Department of the Environment:
Contaminated Land Research Report

GUIDANCE ON PRELIMINARY SITE INSPECTION OF CONTAMINATED LAND

Prepared by Applied Environmental Research Centre Ltd

CLR No 2 Volume One (of Two)

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DEPARTMENT OF THE ENVIRONMENT

CONTAMINATED LAND: Identification, assessment and control

GUIDANCE ON PRELIMINARY SITE INSPECTION OF CONTAMINATED LAND

APPLIED ENVIRONMENTAL RESEARCH CENTRE LTD

This report is one of a series of reports financed under the contaminated land research programme of the Department of the Environment. The current series deals with: information needed to assess risks; procedures for categorising and assessing risks; and evaluation and selection of remedial methods.

The purpose of the reports is to provide regulators, developers and other interested parties with authoritative and researched advice on how best to identify and assess the problems contamination can pose and what can be done to tackle them. They cannot, however, address the specific circumstances of each site. Every site is unique. Anyone using the information in a report must, therefore, make appropriate and specific assessments of any particular site or group of sites. Neither the Department nor the authors can accept liability for the use or interpretation of the contents of any report.

General guidance on assessing contaminated land and developing remedial solutions which is complementary to the series is provided by the Construction Industry Research and Information Association (CIRIA).

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CONTENTS

1. INTRODUCTION

This is volume 1 of a two volume report providing guidance on the identification and interpretation of visual and other sensory indicators of the possible presence of contamination on a site. Volume 1 is intended to be a manual for use on site and includes a check list and assessment forms. Volume 2 provides a detailed review of the relevant literature on these indicators.

A range of **abiotic** and **biotic** indicators have been identified that are all detectable by sight or smell.

- **Abiotic** indicators include: debris and structures on site; anomalies in topography and soil between the site and adjacent land or within the site; the presence of characteristic colours and odours.

- **Biotic** indicators are related to biological features of the site and include: the type of animal or plant species present; symptoms of effects of contamination in any species; the condition of the soil.

It must be stressed that there is no certain relationship between the appearance of indicators and the presence of threats to human health through contamination. The appearance of indicators does not prove the existence of a threat, and nor does the absence of indicators prove there is no threat.

The history of the site and nature of the general area should be studied before a site is visited.

This manual is intended for staff with appropriate qualifications and experience in site investigation. They will consider whether any work during a site visit may be undertaken by those with limited skills.

2. PREPARATION FOR SITE VISIT

2.1 PREPARATORY RESEARCH

Preparatory research on the history of the site and its environment before the visit will maximise its usefulness and assist in interpretation of information collected.

2.1.1 Site History

Maps and other documentary sources help identify the past uses of a site. Different types of industrial activity are often associated with specific types of contamination. Whilst preconceived ideas should not influence field observations, an idea of the potential contaminants that may be present as a result of identified past activities on the site can help to focus attention onto those site characteristics which are of most value. Guidance on the sources of information and procedures for researching the history of a site are included within : DD 175 : 1988 (Code of Practice for the identification of potentially contaminated land its investigation, draft) and the "Cheshire Study" (DoE 1990), and also within a forthcoming DoE report entitled "Documentary Research on Industrial Sites".

2.1.2 The Physical Environment

The visual identification of possible contamination depends to a large extent on observations of how site characteristics differ from their surroundings. Knowledge is therefore needed of the geology, soil type, and vegetation of the general area of the site and, where possible, the natural variation which would normally be expected.

2.2 HEALTH AND SAFETY

The history of the site may indicate that it poses threats to personal safety, eg the presence of old mine shafts. On any derelict site it is necessary to take great care as debris and vegetation can quickly form a superficial cover over potentially dangerous features. BS 5930 (1981) provides sources of information relevant to areas of mining, quarrying and waste disposal. Relevant guidance on Health and Safety aspects of site inspection is included within HSE HS(G)66 Protection of Workers and the General Public During the Development of Contaminated Land (1991)(HMSO) and should be followed at all times.

