surveyed in ?
  - XY Coordinates
  - Accurate height data (mAOD) is needed for groundwater contours
- Are logs presented for all locations?
- All Logs should include:
  - Site details & date
  - Who has done the logging?
  - Evidence of contamination
    - Visual, olfactory
  - Sample depths
  - Water strike depths
  - Details of any well installed
    - Incl response zones

Site investigation report: Data presentation

- Many different ways to display data but graphical presentation is quicker and easier for the reviewer to understand
  - Eg spatial and depth plots
- Variety of free and commercial software available:
  - Specialist tools
  - GIS packages
- But it is vital to ensure the raw data is also presented and is adequate:
  - Sampling & analytical strategies
  - Descriptions & logs
  - Laboratory data

May be absent. Data analysis can be included in the interpretive report

Site investigation report: Look for evidence that…

- All SI activities are well documented
- Sampling & analytical strategies are adequate to address the contaminant linkages & uncertainties in the CSM
- Sampling and monitoring is adequately documented and was inline with these strategies
- A sufficiently robust dataset was gathered
  - Beware of many locations but very few samples
  - Quality & quantity
- All raw data is included
- Any data summaries and graphs are consistent with the raw data

Site investigation report: Other useful references:

- BS 5930:2015+A1:2020 Code of Practice for Ground Investigations
- BS 10175:2011+A2:2017. Code of Practice for the investigation of potentially contaminated land
- BS ISO/5667-11 2009: Guidance on sampling groundwaters from potentially contaminated sites.
- DoE (1994) CLR2 "Sampling strategies for contaminated land"
- BS ISO 18400-104:2018 Soil quality. Sampling. Strategies
- Soil quality. Sampling. Quality control and quality assurance
- BS8485 - 8485:2015+A1:2019 - Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings
- Association of Geotechnical and Geoenvironmental Specialists (AGS)
  - http://www.ags.org.uk
  - Various relevant publications

Coming Up Next:

Practical – Review the site investigation strategy

Video - Model Answer

Session 4

Reviewing Risk Assessment Reports

Risk assessment reports:

- Aim: To use the additional data gathered during the site investigation(s) to determine which, if any, contaminant linkages require risk management
  - Ie may pose unacceptable risks
- Various Types
  - Different receptors
  - GQRA/DQRA
- We will focus on human health risk assessment reports, but many of the principles will apply to all receptors

Risk assessment reports: General Considerations

- Authors
  - Competent persons?
  - Evidence of internal review – quality assurance
- Date
- Status – final/draft/draft final
- Is the "site" clearly defined
- Clear aim and objectives for the report
- Conceptual model dictates the types of risk assessment needed
- Risk estimation
- Risk evaluation that drives:
  - Updated conceptual model
  - Conclusions and next steps

Risk assessment reports:

- Zoning
  - If the CSM/site investigation has been zoned:
    - Does the site investigation data still support the basis for zoning?
    - If not, should the site be rezoned?
  - Separate risk assessments may be needed for each zone
- Data analysis
  - Ideally report will:
    - Look for trends in the data to support CSM
    - Where are the high concentrations? Are there any clusters spatially or with depth or material type?
    - Examine the reliability of the data eg present the QA/QC results
  - Often not done

Risk estimation

- Likely exposures are predicted and compared with relevant thresholds
- Representative soil concentration is compared with GAC/SSAC

- Followed by risk evaluation
  - decision
  - uses lines of evidence to justify decision

Risk assessment reports: Representative site concentrations

- What contaminant concentration has been used?
  - Maximum?
  - 95th Lower Confidence Limit or Upper Confidence Limit – depends on null/alternative hypothesis?
  - Average?
  - Other?

Based on non targeted sampling strategy

More discussion on representative concentrations in CLM-3

- Choice is influenced by the sampling strategy
- Remember: this will influence the uncertainty and should be discussed in the risk evaluation

Risk assessment reports: Assessment Criteria

- What assessment criteria have been used?
- Is the GAC/SSAC appropriate for the site?
  - Receptors
  - Legal context
- Are they compliant with relevant UK policy?
- Are they compatible with the CSM?
  - For an appropriate land use
  - Consider all the relevant exposure pathways

Is any uncertainty likely to under or overestimate the risk?

