

**APPENDIX 3**  
**ENVIRONMENTAL RISK**

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### ENVIRONMENTAL RISK ASSESSMENT

#### A3.1 STATUTORY FRAMEWORK AND DEFINITIONS

A3.1.1 The statutory definition of ‘contaminated land’ is defined in Part IIA of the Environmental Protection Act 1990, ref 8.13, which was inserted by Section 57 of the Environment Act 1995, ref 8.14, and came into force in England in 2000, as;

*‘any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that:*

*(a) significant harm is being caused or there is a significant possibility of such harm being caused; or*

*(b) pollution of controlled waters is being, or is likely to be, caused’.*

A3.1.2 In Scotland, this has been amended by the Water Environment and Water Services (Scotland) Act 2003, ref 8.15, to *‘significant pollution of the water environment is being caused or there is a significant possibility of such pollution being caused’.*

A3.1.3 The purpose of Part IIA was to help address the problems caused by historical contamination, with the voluntary remediation of such land encouraged without the use of the Act. The planning regime assists in this, with Planning Policy Statement 23: Planning and Pollution Control (PPS23), ref 8.16, published in 2004, setting out the minimum requirements for the remediation of land affected by contamination as *‘after carrying out the development and commencement of its use, the land should not be capable of being determined as contaminated land under Part IIA of the EPA 1990’.*

A3.1.4 The UK guidance on the assessment of contaminated has developed as a direct result of the introduction of these two Acts. The technical guidance supporting the legislation was originally summarised in a number of key documents collectively known as the Contaminated Land Reports (CLRs), a proposed series of twelve documents. Seven were originally published in March 1994, four more were published in April 2002, while the final guidance document, CLR 11 was published in 2004. CLR7 to 10 were withdrawn in 2008, with CLR 9 and 10 effectively replaced by the Environment Agency in the form of Science Reports SR2, ref 8.17 and SR3, ref 8.18.

A3.1.5 CLR11 remains valid and sets out the framework of the investigation process, with the overall approach one of risk management, with risk given the definition of *‘a combination of the probability or frequency, of occurrence of a defined hazard and the magnitude of the consequences of the occurrence’.* In establishing whether a site fulfils the statutory definition of ‘contaminated land’ it is necessary to identify whether the three essential elements of risk exist. These are defined as:

- A contaminant - a substance which is in, on or under the land and has the potential to cause harm or to cause pollution of controlled waters;
- A receptor - something which could be adversely affected by a contaminant, such as people, an ecological system, property or a water body; and
- A pathway – a route or means by which a receptor can be exposed to, or affected by, a contaminant.

A3.1.6 A *‘pollutant linkage’* may be defined as the link between a contaminant *‘source’* and a *‘receptor’* by means of a *‘pathway’*. There may be none, one or many pollutant linkages

existing on a site, which may utilise the same or different sources, pathways and receptors, which may change over the passage of time.

A3.1.7 Each pollutant linkage that exists in respect of the land in question must fulfil one or more of the following criteria:

- significant harm is being caused to the receptor in the pollutant linkage,
- there is a significant possibility of significant harm being caused to that receptor,
- there is (significant) pollution of controlled waters (the water environment) which constitute the receptor, or
- pollution of controlled waters is likely to be caused
- (there is a significant possibility of such pollution being caused).

A3.1.8 A pollutant linkage indicates that all three elements have been identified. The site can only be defined as 'Contaminated Land' under Part IIA if a pollutant linkage exists and the criteria above are met.

A3.1.9 The main potential receptors include:

- 1) Humans – current site occupants, construction workers, future site users and neighbouring site users.
- 2) Controlled Waters – surface water and groundwater resources
- 3) Property – including buildings, crops, livestock and pets
- 4) Ecological systems – including current/future site and neighbouring vegetation

A3.1.10 The main potential pathways to be considered include:

- a) Ingestion and/or inhalation.
- b) Uptake of contaminants via cultivated vegetables.
- c) Dermal contact
- d) Migration through permeable strata
- e) Drains or services
- f) Direct contact with building materials and services
- g) Fire and explosion

## **A3.2 ASSESSMENT METHODOLOGY**

A3.2.1 The guidance proposes a four-stage assessment process for identifying potential pollutant linkages on a site. These stages are set out in the table below:

No.	Process	Description
1	Hazard Identification	Establishing contaminant sources, pathways and receptors (the conceptual model).
2	Hazard Assessment	Analysing the potential for unacceptable risks (what linkages may be present and what could be the effects?).
3	Risk Estimation	Trying to establish the magnitude and probability of the possible consequences (what degree of harm might result and to what receptors, and how likely is it).
4	Risk Evaluation	Deciding whether the risk is unacceptable.

A3.2.2 Stages 1 and 2 develop a '*conceptual model*' based upon information collated from desk based studies, and reconnaissance of the site (a walkover survey). The walkover survey should be conducted in general accordance with CLR 2. The formation of a conceptual model is an iterative process and as such, it should be updated and refined throughout each stage of the project to reflect any additional information obtained.