2.3 EQUIPMENT

This manual is designed to be used as part of an initial visual assessment, without the use of sophisticated equipment or time-consuming operations. More sophisticated instruments may be needed at a later date to confirm any initial suspicions of contamination. However, at this stage, there are a few simple items which will be useful:

- clipboard plus site map at a suitable scale - the scale should be as detailed as possible without making the sheet too large to be easily handled in the field
- compass, measuring tape
- trowel, or other implement, to enable simple basic observations of soil characteristics beneath the surface, and to aid collection of plants where necessary
- camera
- pH testing kit - at the simplest universal indicator papers - to gain indications of soil or water pH status
- plastic bags, ties and labels for samples of vegetation or other materials on site which can subsequently be analysed in the laboratory
- jam jar or small bottles
- protective gloves.

It should be noted that it is an offence to dig up species protected under Section 8 of the Wildlife and Countryside Act 1985.

3. SITE INSPECTION - OVERVIEW OF INDICATORS

3.1 INTRODUCTION

Chapter 4 contains a check list for recording indicators that may be found on site. The check list itself contains notes to aid observation. This chapter provides additional information on what to look for and on the interpretation of data collected. It should be read before using the check list.

The limitations of using indicators should always be borne in mind. Abiotic indicators only occasionally point to the presence of particular contaminants. Their primary value is in providing clues to previous uses of land. Biotic indicators alone are rarely of use. However, abiotic and biotic indicators **in combination** can provide good grounds for thinking that something is wrong and that further investigation is warranted.

The presence of some contaminants, such as dioxins and PCBs, may not suspected on the basis of a site visit. The evidence of past or current activities (for example, electrical industries, incinerators) may be the only clue that such contaminants could be present.

3.2 ORIGINS OF CONTAMINATION

Contamination may be present as a result of:

a) waste materials brought to the site and deposited

b) waste materials generated by activities on or near the site and deposited

c) deposition/accumulation of materials used or produced by previous or current activities on or near the site. This may result from fall-out of emissions to air, runoff from stockpiles, or general spillage of materials.

Contamination carried by air or water seepage through the soil may extend some distance from the source.

3.3 OUTSIDE THE SITE

3.3.1 Street Names

Evidence of past activities associated with an area may be obvious from street or public house names - for example Gasworks Lane, Coal Tar Street, Brickmakers Arms.

3.3.2 Boundaries and Entrances

Evidence that there was once a strong or secure boundary fence enclosing the site, together with any large gateways or access points which now seem out of keeping, may indicate that industrial activities once took place on the site.

3.3.3 Neighbouring Buildings

If there have been past problems of contamination or gas seepage from a site, measures may have been taken to protect the pipework of neighbouring buildings from such hazards. Such measures, being expensive, are not taken without good cause, so evidence of unusual specifications for pipework for example, could be a clue to the existence of problems.

3.4 SITE DEBRIS

Indicators of past activities on the site may include: old buildings; discarded equipment; signboards; oil drums or containers which may have contained potential contaminants.

Even on closed landfill sites, which have been restored some time ago, there may be residual indicators of the site's past use, for example fences or gateways which now serve no purpose, and roads or tracks which stop in the middle of a field, but which previously led to operational buildings.

Notes should be made of any findings because if the significance of any feature is in doubt it may be checked later with the historical record of the use of the site.

3.5 EVIDENCE OF DISCONTINUITY

Discontinuities between the site and the surrounding area, or within the site itself, may provide indirect evidence for former potentially contaminative uses. These include: landfilling; flytipping; ad hoc disposal of wastes; quarrying/mining, and industrial activities which may have involved some levelling or recontouring.

The surface may look artificially graded, and there will often be other contrasts in topography, type and appearance of vegetation, and general appearance, when compared to the surrounding area.

If waste has been placed in a pit it may have decomposed or settled over time, leaving sunken areas on the ground surface, or irregular hollows and humps. However, if waste has been disposed of after compaction and treatment, and 'capped' by a depth of topsoil, any infilling may not be immediately obvious.