Risk assessment reports: Risk evaluation

- Must be present!
- Should include:
  - Conclusion about any linkages where the risks have been shown not to be unacceptable and removed from the CSM
  - Consideration of whether the uncertainties in the risk estimation could affect this decision. For example:
    - Representative concentration: could it be higher given the confidence/variation in the site investigation data?
    - Assessment criteria:
      - What level of risk does it represent? And what uncertainties does it contain with respect to the current site?
  - Additional relevant 'lines of evidence'

Risk assessment reports: 'lines of evidence'

- GQRA (and DQRA) help estimate likely risks but conclusions will be more robust if there are additional 'lines of evidence'
- A good report will highlight, where apparent risks:
  - correlated with certain areas or historic uses
  - Are associated with specific ground conditions:
    - Specific strata
    - Evidence of colours, odours
    - Presence Fragments of coal, ceramic or tarmac
- Such correlations may allow the:
  - risks to be legitimately discounted (eg fragments of coal are unlikely to be ingested)
  - Remediation to be legitimately limited/better targeted (eg to the areas of red shale)

Risk assessment reports: Conclusions and next steps

- Are explicit conclusions presented?
  - That meet the stated aim and objectives?
- Are the conclusions justified by the:
  - Site investigation data;
  - Risk estimation; and
  - Risk evaluation?
- Are unacceptable risks identified?
- If so, what are the next steps?
  - Are these suitable and appropriate

Does the report allow you to make the decision you need to make?

List any issues that need clarifying

GQRA reports: LCRM

- summary of the PRA
- GQRA objectives
- how generic assessment criteria (GAC) were selected, derived and used
- what assumptions were used or made about the GAC
- information collected
- data quality assessment
- results of the comparison with GAC
- identification of and reasons for not considering any potential S-P-R pollutant linkages
- outline and updated CM
- confirmed relevant contaminant linkages (RCLs)
- details of how the risk was evaluated
- conclusions and next steps
- Relevant site investigation reports

https://www.gov.uk/guidance/land-contamination-how-to-manage-the-risks/reporting-requirements

GQRA reports: Common published GACs

- Environment Agency's Soil Guideline Values (SGVs) – published 2009
- LQM/CIEH Suitable 4 Use Levels (S4ULs) - published 2014
- Defra Category 4 Screening Levels (C4SLs) – published 2014 onwards
- CLAIRE/EIC Generic Assessment Criteria – published 2010
- Some GAC have been officially withdrawn:
  - Atkins ATRISK Soil Screening Levels (SSLs)
  - All 2002 SGVs (including lead)
  - 2009 SGVs (2009) for mercury (withdrawn 2018) and Nickel (withdrawn 2015)
  - 1st (2007) and 2nd (2009) Edition LQM/CIEH Generic Assessment Criteria

Check that the GACs used match the published values, especially for key contaminants

GQRA reports: Non-published GACs

- GACs are always based on generic land uses
  - UK generic land uses: RwHP RwoHP allotments commercial POS(2 variants)
- Modification of published GACs
  - Eg correction of published GACs with respect to SOM
  - Look for:
    - Justification of the adopted SOM; and
    - Details of how the modelling was undertaken
- Deriving new GACs
  - EG "in-house" GACs or GAC for new contaminants
  - Look for:
    - Clear statement about the landuse adopted and the source of the inputs
    - Full description and justification for all the physical-chemical inputs, including all toxicological inputs

Lower SOM will always produce lower GACs for organic compounds!

Must include clear and robust justifications - lots of appendices?

More details in CLM-3

DQRA reports: LCRM

- summary of the PRA (and GQRA if done)
- DQRA objectives
- approach to DQRA - including which RA tools were used
- information collected
- information on zoning, outliers and other anomalous features
- assessment of data
- derivation of site specific assessment criteria and risk estimation techniques
  - any assumptions used
  - DQRA model results such as remedial targets
  - model validation and sensitivity analysis
- results of assessment
- outline and updated CM - including how it was refined with the confirmed RPLs
- clear statement of unacceptable or acceptable risks identified, this must include any uncertainty
- identification of and reasons for not considering any RPLs
- conclusions and next steps
- Relevant site investigation reports

https://www.gov.uk/guidance/land-contamination-how-to-manage-the-risks/reporting-requirements

DQRA reports: Risk Assessment Tools

- All risk assessment tools have limitations
- Justification for tool used should be included in the report
- Most DQRA will use UK risk assessments tools
  - Unmodified, non-UK tools may not follow UK guidance
  - May be used by experienced risk assessors eg to model additional pathways
- Check risk assessment tool output carefully
  - look for any discrepancy with the inputs stated within the report

DQRA reports: Non-standard Contaminants

- Where chemical inputs have not been published by an authoritative source, pay extra attention to the inputs used
- Look for:
  - Clear description of the contaminants, including its likely state in the environment (eg solid, liquid, volatile, NAPL) and REDOX status (Cr III or VI)
  - Detailed discussion and justification of all toxicological inputs. Including where they were sourced from? Was the SP1010 or SR2 framework followed? Variability?
  - Detailed discussion and justification of all physical-chemical inputs. Including where they were sourced from? Was the SR7 framework followed? Variability?
- The report needs to contain comprehensive justification

DQRA reports: Non-standard landuses & pathways

- Rarely undertaken in the UK!
- Modelling non-standard landuses involves defining assumptions relating to:
  - Who uses it - Sex, age, height, body weight etc.
  - How they use it - How many times per year? How many hours? Indoors or outdoors etc.
  - **Requires detailed reporting, justification and full references**