A3.2.3 The extent of the desk based research and enquiries to be conducted should be in general accordance with CLR 3. The information from these enquiries is presented in a preliminary investigation report with recommendations, if necessary, for further work based upon the conceptual model. In the absence of specific information on contamination anticipated to be encountered, specific DoE 'Industry Profiles' provide guidance on the nature of contaminants relating to a variety of industrial processes and should be used as the basis for determining which contaminants are more likely to be present on a site.

A3.2.4 If potential pollutant linkages are identified within the conceptual model, an intrusive ground investigation and report will be recommended. The investigation should be planned in general accordance with CLR 4, and BS10175. The number of exploratory holes and samples collected for analysis should be consistent with the size of the site and the level of risk envisaged. This will enable a generic quantitative risk assessment (GQRA) to be conducted, at which point the conceptual model can be updated and relevant pollutant linkages can be identified.

A3.2.5 A two-stage investigation may be more appropriate where time constraints are less of an issue. The first stage investigation may be conducted as an initial assessment for the presence of potential sources, with the second being more refined in order to delineate or further characterise any contamination or the physical properties of the site.

### **A3.3 RISK EVALUATION**

A3.3.1 The risk evaluation is a qualitative method for interpreting the data from the hazard estimation stage. It involves the classification of the:

- magnitude of the potential 'consequence' (severity) of the risk occurring and:
- magnitude of the 'probability' (likelihood) of the risk occurring.

A3.3.2 These are defined in the following sections:

### A3.4 CLASSIFICATION OF CONSEQUENCE

Classification	Definition	Examples
<b>Severe</b>	Short-term (acute) risk to human health likely to result in 'significant harm' as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution (note: Water Resources Act contains no scope for considering significance of pollution) of sensitive water resource. Catastrophic damage to buildings property. A short-term risk to a particular ecosystem, or organism forming part of such ecosystem (note: the definitions of ecological systems within the Draft Circular on Contaminated Land, DETR, 2000).	High Concentrations of cyanide on the surface of an informal recreation area.  Major spillage of contaminants from site into controlled water.  Explosion, causing building collapse can also equate to a short-term human health risk if buildings are occupied.
<b>Medium</b>	Chronic damage to Human Health ('significant harm' as defined in DETR, 2000). Pollution of sensitive water resources (note: Water Resources Act contains no scope for considering significance of pollution). A significant change in a particular ecosystem, or organism forming part of such ecosystem, (note: the definitions of ecological systems within Draft Circular on Contaminated Land, DETR, 2000).	Concentrations of a contaminant from site exceed the generic, or site-specific assessment criteria.  Leaching of contaminants from a site to a major or minor aquifer.  Death of a species within a designated nature reserve.
<b>Mild</b>	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ('significant harm' as defined in the <i>Draft Circular on Contaminated Land</i> , DETR 2000). Damage to sensitive buildings/structures/services or the environment.	Pollution of non-classified ground water.  Damage to building rendering it unsafe to occupy (eg foundation damage resulting in instability).
<b>Minor</b>	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc). Easily repairable effects of damage to buildings, structures and services.	The presence of contaminants at such concentrations that protective equipment is required during site works.  The loss of plants in landscaping scheme.  Discoloration of concrete

A3.4.1 In theory, both severe and medium classification can result in death. The differential is that severe relates to short term risk while medium relates to long-term risk. Therefore, the classification of severe requires urgent action while medium may require urgent action but usually long term action would be sufficient.

### A3.5 CLASSIFICATION OF PROBABILITY

Classification	Definition
<b>High likelihood</b>	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution
<b>Likely</b>	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur.  Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
<b>Low likelihood</b>	There is a pollution linkage and circumstances are possible under which an event could occur  However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term
<b>Unlikely</b>	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term

A3.5.1 For the purposes of this preliminary investigation, any source of contamination that has been identified by professional judgement as potentially impacting on the site has been classified as being 'likely' to be present, unless proven otherwise by intrusive investigation.

### A3.6 COMPARISON OF CONSEQUENCE AGAINST PROBABILITY

A3.6.1 These classifications are compared to indicate the risk presented by each pollutant linkage. Once the consequence and probability have been classified they can be used to produce a risk category as below:

		Consequence			
		Severe	Medium	Mild	Minor
Probability	High likelihood	Very high risk	High risk	Moderate risk	Moderate/low risk
	Likely	High risk	Moderate risk	Moderate/low risk	Low risk
	Low likelihood	Moderate risk	Moderate/low risk	Low risk	Very low risk
	Unlikely	Moderate/low risk	Low risk	Very low risk	Very low risk

A3.6.2 The action required for the classified risks are as follows:

<p><b>Very high risk</b></p>	<p>There is a high probability that severe harm could a risk to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening.</p> <p>This risk, if realised, is likely to result in a substantial liability.</p> <p>Urgent investigation (if not undertaken already) and remediation are likely to be required</p>
<p><b>High risk</b></p>	<p>Harm is likely to arise to a designated receptor from an identified hazard.</p> <p>Realisation of the risk is likely to present a substantial liability.</p> <p>Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the longer term</p>
<p><b>Moderate risk</b></p>	<p>It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild</p> <p>Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term</p>
<p><b>Low risk</b></p>	<p>It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.</p>
<p><b>Very low risk</b></p>	<p>There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.</p>