Where contamination has been caused by former or current industrial activity there may be little topographical evidence to indicate its presence, and the only clues may be in the more detailed examination of vegetation and soil characteristics.

3.6 ODOURS

Sometimes gases or vapours can be given off by, or associated with, different types of contamination. But they may also be produced naturally from decomposing vegetation, anaerobic mud (hydrogen sulphide), and other organic sources. Their odours may be distinctive.

Disturbing the soil on industrial ground may cause new odours to become apparent.

The presence of a strong odour may be a good indicator, but the absence of one should not rule out the presence of contamination, for example whether or not any gas/vapour can be detected may well depend on the weather conditions at the time, the concentration of the gas/vapour and the pH of the soil or water.

Some odours associated with particular contaminants are included in Table 16 of Volume 2.

3.7 COLOURS

The colour of soil or of deposits may sometimes indicate contamination. For example, yellow colouration often, but not always, indicates chromium waste; white powder could be one of a number of chemicals including calcium sulphate; copper salts are bluish-green, dichromates are orange and most cobalt salts are deep pink.

In severe cases of landfill gas contamination generally there will be black sulphide or orange/brown iron staining at the soil surface.

Further examples are included in Table 2 of Volume 2.

3.8 WATER AND DRAINAGE

Changes in drainage within a site may indicate that disturbance or infilling has taken place.

Surface pools or streams draining the site may indicate there is contamination. Leachate from contaminated material within the site may percolate through soil and groundwater to emerge some distance from the source.

Where access is possible, it is helpful to inspect streams draining from the site some way downstream beyond the site boundary. Additionally, if possible, it is useful to note the state of streams entering the site upstream - some streams may already be contaminated when they enter the site.

Information on the quality of water, both above and below a contaminated site, may be available from the National Rivers Authority (NRA) who should be consulted either before or after the site inspection.

The most obvious signs of possible contamination are:

- turbidity of the water (other than after heavy rainfall)
- discoloration of water and sediments - e.g. dark or reddish ochre staining
- odours associated with the water
- presence of sewage fungus
- foaming

- presence of oily deposits or film on water surface (natural processes can also produce a film from decaying organic matter, but man made oils can often be distinguished from this by smell).
- gases bubbling continuously through the water
- lack of, or abnormal, aquatic vegetation and fauna.

The aquatic invertebrate community can give a useful initial impression of the health of a watercourse or water body. A low diversity invertebrate community dominated by sewage fungus, rat-tailed maggots and bloodworms is likely to reflect organic contamination; one with a high diversity of freshwater lice, leeches, mayflies, caddis flies, damsel flies, water beetles and water bugs is unlikely to be severely contaminated.

3.9 TREES

The presence of mature trees may indicate that a site has been undisturbed for some time. Healthy established trees, particularly if young seedling trees and saplings are also present, may indicate that soil and drainage conditions are good.

Signs of stress in trees may suggest the presence of contaminants; but, it is often difficult to draw firm conclusions as stress may be induced by a range of other factors, such as air pollution, drought, and lack of nutrients.

3.10 OTHER VEGETATION

Apart from any site debris, the vegetation on the site is likely to be the most obvious visual characteristic of possible contamination. However, some urban sites may not have much vegetation.

It is important to be aware of the inter-relationships between climatic conditions, soils, drainage, and vegetation. In normal circumstances a particular type of soil under particular climatic and drainage conditions supports a fairly characteristic range of plants.

Anomalies in these relationships may provide an indication of potential contamination, for example the occurrence of salt-tolerant species on an otherwise 'normal' soil away from the coast, or absence of vegetation on an

otherwise apparently well-structured and well-drained soil. The question to consider is whether a superficially unusual phenomenon is anomalous, or whether it could be reasonably expected within the natural variation of the vegetation and soils for that area. Caution is necessary where comparisons with the surrounding environment cannot be made.

It is important to relate the assessment of vegetation to the season. An assessment will be most useful in spring and summer. Sites which are waterlogged in winter may support a thriving population of annuals at other times of the year.