More details in CLM-3

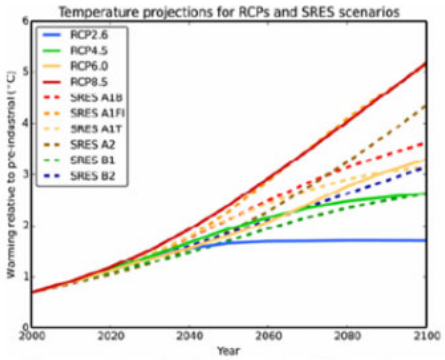
- Modelling non-standard pathways:
  - Eg onsite water supplies, ingestion of site-produced eggs, meat or fish
  - How has it been considered within the risk assessment
    - Qualitatively, pre-existing algorithm/ tool, empirically derived algorithm?
  - **Requires detailed reporting, justification and full references**

Climate Change

- Consideration of impact of climate change on input parameters
- Sobra 2022

Being Updated

UKCP	UK Climate Projections
RCP	Representative Concentration Pathway



Temperature Projections for different scenarios (Figure A3-1), Sobra 2022

Risk assessment reports: Other useful references

- Environment Agency (2009) Human health toxicological assessment of contaminants in soil
  - Science report – SC050021/**SR2**
- Environment Agency (2009) Updated technical background to the CLEA model
  - Science Report – SC050021/**SR3**
- CLEA software (version 1.05) handbook
  - Science Report – SC050021/**SR4**
- Defra (2014) outputs from SP1010 project
  - SP1010 Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Final Project Report
  - Defra SP1010 Policy Companion Document

Risk assessment reports: Other useful references

- Groundwater risk assessment
  - Remedial Targets Methodology
    - Guidance
    - User Manual
  - Locating compliance points
    - https://www.gov.uk/guidance/land-contamination-groundwater-compliance-points-quantitative-risk-assessmentsmpliance points

- Asbestos risk assessment
  - SoBRA Asbestos in Soil Human Health Risk Assessment
    - https://sobra.org.uk/asbestos/sobra-asbestos-in-soil-human-health-risk-assessment-aishhra-toolbox/
- Gas risk assessment
  - NHBC - April 2023
    - file:///G:/Shared%20drives/P%20drive/1488-0%20LQM%20LMS/Training%20Materials/5-day%20Series/Day5/resources/hazardous-ground-gas.pdf
  - Sobra top tips
    - https://sobra.org.uk/?pmpro_getfile=1&file=2023/06/Hazardous-Ground-Gas-Top-Tips-SoBRA-May23&ext=pdf

Session 5

Reviewing Phase 3 Reports: Remediation Strategy & Validation Report

Risk Management (Stage 3) reports

- Wide variety of types of reports produced by contractors and consultants during Stage 3
  - Remediation Strategy
  - Verification Plan
  - Remediation Progress Report
  - Verification Report
  - Monitoring and Maintenance Report
- We will concentrate on:
  - Remediation Strategy
  - Verification Report
  - Often cited in planning conditions
- Structure and contents will vary from site to site due to nature of the site and linkages involved

Remediation strategy

- Generally describes:
  - What remediation technologies will be adopted
    - how
    - when
    - where
  - How the remediation will be verified (Verification plan)
  - Any actions needed to ensure the longer-term management of the risks (monitoring and maintenance plan)
  - Health, safety and environmental considerations (including relevant risk assessments and monitoring requirements)

Remediation strategy: General Considerations

- Authors
  - Competent persons?
  - Evidence of internal review – quality assurance
- Date
- Status – final/draft/draft final
- Is the "site" clearly defined
- Clear aim and objectives for the report
- Conceptual model
- Remediation to be conducted
- **Verification requirements**

Remediation strategy: LCRM

- Distinct from the options appraisal report
- Complex and variable structure
- Remediation strategy potentially includes:
  - Introduction
    - Site setting
    - Site assessment
      - Incl summary of options appraisal
    - Remediation activities summary
- Sections on:
  - Implementation
  - Remediation verification
  - Monitoring requirements
  - Maintenance requirements

https://www.gov.uk/guidance/land-contamination-how-to-manage-the-risks/reporting-requirements

Key Information

- Relevant Contaminant Linkages (RCLs)
  - Output of RA
  - Starting point
- Remediation Objectives
  - Break the contaminant linkage by
- Remediation Criteria
  - Provide evidence that linkage is broken

Remediation in context of contaminant linkages

In all remediation reports

Remediation strategy: Implementation including

- preparatory works
- zoning or phasing of remediation
- scope of work
- anticipated timescales
- environment protection - such as emissions, noise, odour, nuisance control
- details of monitoring boreholes
- Post-remediation maintenance requirements

- Plans included must show:
  - site boundary
  - location of areas to be remediated including relation to any proposed development
  - proposed locations and phasing of remediation works
  - areas to be used for storage
  - monitoring points

https://www.gov.uk/guidance/land-contamination-how-to-manage-the-risks/reporting-requirements

