An Introduction to Land Contamination and Development Management

Contents

Land Contamination and Development Management

Guidance for assessing and addressing land contamination issues to meet the requirements of the local planning authority

Introduction

Land that has been previously occupied by or situated adjacent to industrial, commercial or agricultural activities may be affected by contamination from chemicals and ground gas generation. Sometimes contaminants may even be present naturally.

Land contamination is addressed voluntarily by landowners or regulated by the Local Authority through development management and under Part IIA of the Environmental Protection Act 1990 (Part IIA)[1].

Failure to carry out appropriate assessment and remediation whilst developing a site may result in its determination as Contaminated Land under Part IIA[1] and remediation actions will be enforced by the Local Authority.

This guide is intended to provide developers, planning agents, and consultants with advice on what information is required in relation to land contamination, so that the Local Authority can discharge its statutory responsibilities relating to Planning Applications and Building Standards.

"The responsibility for the safe development of a site rests with the developer"

Planning Advice Note 33 (PAN33)[2]

This guide should be read in conjunction with PAN 33[2], the Building (Scotland) Regulations Technical Handbook[3] and the Model Procedures for the Management of Land Contamination (CLR 11)[4].

The checklists provided indicate the minimum level of reporting required.

Advice on specific requirements should be sought from the Local Authority contaminated land regulator.

Development Management

A key role of development management with regard to land contamination is to ensure that land is made suitable for its intended use.

Scotland's policy for managing the development of land applies the **suitable for use** approach to address our historic legacy of land contamination. Risks therefore need to be assessed on a site-by-site basis and each phase of assessment should be site specific.

The **suitable for use** approach, defined by PAN33[2] consists of three elements:

i. **Ensuring that land is suitable for its current use;**

ii. **Ensuring that land is made suitable for any new use, as planning permission is given for that new use; and**

iii. **Limiting requirements for remediation to the work necessary to prevent unacceptable risks to human health or the environment in relation to the current use or future use of the land for which planning permission is being sought.**

It is important to consider potential contamination risks that may impact upon water and the wider environment, irrespective of the proposed development land use.

Building (Scotland) Regulations 2004[3] requires every building to be designed and constructed in such a way that there will not be a threat to the building or the health of people in or around the building due to the presence of harmful or dangerous substances.

The applicant needs to satisfy the Planning Authority that unacceptable risk from contamination will be successfully addressed through remedial action without undue environmental impact during and following the development.

Where an agreed remediation scheme includes future monitoring and maintenance schemes, arrangements will need to be made to ensure that any subsequent owner is fully aware of these requirements and assumes the ongoing responsibilities that are tied to the land.

In the course of considering site investigation, assessment, remediation and completion reports issued as part of a planning application submission, the contaminated land regulator may consult with Scottish Environment Protection Agency (SEPA) for technical advice.

Risk Assessment Framework

A risk assessment is a process that identifies all the potential contamination hazards and considers the likelihood of harm being caused to human health and the wider environment.

The assessment should be site specific and a good environmental risk assessment should contribute to effective site development by providing a comprehensive and robust aid to decision-making.

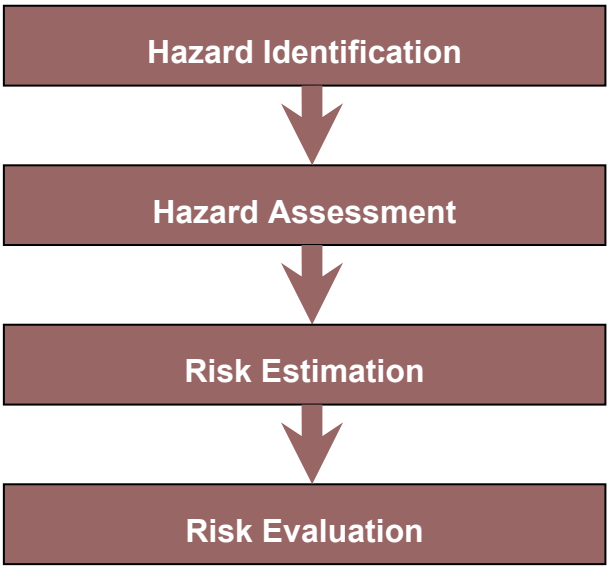
The UK risk assessment framework is based on a phased approach (PAN33[2] and R&D 66[6]):