Particular attention should be paid to the following:

- presence or absence of vegetation
- type and diversity of vegetation
- health of vegetation
- presence of any indicator species

3.10.1 Presence or Absence of Vegetation

Patches of bare ground in an otherwise vegetated area may indicate contamination but there can be other explanations. Reasons for bare patches include:

- concrete, site debris etc, on or below the soil surface

- contaminants affecting plants directly or indirectly, through lack of nutrients, etc. In such cases, there may be deposits on the soil surface, or staining on or within the soil, and possibly associated odours.

- extreme conditions not related to contamination, for example lack of nutrients or periodic waterlogging or drought. These could be caused by natural factors, such as localised poor drainage, or as a result of human activities, for example an old well or pit shaft backfilled with rubble.

- mechanical wear or compaction caused by vehicles.

3.10.2 Type and Diversity of Vegetation

Normally some form of vegetation will soon cover any untended site. Initially, fast-growing and spreading annual and ruderal (or disturbed ground) species are the main colonisers. As there are more opportunities to colonise a disturbed site with the passage of time (ie there is "natural succession"), these would tend to be replaced by a more varied assemblage of perennial plants and eventually those shrubs and trees which are characteristic of the area.

The vegetation type and species diversity will depend not only on the underlying soil, but also on climatic influences, any management regime, such as mowing or grazing, and the availability of colonisers in the vicinity of the site.

Generally, mowing or grazing (animal droppings are a good indication of grazing by wild animals) tend to increase species diversity. If the vegetation is unmanaged, certain species, for example rank grasses on neutral soil, tend to dominate the sward initially, to be colonised later by shrub and tree species.
It is useful to know the time period over which the vegetation has become established, since this will allow an assessment to be made of whether the natural succession is being arrested for any reason.

Under normal conditions, the following would generally be expected:

- a neutral to slightly acid soil of pH 4-5-6.5 could normally support up to 20-30 species per square metre, and would include species such as ribwort plantain (*Plantago lanceolata*), common sorrel (*Rumex acetosa*), meadow buttercup (*Ranunculus acris*), yarrow (*Achillea millefolium*) and burdock (*Arctium minus*). The number and range of species present will be influenced by soil fertility.

- an acid soil of pH less than 4.5 normally supports only 4-5 species per square metre, and may include species such as ling (*Calluna vulgaris*), and wavy-hair grass (*Deschampsia flexuosa*).

- a calcareous soil of pH greater than 6.5 can have a wide species mix of up to 30-40 species per square metre, including some easily recognised species such as several species of orchid, wild thyme (*Thymus praecox*) and rough hawkbit (*Leontidon hispidus*).

If the species mix is different from that which is expected or observed in the surrounding area, it could mean that the surface soil layer has been imported from elsewhere, indicating that a past landfill or other possibly contaminated site may lie underneath.

If the diversity of species is very much less than expected for the soil type, there could be inhibiting factors preventing the development of the vegetation. Where a thin layer of capping soil covers a landfill, the drainage conditions within the landfill often mean that the soil is subject to drought in summer and poor drainage with possible waterlogging in winter. Under such conditions the vegetation will have a restricted species mix, dominated by those species most tolerant of extreme conditions.

Vegetation may still be arrested at the first stage of succession, and contain ruderal and annual species only. Such checks to succession can be caused by "natural" unfavourable growing conditions, but could also result from contamination.

Differences in vegetation type within the site may indicate localised areas of infill, or contamination, although there may be natural explanations such as isolated pockets of poor drainage. Sometimes contamination and unfavourable natural conditions cause similar patterns of vegetation: for example, both waterlogging and landfill gas prevent plant roots from taking up oxygen, and result in a localised and poor species mix, frequently dominated by stress tolerant grasses or rushes such as some rush *(Juncus)* species.

3.10.3 Health of Vegetation

Symptoms of poor health in vegetation include:

- generally weak, reduced growth
- discoloration of foliage
- shallow and stunted root system
- dieback (noticeable during growing season).