Remediation strategy: Verification and monitoring including

- Sampling and testing:
  - Objectives and acceptance criteria
  - analytical tests including LOD
- Monitoring:
  - objectives and acceptance criteria
  - frequency, duration, location, analytical method etc.
  - Define when monitoring can stop
- need for additional equipment or facilities, eg monitoring wells

- Contingency actions if remediation criteria not met
- Reporting details
- how changes will be agreed with the regulators if needed
- Who is responsible for:
  - each type of measurement
  - Data analysis and reporting
  - Waste and permitting requirements

https://www.gov.uk/guidance/land-contamination-how-to-manage-the-risks/reporting-requirements

Remediation strategy: Maintenance including

- elements which will need maintenance
- schedule of the regular maintenance activities
- how reactive maintenance, such as breakdown or vandalism will be dealt with
- how decisions will be made on replacing or upgrading the remediation treatment technology if it becomes ineffective
- how the supply of consumables will be adequate, such as treatment chemicals
- how power supplies will be guaranteed, for example by providing emergency backup

https://www.gov.uk/guidance/land-contamination-how-to-manage-the-risks/reporting-requirements

Remediation strategy: Remediation Criteria

- Remediation Criteria should:
  - Be based on the remediation objectives
  - Be clear and unambiguous
  - Agreed with LA and EA (as a minimum)
  - Be tied into contaminant linkages
  - As a minimum they should:
    - Set appropriate remediation target concentration or goals
    - Specify the sampling strategy needed to demonstrate compliance
    - Indicate type of testing/LOD to be used
    - Describe any statistical approaches to be adopted (e.g. all, mean, max or 95th%ile value to meet remedial target level?)

Remediation strategy:
Remediation Criteria Examples

Remediation Strategy

Removal of contaminated materials (e.g. excavation and off-site treatment)

- Validation
  - Testing of material left *in situ* (base and sides of excavation)
  - Testing of imported material (if used)

- Example Remediation Criteria

"The impacted material will be identified using a PID instrument, excavated and disposed of at a suitably licenced off-site facility. The excavation will be validated with 5 samples (4sides plus base) or 1 sample per 5 $m^{2,}$ whichever is greater. Samples will be tested for the agreed validation suite. The average concentration per excavation must be below the agreed reuse criteria with any one sample containing up to 150% of the relevant criteria"

Remediation strategy:
Remediation Criteria Examples

Remediation Strategy

- Source zone treatment (e.g. chemical oxidation, bioremediation such as biopiles)
- Validation :
  - periodic measurement of contaminant concentrations in treated material
  - testing of material left *in situ* or un-treated

- Example remediation criteria

"Excavations will be validated as for "dig and dump". Reuse of materials from a treated stockpile will be permitted below 0.4 mbgl, if composite samples (5 subsamples from different depths) collected at a frequency of 1 per $250m^3$ contain less than 5 ug/kg of benzene and <100 mg/kg C10-C40 EPH as measured using the agreed analytical test. In each stockpile, a single sample may contain up to 8ug/kg and 125 mg/kg C10-C40 EPH."

Remediation Criteria: Examples

- Remediation Strategy
  - Capping
- Validation
  - Contamination testing of imported materials
  - Contamination testing in cap
  - Thickness of cap

- Example Remediation Criteria
  - "The cap will consist of 400mm of topsoil over a 200mm 'no dig' layer of site-won crushed concrete. All imported capping soils will meet the reuse criteria presented in Table 1 tested at a frequency of 1 per 400 m^3. Site-won aggregate will meet the specification presented in Table 2 composite sampled (5 subsamples) at a frequency of 1 per 250 m^3. Capping in garden areas will be validated based on window sampling (1 per 5 gardens) with appropriate logging and photographic records."

Remediation strategy: Review questions

- Is remediation strategy clear for
  - Each part of site
  - Each pollutant linkage
- Is the proposed strategy:
  - Likely to be viable?
  - Realistic? (Eg enough space and time)
  - Suitable for contaminants in pollutant linkages?
  - Suitable for media on which to be applied?
  - Likely to meet remediation objectives/criteria?

- Does the strategy
  - **Present clear and detailed remediation criteria**
    - **Will you be able to use these to discharge conditions later?**
  - address all linkages in the CSM?
  - Include an appropriate validation plan?
  - Include appropriate long-term monitoring/maintenance measures?