Phase 1 Hazard identification and assessment (desk study)

Phase 2 Risk estimation and evaluation (Generic and Detailed)

Phase 3 Remediation; design, implementation & verification

The site assessment comprises the following key components (PAN 33[2], R&D 66[6]);



It is essential that the site investigation and assessment is carried out by competent and experienced persons.

Usually, this requires commissioning of environmental consultants or specialists. These persons must be familiar with all elements of risk assessment and site investigation techniques. They should also be familiar with current UK policy and the legislative framework surrounding land affected by contamination.

All risks must be fully evaluated, to ensure that robust, justifiable conclusions about the site characteristics and associated level of risks have been made.

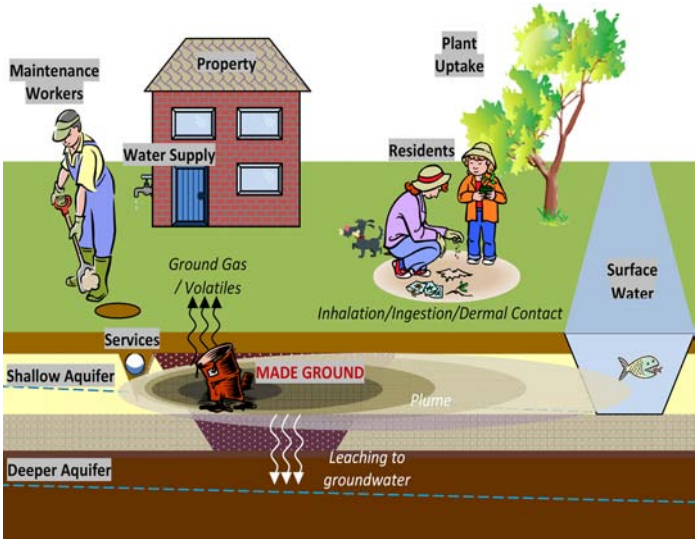
All recommendations must be defensible and any uncertainties of the risk evaluation process must be identified and recorded.

Potential risks should not be disregarded where information is limited or unavailable.

Phase 1 Hazard Identification and Assessment

This initial phase comprises preliminary investigations, also known as a desktop study. This is because the majority of the site investigations is office based research.

The aim of this phase is to identify and assess the potential hazards that could present a risk at the site.



Conceptual site models are an essential element of the assessment and present the possible connections between identified potential **contaminant sources**, **pathways** and **receptors**.

A **pollutant linkage** is the relationship between **contaminant source**, **pathway** and **receptor**. The potential for harm only occurs when the linkage is complete.

For further information on creating a **conceptual site model** and carrying out a preliminary qualitative risk assessment please refer to CLR 11[4] and R&D 66[6].

Understanding the history of a site is crucial to understanding the potential for source contaminants to be present.

A site containing contaminants may not cause significant harm to a receptor in its existing use, but where a development is proposed there is the possibility that significant pollutant linkages will be created. Therefore, it is important that low risks identified at this phase are not discarded entirely from the remainder of the assessment process.

The usual approach to risk assessment examine the source of contamination in relation to the receptor. The types of receptor to be protected are defined within statutory guidance[5] as;

Human Beings;

The Water Environment includes all surface waters (rivers, lochs, canals, transitional waters and coastal waters), groundwater and wetlands;

Ecological systems that are designated protected areas, such as Sites of Special Scientific Interest, land declared a national nature reserve, etc; *and*

Property in the form of buildings, services, domestically grown produce, crops, livestock, owned or domesticated animals including wild animals that are the subject of shooting and fishing rights.