The health of vegetation will be affected if subject to stress, which could result from various natural or artificial causes. Healthy plants should usually be green and vigorous with a well-developed and spreading root system.

The structure and extent of the root system is a good guide to plant health particularly in winter when the vegetative parts of perennials tend to die down. Shallow rooting, particularly in trees, suggest that roots may have encountered contamination at depth or waterlogging. Where this occurs, roots frequently spread horizontally along the soil boundaries, without penetrating into the deeper horizons, and may be visible at the surface.

When herbaceous plants root into contaminated soils, poor root development may result. In extreme cases, such as in severely metal-polluted soils, inhibition of root growth may produce a coral-like mass of stunted roots bearing very poorly developed peg-like secondary branches.

Legumes such as clovers are very sensitive to some soil pollutants. Nodule development on their root systems (essential for their nitrogen fixing activity) is greatly affected by metallic soil contaminants with nodules appearing poorly formed and white rather than pink.

Both nutrient deficiencies and contaminants can cause discoloration of foliage. Yellowing of younger leaves is a good indicator of poor health, but can have various causes - air pollution, nutrient deficiency, or possibly frost damage. At the end of their growing season (end of summer/beginning of autumn), plants will often appear unhealthy and have yellowing leaves. At this time of year it is particularly important to compare the condition of species on site with the same species outside: if they are dying down both on the site and outside there is probably no problem; on the other hand, if a patch of vegetation on site is yellowing, but elsewhere the same species appear green and healthy, there may be a local problem.

Pests and diseases can also cause mottling and disfiguration of foliage.

3.10.4 Presence of Indicator Species

There are some plants which are tolerant of extreme conditions, and some which have evolved tolerance to certain contaminants. These can be used as 'indicator' species because their presence may be associated with unusual and possibly contaminated conditions.

Some examples of indicator species are : certain rush (*Juncus)* species on sites affected by landfill gas ; vernal sandwort (*Minuartia verna*) on calcareous sites

heavily contaminated with lead and zinc; ling (*Calluna vulgaris*) in local pockets of acidity.

Species which have been reported to be tolerant of particular contaminants or groups of contaminants are included in the Appendix, Volume 2.

3.11 SOIL

Soil with a well developed structure supporting a healthy vegetation cover may indicate that there are no problems of contamination at the site.

Soil which is different in colour and structure from that found naturally around the site suggests that it has been brought in as cover material. The underlying material may or may not be contaminated.

If contaminants are present, some signs may be obvious from a close inspection of the soil surface, particularly if it is bare of vegetation, for example staining, oil deposits or seepages from the surface, encrustations of minerals or salts. Beneath the surface there may also be layers of such deposits or stains present.

The presence or otherwise of soil microorganisms will influence soil structure and texture and thus the general 'health' of the soil. Soils which have been moved or stored before spreading are likely to have a poorer structure because their microbial community has been disturbed.

A build up of organic matter on the surface may be an indication that conditions in the soil are preventing the soil microorganisms from breaking down the surface leaf litter into humus. However other possible factors should also be considered, for example acidity, or the leaf litter deriving from a species such as beech which is slow to decay.

Absence of wormcasts may indicate possible contamination unless the soil is naturally acidic.

A pH measurement can sometimes indicate if significant levels of certain kinds of contamination are present. There is considerable natural variation in soil pH but most soils will be within the range 3-4.5 acidic, 4.5 - 6.5 neutral, 6.5 - 8 calcareous. Extreme readings should be investigated further.

3.12 SUMMARY OF KEY INDICATORS

The following table of key indicators will be useful in a preliminary site inspection. With the exception of the identification of tolerant or indicative species, these indicators should be relatively easy to note by staff with little experience or biological knowledge.