Verification Reports

Verification reports: LCRM

- Complex and variable structure
- Typically includes:
  - Essential details of site and remediation including
    - CSM and RCL
    - Remediation objectives
    - Remediation criteria
  - Details of how compliance has been demonstrated
- Supporting information:
  - photographs
  - plans, maps and diagrams, incl monitoring locations
  - test results – all in situ, on-site and laboratory data
  - Transfer/consignment notes
  - Topsoil certificates
  - how health and safety was dealt with
  - progress reports
  - important correspondence (eg with regulators)

https://www.gov.uk/guidance/land-contamination-how-to-manage-the-risks/reporting-requirements

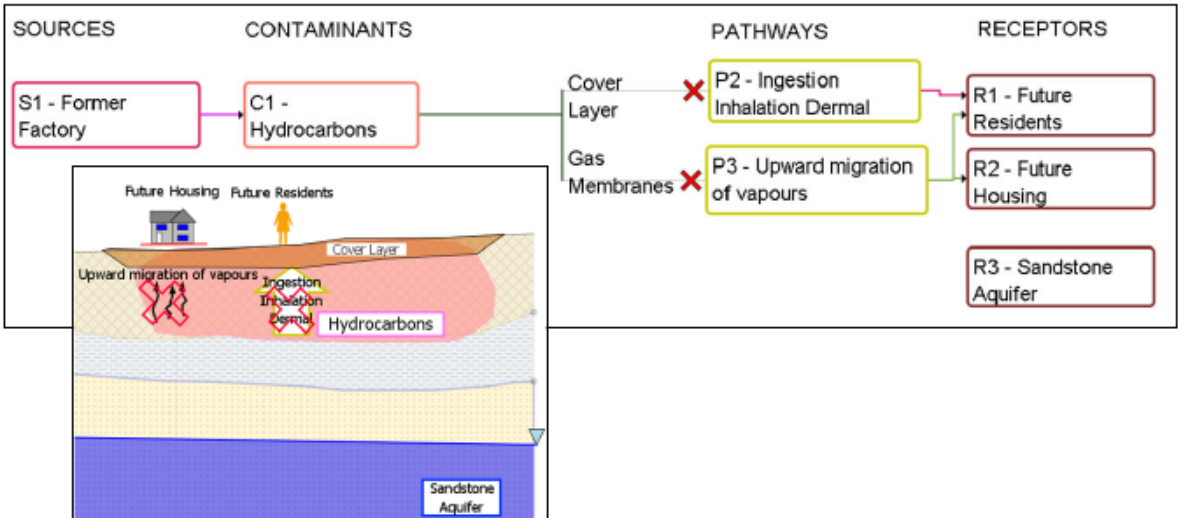
Verification report should:

- Be clear, concise and logical
- Describe remediation conducted including:
  - deviations from original plan
  - evidence that the remediation was carried out
  - evidence that remediation was effective
- Clearly present the final site conditions:
  - Description of site conditions at completion
  - '*as-built*' plans and drawings
  - Final site levels and contours
- Provide comprehensive evidence that the agreed remediation criteria have been met

At the end of the day…

- Draw the pre remediation conceptual model
- Add the impact/effects of remediation
- There should be no (potential) significant contaminant linkages left !

At the end of the day…



Session 6

Sources of Information

Reviewing reports

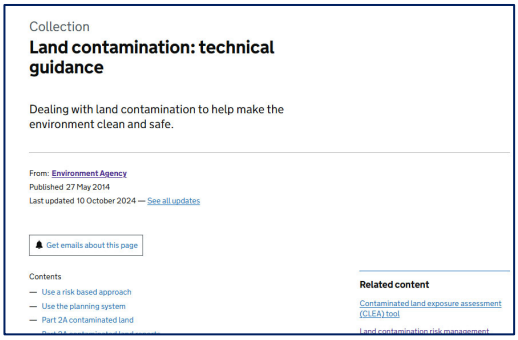
- PRA – straightforward
- SI – reasonable
- GQRA – need to know AC
- DQRA – challenging!
- Remediation /Verification
  - Varied reports
  - Similar principles
- *Anchor everything back into the CSM!*

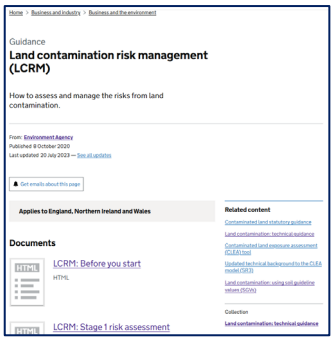
Sources

- Many!
- Gov Depts, Environment agencies, research organisations, partnership organisations etc
- How do you keep up-to-date?
  - Professional magazines, newsletters

.gov.uk

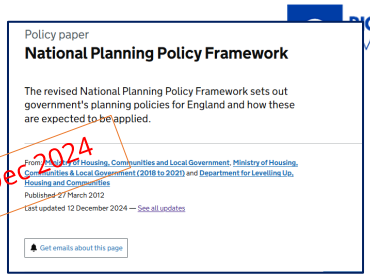
- LCRM
- https://www.gov.uk/government/collections/land-contamination-technical-guidance