Land contamination may present a risk to human health and the environment through various pathways (PAN 33[2]);

- Direct uptake of contaminants into the food chain or ecosystems;
- Direct ingestion or inhalation of, or contact with, contaminants;
- Contamination of water resources;
- Fire and explosion of combustible contaminants; and
- Attack on building materials and services by corrosive contaminants.

A **walkover survey** should be carried out by a **competent person** to identify or confirm land use, potential receptors, obvious contamination, evidence of harm, access constraints and the presence of **invasive species** such as Japanese Knotweed, which should be treated or fenced off prior to investigation equipment entering the site.

Other constraints such as mineral extraction, ground instability, unexploded ordnance and unsafe buildings should also be considered, as this may affect the investigation design.

The contaminated land regulator should be contacted at this initial phase to highlight any known issues associated with the site.

Phase 1 Checklist (minimum requirements)

Purpose and Aims of the Study Include details of the proposed development.	
Site Plans Location, proposed development, historical, environmental, proposed investigations.	
Historical Background Review of previous land uses and potentially contaminative activities within the site and surrounding area.	
Consultations Local Authority Services, SEPA, Scottish Natural Heritage, British Geological Society, Archaeologist, Utilities, Anecdotal etc.	
Environmental Setting Consideration of Topography, Hydrology, Geology, Hydrogeology, Archaeology and Ecology etc.	
Reconnaissance/ walkover survey Include photographs and original survey records. Observations of any invasive species (this may impact on future investigation design and remediation plans).	
Conceptual Site Model One of the most important elements of the report. Identification and description of potential pollutant linkages associated with the proposed development.	
Qualitative Risk Assessment Subjective evaluation on the level of risk associated with each identified potential pollutant linkage.	
Conclusions & Recommendations Consider if further assessment is required and provide outline investigation proposals to complete gaps in the conceptual site model and inform decision making process.	

The checklists within this document are intended to provide a summary of minimum reporting requirements. Some Local Authorities have their own detailed guidance available, this document does not supersede these publications.

Phase 2 Risk estimation and evaluation

Generic Quantitative Risk Assessment

At this phase, risk assessment criteria are derived using generic assumptions about the characteristics and behaviour of sources, pathways and receptors within the site.

Where conservative assumptions have been made, it may be possible to apply the resulting criteria as a preliminary screening tool.

Intrusive investigation, sampling, analysis and monitoring are usually required at this phase. The site investigation design should be based on the **conceptual site model** established in Phase 1, to gain more information about pollutant linkages.

R&D Publication 66[6] issued in 2008 provides comprehensive Guidance for the Safe Development of Housing on Land Affected by Contamination.

The investigation should be designed to reflect the planned use of the land. For example, a human health risk assessment for a residential development will require near-surface soil sampling in proposed garden areas. Where contamination of groundwater is suspected, the risk assessment is likely to require an assessment of contaminant mobility in the soil, borehole monitoring installations and measurements that enable interpretation of groundwater quality and flow direction.

The intrusive investigation must be carried out by **suitably competent and experienced contractors**. Investigation design, logging and sampling techniques should be carried out in accordance with current codes of practice, such as BS10175[7].

Assessment Models

There are a number of environmental risk assessment models available. CLEA is the model most frequently used for deriving human health assessment criteria and soil guideline values (SGVs) are available for a selection of substances.

With any environmental risk assessment model it is important to understand its limitations and to ensure that the methodology selected is authoritative, scientifically based and appropriate for the proposed scenario.

Ground Gas Assessment

Where there is a potential for the presence or migration of ground gases, further investigations will be required. This type of investigation will need to be carried out in accordance with suitable risk assessment methods. Available guidance include:

- Various CIRIA publications, such as the CIRIA Guide C665[8] 'Assessing risks posed by hazardous ground gases to buildings'
- NHBC Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present.
- CIEH Ground Gas Handbook

It is the responsibility of the appointed specialist undertaking the risk assessment to ensure that the most appropriate risk assessment tool is used and that it is the current version.