- past industrial use indicated from desk research, street names etc.
- past industrial use indicated from site debris, and existing infrastructure, eg. fences, roads, etc.
- odours
- coloured or oily deposits on the soil surface
- condition of water bodies or water courses
- obvious discontinuities, in terms of vegetation, topography, soil type, within the site or between the site and its surroundings
- presence of bare or poorly vegetated patches of ground
- uncharacteristic plant assemblage for location, climate, soil type and period of colonisation
- lack of species diversity
- visible signs of plant stress or discoloration
- poor root and nodule development
- presence of indicator species, particularly plants and aquatic macroinvertebrates
- litter build up on soil surface
- absence of wormcasts (unless soil is naturally acidic)
- poor soil structure

4. USE OF ON SITE CHECK LIST

The check list is designed to be used on any site, rural or urban, where land needs to be checked for potential contamination; however some of the questions may be more relevant to some types of site than others.

The completed check list should be kept on record.

The check list incorporates spaces for the field officer to make his/her own notes, since a "Yes/No" answer by itself may be inappropriate. The questions in **"bold"** can be answered by those with more limited experience of contaminated land assessment. The other questions provide more detailed information on those factors and features that may give a clearer indication of the type and source of any contaminant. Some of these questions may require specialised knowledge on the part of the assessor, for example the ability to identify major vegetation types or individual species. Even if the field officer is only able to answer the **"bold"** questions, there should be enough information for a basic site assessment.

By working through all the questions in the on-site checklist, and matching observations to the explanatory notes associated with some of the questions, there may be indications that certain contaminants are present. Further information that will assist in interpretation is included within Volume 2. These include summary sheets for each of the main contaminants or groups of contaminants listing the principle abiotic and biotic indicators.

Where contamination is suspected samples should be taken for laboratory analysis.

When the check list has been completed, the officer can make a judgement about the priority of the site for further investigation by completing the summary assessment sheets in chapter 5.

ON SITE CHECKLIST

Explanatory Notes (in Boxes)

Aims/Actions in italic type

Key Questions inset and in ordinary type are those that may require more knowledge to make a meaningful assessment.

Key Questions in bold are those that can be answered with little or no experience; the other key questions may require more knowledge to make a meaningful assessment.

Aim/Action 1. Identify any past industrial activities which could have been associated with the site.

NOTES

KQ 1a Are there relevant street/house/ locality or pub names within 500m of the site?

1a
e.g. Coal Tar Lane, Gasworks Alley etc.

KQ 1b Are there any site features or relics which may indicate the past history of the site?

1b
e.g. old equipment, drums, signs, remains of buildings or structures.
NB. Care must be taken to ensure personal safety. It is also necessary to be aware that fly tipping may have taken place.

KQ 1c Are there any signs of steam/smoke emanating from the ground; or other signs (e.g. melting snow) or temperature differences

---

1c
Temperature differences could be associated with subterranean fires and/or landfill gas, both of which are associated with former landfill disposal operations.

Aim/Action 2. Assess whether the site, or part of the site, is likely to have been infilled or used for waste disposal

KQ 2a Does the site appear markedly different from its surroundings in terms of:
topography
vegetation
drainage
soil type
any other factors?

2a
If you have answered 'yes' to any of these questions, the differences could result from the presence of infill materials - either deposited as waste or as fill - for example to level the site.

KQ 2b Are there discontinuities within the site in terms of:
topography
vegetation
drainage
soil type?

2b
If there are discontinuities within the site, it may be advantageous to divide the site into several homogeneous areas. As far as possible, the boundaries of obvious discontinuities of the vegetation, topography, and drainage should be outlined on the site map. If the site has been subdivided the following information should be recorded for each separate area.

Aim/Action 3. Assess whether anything is adversely affecting the health of trees and vegetation.

KQ 3a Are there patches of bare or sparsely vegetated ground contrasting with the vegetation cover over the rest of the site?

3a
Bare patches should be mapped and investigated more fully using the following questions as a guide -
If there are no obvious bare patches, these questions should be answered with respect to the site generally.

KQ 3b Are trees present on the site?

3b
It would be helpful, but not essential, to identify any trees present, and note their frequency, approximate age (e.g. young/mature).

KQ 3c Are any trees showing signs of stress or do they appear stunted or diseased?