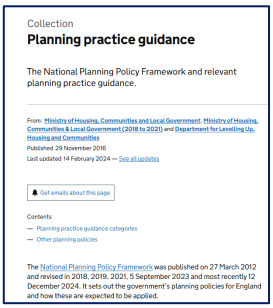


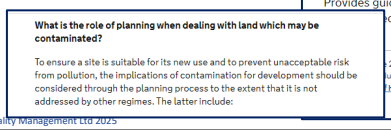
.gov.uk

- Planning
  - NPPF
    - https://www.gov.uk/government/publications/national-planning-policy-framework--2
  - Planning Practice Guidance
    - https://www.gov.uk/government/collections/planning-practice-guidance
  - Planning – role of planning
    - https://www.gov.uk/guidance/land-affected-by-contamination



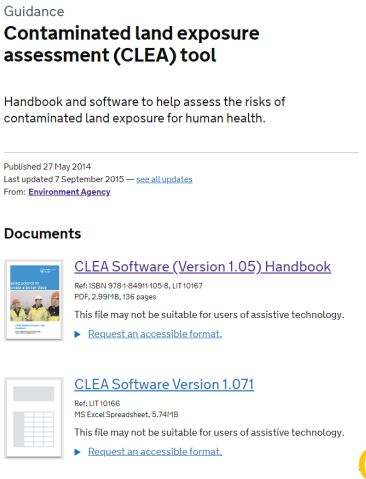
New! - Dec 2024





.gov.uk

- CLEA pages
- Publications relevant to human health risk assessment
- CLEA software
- https://www.gov.uk/government/publications/contaminated-land-exposure-assessment-clea-tool



Guidance

Contaminated land exposure assessment (CLEA) tool

Handbook and software to help assess the risks of contaminated land exposure for human health.

Published 27 May 2014
Last updated 7 September 2015 — see all updates
From: Environment Agency

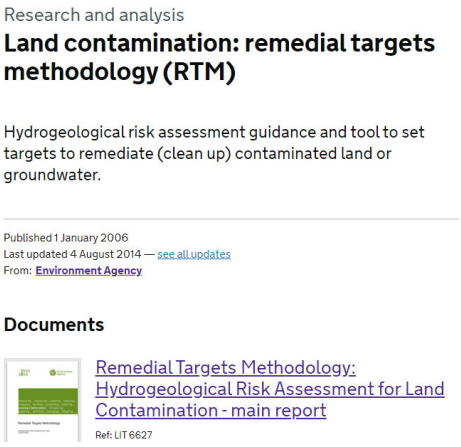
Documents

CLEA Software (Version 1.05) Handbook
Ref: ISBN 978-1-84911-105-8, LIT 10167
PDF, 2.99MB, 136 pages
This file may not be suitable for users of assistive technology.
▶ Request an accessible format.

CLEA Software Version 1.071
Ref: LIT 10166
MS Excel Spreadsheet, 5.74MB
This file may not be suitable for users of assistive technology.
▶ Request an accessible format.

.gov.uk

- Hydrogeological risk assessment guidance
  - https://www.gov.uk/government/publications/remedial-targets-worksheet-v22a-user-manual



Research and analysis

Land contamination: remedial targets methodology (RTM)

Hydrogeological risk assessment guidance and tool to set targets to remediate (clean up) contaminated land or groundwater.

Published 1 January 2006
Last updated 4 August 2014 — see all updates
From: Environment Agency

Documents

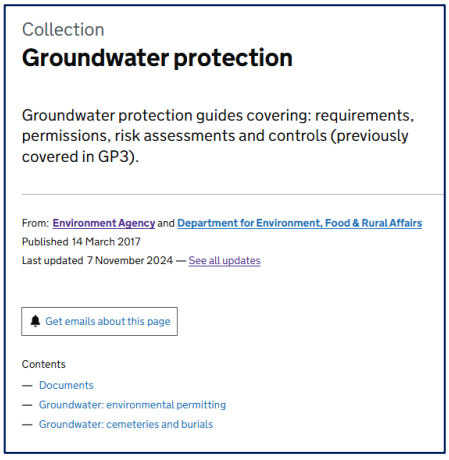
Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination - main report
Ref: LIT 6627

Defra

- Part 2A Statutory guidance
- Outputs from various government task forces
- Outputs from various Defra research projects
- + more

Water Environment (Environment Agency)

- Water pollution information
- Water quality information
- Guidance on protecting water resources
- Guidance on assessing impact of pollution on water resources
- https://www.gov.uk/government/collections/groundwater-protection



Collection

Groundwater protection

Groundwater protection guides covering: requirements, permissions, risk assessments and controls (previously covered in GP3).

From: Environment Agency and Department for Environment, Food & Rural Affairs
Published 14 March 2017
Last updated 7 November 2024 — See all updates

Get emails about this page

Contents

— Documents
— Groundwater: environmental permitting
— Groundwater: cemeteries and burials

Natural Resources Wales

- Welsh Government Sponsored Body
- Purpose is to ensure that the natural resources of Wales are sustainably maintained, enhanced and used, now and in the future
- Operational since 2013
- Merger of Countryside Council for Wales, Environment Agency Wales & Forestry Commission Wales
- https://naturalresources.wales/guidance-and-advice/business-sectors/planning-and-development/advice-for-developers/land-contamination/?lang=en

Land contamination

Our role in managing and dealing with land contamination

For land contamination Natural Resources Wales' key role is to advise local authorities during the planning process on the risks to, and protection of, the water environment.