While assessment criteria or models developed in other countries may be appropriate, it is essential to examine the assumptions built into the criteria/models and determine whether they are applicable to the local site conditions, UK policy and good practice.

Risks to groundwater and surface waters should be assessed with reference to current guidance publications available from SEPA's website[10].

The nature and extent of contaminant concentration at the site (or part of the site) can be derived from the statistical analysis of the chemical analytical data obtained from the investigation. However, this is not always appropriate. For example where investigations are targeted or where there is insufficient representative sample data.

Detailed Quantitative Risk Assessment

In some instances appropriate generic guideline criteria are either unsuitable, unavailable or exceeded. In such cases it may be necessary to calculate assessment criteria using a detailed quantitative assessment model.

By carrying out a detailed risk assessment it may be possible to reduce the scope of site remediation works required. In some cases it may demonstrate the absence of significant risk and the corresponding remediation measures are not required.

Although, specialist sampling and analysis techniques can be used to further inform a detailed risk assessment, additional intrusive investigations are not always necessary.

The regulatory authorities need to be satisfied with the proposed assessment criteria and the approach used in their derivation. The risk assessor should therefore produce a documented assessment that can be evaluated by the regulator, who will be looking for transparency in deriving values, evidence of sound science and clarity in any assumptions made.

Additional work may be required towards designing a suitable remediation scheme. This might involve the delineation of contamination sources or analysis to assess the viability of some remediation techniques.

Whilst generic criteria can be used to eliminate pollutant linkages from further assessment, it is considered inappropriate to apply generic criteria as a remediation target value, unless the developers have specifically chosen to adopt a conservative approach. It will usually be necessary to calculate a remediation target value.

Phase 2 Checklist (minimum requirements)

Purpose and Aims of the Study	
Site Investigation Strategy Justification and methodology in relation to the conceptual site model.	
Sampling and Analysis Strategy Justification, methodology in relation to the conceptual site model. Details of quality assurance procedures. Consideration should also be given to analysis that would be useful in designing suitable remediation scheme.	
Accurate Site Investigation Plans Exploratory hole location plan. Cross sections and contour plans summarising findings of investigation. Delineation of contamination extents.	
Environmental Monitoring Soil, ground gas, vapour & water environment. All relevant original data should be included e.g. laboratory certificates.	
Environmental Setting Interpretation of ground investigation data, including any variation from previous assumptions. All relevant field records should be included.	
Justification for model selection & parameters Summarised in tabular format. Provision of reference source, limitations of the data, sensitivity analysis and justifying the selection of parameters with respect to the site specific conditions.	
Site Specific Quantitative Risk Assessment The derivation and application of appropriate assessment criteria with respect to the proposed conceptual site model and protection of Human Health, the Water Environment, Protected Ecological Sites and Property.	
Significant Pollutant Linkages Interpretation of chemical analysis and environmental monitoring data. The identification of significant pollutant linkages which will require either; i) Further investigation and/or assessment ii) Remediation.	
Revised Conceptual Site Model A revision of the Conceptual Site Model highlighting the pollutant linkages that have either been addressed or require further consideration.	
Recommendations This section should include; • Basic design recommendations such as concrete specification and water supply pipe materials and installation details. • Contingency procedures in the event that previously unrecorded contamination is encountered. Where appropriate this section should also consider ; • Options appraisal of remediation approaches. • Outline scope and design for any additional supporting investigation and assessment work. • Addressing remediation constraints presented by invasive species, mine workings etc.	
Conclusions	

Phase 3 Remediation; design, implementation & verification

Remediation

Where the assessment identifies unacceptable risks to human health, property or the environment, a suitable remediation scheme must be developed and implemented.

Remediation scheme objectives must be based on the conceptual site model and address the identified unacceptable risks. Further investigations may be necessary to delineate and characterise contamination.

The proposed scheme should also be demonstrated to be suitable to deal with these risks in a manner that is protective to people and the wider environment.