3c
Some signs of stress can be linked to some types of contamination. Examples are given below, but it is generally extremely difficult to say whether contamination or other environmental factors are the cause of such symptoms, and any conclusions should be made in the context of the other site observations. Notes should be made of any observed symptoms:
Symptom of stress include:

- yellowing leaves/needles out of season
- premature leaf fall
- dead branches
- shedding bark.

KQ 3d Are young seedling and sapling trees regenerating naturally?

- -
- -
- -
- -

3d

Regeneration of young, healthy, trees tends to indicate that any stress is not associated with the soil conditions.

KQ 3e Does the vegetation appear healthy?

- -
- -
- -
- -
- -
- -
- -

3e

In spring and summer healthy vegetation will appear plentiful and vigorous. If there is any doubt about the status of the vegetation the root system should provide a further guide.[1] A healthy plant will have a full and spreading root system. The roots of clover can be a good indicator of stress. Roots of healthy plants have pink nodules whereas unhealthy plants are likely to have small white nodules. The vigour of plants will depend on the season, and it may be particularly difficult to make an assessment of plant health in winter when any vegetation which is present may not look its best. The roots may still give some guide. Comparison of vegetation on-site with the appearance of similar species outside the site will help in the identification of whether symptoms are related to stress. Features to look for include:

- defoliation
- yellowing or otherwise discoloured foliage
- wilting
- stunted growth.

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[1] It is an offence to dig up species protected under Section 8 of the Wildlife and Countryside Act (1981).

KQ 3f From closer examination is there any indication of the cause of symptoms?

- -
- -
- -
- -

3f
For example, yellowing at the tips of the leaves may be the result of a hard frost, while yellowing at the margins is more likely to result from nitrogen or other nutrient deficiencies. Yellow blotches can sometimes be caused by air pollution.

Aim/Action 4. Assess whether there are any factors on-site inhibiting the natural diversity and succession of the vegetation.

KQ 4a Does the vegetation cover consist mainly of annual species, or are perennial plants characteristic of the surrounding area present?

- -
- -
- -
- -

4a
If the site has been undisturbed for some time, herbaceous and perennial plants are likely to be present. If they are not, then some adverse condition or combination of conditions (which could include contamination, infertility, poor soil structure) is inhibiting the natural succession.

KQ4b Is the range and diversity of species present in the sward what you would expect for the relevant soil type?

- -
- -
- -
- -

4b
Soils of different pH support markedly different flora, and species diversity. If there are fewer species than would normally be expected, some adverse conditions or stresses may be limiting the range of species able to exist. Species diversity will vary with the extent of area investigated, but as a rough guide species diversity would reflect pH as follows:
acid soil (pH <4.5): 4-5 species
neutral soil (pH 4.5-6.5): 20-30 species
Calcareous soil (pH >6.5): 30-40 species

Aim/Action 5. Identify specific signs which may indicate contamination is present

KQ 5a Are there any plants present which are typically associated with a contaminant or group of contaminants?

- -
- -
- -
- -

5a

Examples of indicator species include:

Orchids	-	high pH wastes or soils
Vernal sandwort	-	lead and other metals
Rushes	-	waterlogged areas (possibly affected by landfill gas)
Heathers	-	low pH wastes or soils
Nettles	-	high nitrogen and phosphorus

Further examples can be found in Volume 2.

KQ 5b Is there any surface staining visible on the soil or any surface deposits or seepages from the soil?

- -
- -
- -
- -

5b

Notes or photographs of any obvious occurrences should be taken. Some visual characteristics and associated contaminant sources are provided below:

Examples:	**Possible Cause**
Blue Billy	gas works waste
Black sulphide deposits -	landfill gas, hydrocarbons
Oily patches	chemical processing/ transport industries.

KQ 5c Are there any obvious stains or coloured layerings at depth within the soil?

- -
- -
- -
- -

5c

It will be necessary to dig a small profile into the soil as far as practicable. If stains etc are visible these should be noted. Cf. 5b.

KQ 5d Are any odours present, particularly associated with any deposits/stains found in 5b and 5c above?