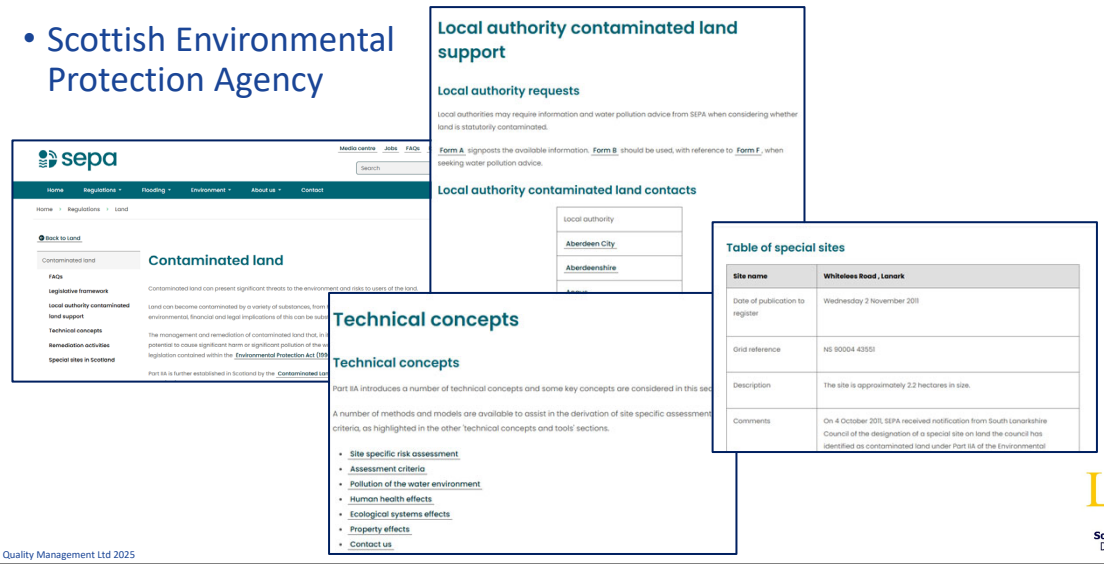
We will also work with developers, their consultants and major land owners to provide generic and site-specific advice, particularly on water issues, prior to their applying for planning or when voluntary remediation is being proposed or undertaken.

What is land contamination?

Land contamination may arise from a previous use of a site, or an adjacent site, that has had an industrial, commercial or landfilling activity. Land can be contaminated by

SEPA

- Scottish Environmental Protection Agency



sepa

Contaminated land

Local authority contaminated land support

Local authority requests

Local authority contaminated land contacts

Table of special sites

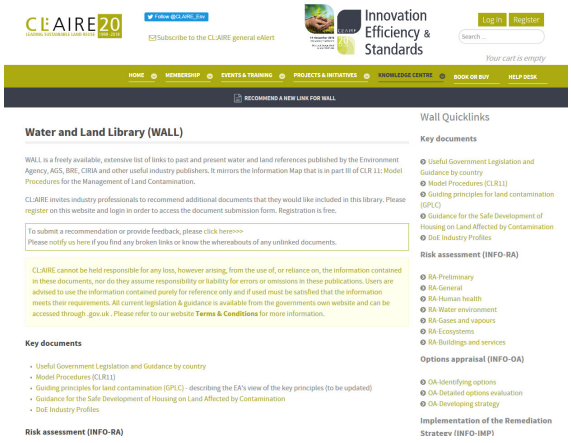
Technical concepts

Technical concepts

- Site specific risk assessment
- Assessment criteria
- Pollution of the water environment
- Human health effects
- Ecological systems effects
- Property effects
- Contact us

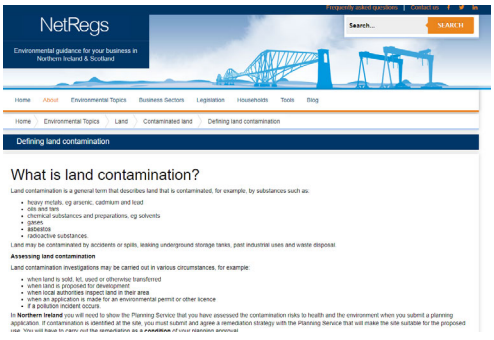
Water and Land Library (CL:AIRE)