Where ground works require the importation of materials for soil or fill onto the site, these must be suitable for use and depending on the origins of the material it may be necessary to comply with criteria for registering an exemption from waste management licensing with SEPA. The appropriate supporting documentation should be provided to the regulators **before** importation of such materials.

Consultation with the contaminated land regulator should take place prior to the importation of soils so that the details can be agreed.

It should be noted that whilst the Planning Authority may agree on remediation objectives, these objectives may also be subject to review by SEPA on application for a mobile plant licence or exemption to waste management licences for the reuse of treated material on-site. Other activities affecting the water environment may also require authorisation from SEPA.

The development team should consult the SEPA local team directly during the design stages of the remediation scheme; where treatment of soils or the groundwater is required, where soil is to be disposed off-site or where the water environment may be affected by the remediation actions.

Compliance with the Construction (Design and Management) Regulations and appropriate health and safety procedures must be in place before work commences.

Adequate insurances must be in place including professional indemnity and public liability.

Previously unrecorded contamination may be encountered during site works and a revised risk assessment and remediation scheme may be required.

"Where new development is taking place, it will be the responsibility of the developer to ensure the required and necessary remediation is carried out. In many cases, the enforcement of any remediation requirements will be through compliance with planning conditions and building standards requirements, rather than through a remediation notice issued under Part IIA."

Contaminated Land Statutory Guidance (Annex 1, Paragraph 44)[5]

More detailed checklists can be obtained from the Environment Agency publication, 'Guidance on Requirements for Land Contamination Reports' (2005)[9], and is available to download from the Environment Agency website. Some Local Authorities may also have detailed checklists available.

Any changes made to the agreed Remediation Scheme must be approved by the regulators before being implemented.

Remediation Checklist

(minimum requirements)

Purpose and Aims of the Works To break pollutant linkages. Refer to the conceptual site model.	
Site Plans Before, during and after.	
Appraisal of Remediation Options May include cost-benefit analysis.	
Consultations Summary of agreements, who, when and correspondence reference if available.	
Remediation Targets Requires appropriate consultation with regulators.	
Specification and Methodology details for Remediation Scheme	
Outline of Verification/Validation Strategy What validation and verification works will be required, who will provide certification.	
Environmental Monitoring During site works and if required following remediation works.	
Maintenance Plan Lifespan of remediation work and any maintenance requirements.	
Contingency Plan What happens if remediation fails? Contact information for development parties should be supplied.	

Completion Reporting

After completion of the remediation works, a completion report must be submitted to the Planning Authority for approval **before construction begins** (unless the remediation forms part of the construction). The report should include validation and verification, which demonstrate that the agreed remediation objectives have been met.

Verification – do the works comply with the remediation scheme design?

Validation – does the remediation scheme design successfully remove or break the significant pollutant linkages?

For large remediation schemes, interim reports may be acceptable with the final completion report submitted to the regulators prior to the site being occupied.

The purpose of these interim reports is to ensure that the work is verified while the development progresses rather than waiting until the site development is complete. This should ensure that issues can be resolved earlier therefore avoiding unnecessary delay on completion of the development. These interim reports must be collated and submitted with the final completion report.

Subject to the findings of the verification work, the regulators may require additional investigation and remediation work to be undertaken. Acceptance of a building standards completion certificate (required to legally occupy a new building) may be dependent on this completion report being satisfactory.

There may be a requirement for future monitoring of the site, to verify whether the remediation has been successful, particularly where on-site treatment processes have been used.