www.claire.co.uk/information-centre/water-and-land-library-wall



www.netregs.org.uk

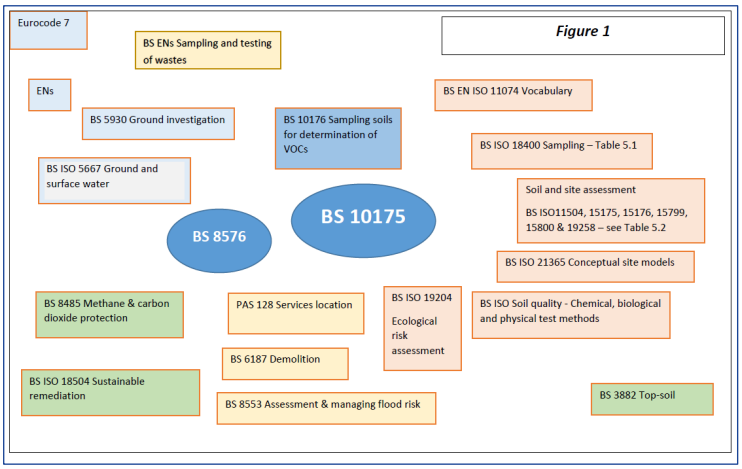
- Environmental legislation
  - Northern Ireland & Scotland
- Free environmental guidance for small businesses by topic / business sector
- Email updates - legislation
- Partners: SEPA & Northern Ireland Environment Agency (NIEA)
- In England similar information found on www.gov.uk website

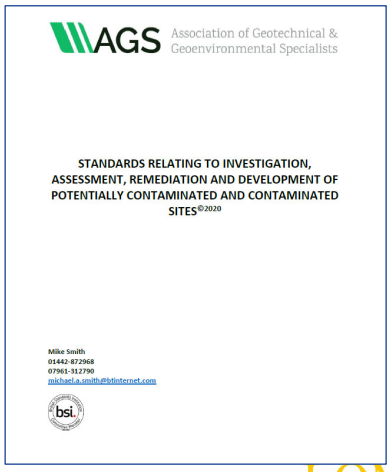


British Standards

- www.bsi.org.uk
- Relevant standards include:
  - BS 5930:2015+A1:2020 Code of Practice for Ground Investigations
  - BS 10175:2011+A2:2017 Code of Practice for the investigation of potentially contaminated land
  - BS 18400 – series – Soil Quality
  - BS 10176:2020 Taking soil samples for determination of volatile organic compounds (VOCs). Specification
  - .....

AGS – Standards - 2020





CIRIA

- Various reports published by CIRIA
  - e.g. Hazardous gases (C665); Volatile Organic Compounds (C682); Remediating & mitigating risks from VOCs (C716); Use of Plastic Membranes as VOC vapour barriers (C748); testing & verification of hazardous ground gas protection systems (C735)
- Asbestos in soil and made ground (C733) 2014
- Financial Control of Risk (C545)
- Environmental Good Practice on Site (C741) 2015
- Good practice guidance: some per- and polyfluoroalkyl substances (PFAS) in soil and the water environment (C819)

New! - 2024

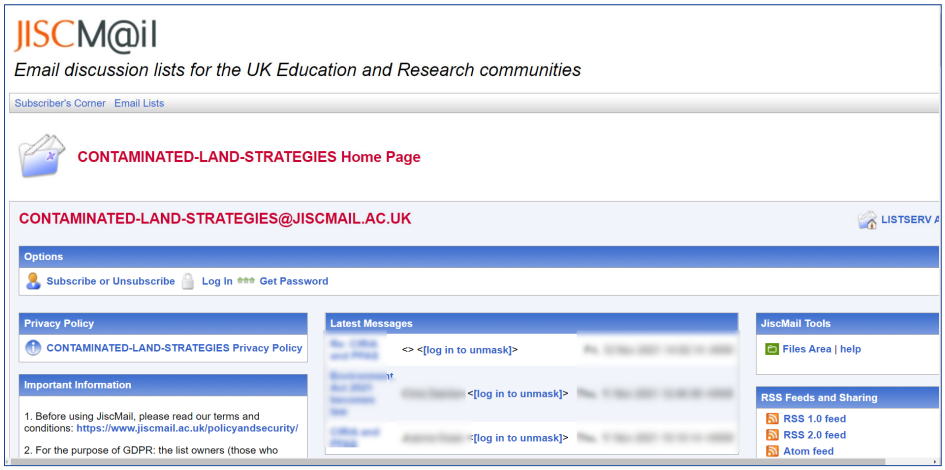
Other UK organisations

- www.cieh.org
- www.sniffer.org.uk
- https://www.gov.uk/government/organisations/uk-health-security-agency
- www.food.gov.uk – food standards agency
- Hse.gov.uk
- www.eugris.info
- www.ends.co.uk
- https://home.environment-analyst.com/

Other Countries

- USA
  - https://www.epa.gov/
  - https://clu-in.org/
  - https://www.itrcweb.org/
- Australia
  - https://www.crccare.com/

www.jiscmail.ac.uk



https://www.jiscmail.ac.uk/cgi-bin/webadmin?A0=CONTAMINATED-LAND-STRATEGIES