Completion Reporting Checklist

(minimum requirements)

Overview of Works A summary of all works carried out.	
Purpose and Aims of the Study To demonstrate that remediation objectives have been achieved.	
Site Plans Appropriate site plans indicating location of validation / verification works.	
Finalised Specification of Works Detailing any changes made to the Remediation Scheme design. Must be prior approved by the planning authority before implementation.	
Waste Transfer Certificates Final excavation plan, destination, quality and quantity.	
Imported materials Final deposition plan, quality data, quantity and source.	
Collated Validation/Verification and Inspection Certificates For capping layers, ground gas mitigation measures and other supervised works.	
Revised Conceptual Site Model Showing the broken pollutant linkages.	
Limitations Identify any limitations to the remediation work, including design lifespan, duration of any workmanship guarantees, relevant title deed burdens etc.	
Any further analysis or monitoring results for verification and validation	

Part IIA

For the purposes of Part IIA[1], a site can only be formally identified as "Contaminated Land" if it meets the following criteria as defined under Section 78A(2) of the Act:

"any land which appears to the Local Authority to be in such a condition, by reason of substances in, on, or under the land, that significant harm is being caused, or there is a significant possibility of such harm being caused; or significant pollution of the water environment is being caused or there is significant possibility of such pollution being caused."

'**Harm**' is subsequently defined as:

"harm to the health of living organisms or other interference with the ecological systems of which they form part and, in the case of man, includes harm to his property."

While these definitions are specific to the Part IIA[1] regime, it is important to consider that if significant pollutant linkages are not appropriately addressed as part of a site development, formal action may be taken post development, at the expense of those persons deemed '**appropriate**' at the time, as defined by the Act[1].

Failure to appropriately assess and remediate significant pollutant linkages whilst developing a site may result in its determination as Contaminated Land under Part IIA[1].

Section 78F(2) of the Environmental Protection Act 1990[1] defines '**appropriate persons**' as those who have caused or knowingly permitted a pollutant to be in, or under the land. As such they may be liable for the remediation of the site if it is subsequently determined as contaminated land by the Local Authority. However, there are also circumstances under which the current owner or occupier of the land contaminated is the appropriate person.

Further Guidance Publications

1	PartIIA of the Environmental Protection Act 1990 as inserted by Section 57 Environment Act 1995 and subsequently amended by; • The Contaminated Land (Scotland) Regulations 2000 (SSI 2000/178) • The Contaminated Land (Scotland) Regulations 2005 (SSI 2005/658). http://www.opsi.gov.uk/ and http://www.netregs.gov.uk
2	Planning Advice Note 33: Development of Contaminated Land. Revised October 2000. http://www.scotland.gov.uk/Topics/Built-Environment/planning/publications/pans
3	The Building (Scotland) Regulations 2004. Technical Handbooks - Section 3: Environment. http://www.opsi.gov.uk/legislation/ http://www.sbsa.gov.uk/tech_handbooks/tbooks2009.htm
4	Model Procedures for the Management of Land Contamination (CLR 11). http://publications.environment-agency.gov.uk/pdf/SCHO0804BIBR-e-e.pdf
5	Environmental Protection Act 1990: Part IIA Contaminated Land - Statutory Guidance: Edition 2. May 2006 [Ref:SE/2006/44]. http://www.scotland.gov.uk/Publications/2006/06/05131212/0
6	EA/NHBC/CIEH Guidance for the Safe Development of Housing on Land Affected by Contamination (2008) R&D Publication 66. Volume 1 and 2. http://www.nhbc.co.uk/Builders/Technicaladviceandsupport/Publications/ContaminatedLandDevelopment/ http://www.environment-agency.gov.uk/static/documents/SR-DPUB66-e-e.pdf
7	BS 10175:2001 Investigation of potentially contaminated sites - Code of practice. http://www.bsi-global.com
8	CIRIA C665 - Assessing risks posed by hazardous ground gases to buildings (revised). http://www.ciria.org/
9	Environment Agency. Guidance on Requirements for Land Contamination Reports. July 2005. http://www.environment-agency.gov.uk/static/documents/Research/devguidev1_1155225.pdf
10	The Scottish Environment Protection Agency: Land Remediation and Waste Management Guidelines. 2009. WAT-PS-10-01 Assigning Groundwater Assessment Criteria for Pollutant Inputs. 2010. http://www.sepa.org.uk

A **Glossary of Terms** can be found in Annex 6 of Part IIA Contaminated Land Statutory Guidance[5] or in R&D 66[6].

Please consider the environment before printing

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