- -
- -
- -
- -
- -

5d

If odours are present the location, source, its strength and prevailing wind direction should be noted. Odours which may be encountered on-site and possible sources are listed below:

Source	**Odour**
H_2S	bad eggs
phenols	antiseptic
solvents	ether
oils/tars	tarry smell
amines	rotting fish
fuel stores	petrol/diesel

Further information is included in Table 16 of Volume 2.

Aim/Action 6. Assess general soil characteristics including pH levels.

KQ 6a What is the pH of the soil?

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- -
- -
- -
- -

6a

An approximate soil pH may be estimated from the species assemblage and diversity (c.f. 4b). Plant species tolerant of acidic and alkaline soils are included in Tables 9 and 11 of Volume 2. Alternatively a quick on-site test can be carried out on a soil/distilled water slurry using pH paper or a portable pH meter. To ensure comparability between samples taken from the same site the ratio of water to soil should be constant (approx. 2:1).

It will generally be necessary to take a number of samples from different locations and, in particular, from any bare patches or where staining, odours etc. are present. An extreme pH value (i.e. outside the range 3 to 8) could indicate contamination. Variation of pH within the site may also indicate that discrete areas of waste materials exist.

KQ 6b Are soil dwelling animals present?

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- -
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- -

6b

Soil macro-invertebrates which might be expected include worms (but not on an acid soil), woodlice, and insects. The presence of worm casts at the surface should be noted. A lack of soil organisms would indicate that the soil system is not functioning normally. This could be as a result of contamination/hazardous gases from landfill/soil compaction/waterlogging.

KQ 6c **Are there any areas of soil compaction or waterlogging?**

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6c

Soil which has been used to cover wastes, or which is affected by landfill gas, may be compacted and poorly drained. Compaction and poor soil structure can also result from a number of other factors (eg. off-road motorcycles) and lack of cultivation.

KQ 6d **What is the depth of organic matter on the surface of the soil?**

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6d

It may be helpful to compare the depth of soil surface litter with that on land outside the site. An excessive build up of litter indicates that the normal soil organisms are not present. Reasons for litter build-up may be natural (e.g. very acid soil) or as a result of contamination.

Aim/Action 7. Assess the quality of any standing or running water on, or draining from, the site

KQ 7a **Are there any obvious signs of contamination associated with water?**

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- -

7a

Possible indications of aquatic contamination:

- Staining, discoloration of water or deposited materials (N.B. these can also occur naturally, eg. ochre staining from iron rich deposits)
- Odour associated with water (see 5e above)
- Eutrophication - eg. choked with algae, deoxygenated
- Presence of oily substances on surface (can also occur naturally)
- sewage fungus
- continuous rapid bubbling through water

KQ 7b Is there an abundance and diversity of aquatic fauna?

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- -
- -
- -

7b

A reasonable impression of water quality can be gained from visual assessment of the abundance and diversity of aquatic invertebrates. This can be carried out either by just looking into the water, if it is reasonably clear, or by pulling a glass container through any submerged vegetation and then observing the fauna sampled. Where possible include names of indicator groups.

Further information on invertebrate indicators of aquatic systems is included in Volume 2.

KQ 7c **Is the water clear, or cloudy**

- -
- -
- -
- -

7c
Clear water can sometimes indicate a reasonable water quality. Cloudy water may be caused by the presence of fine sediment or clay particles, by colloidal suspension of substances either caused naturally (eg. reddish ferric 'gel'); by pollution; or, if greenish, by the dominance of algae associated with eutrophication. Eutrophication could be a result of fertiliser run-off.

KQ 7d Are there any differences in water quality between streams draining into the site, upstream of it, and those leaving the site downstream?

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7d
If streams entering a site appear to be less contaminated than those on the site or downstream from the site, then the site is very likely to be a source of contamination.
The NRA should be consulted for water quality records.

KQ 7e **What are the pH values of water from various parts of the site?**

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- -
- -
- -

7e
Extreme pH results (e.g. >8.0; <3.0) can indicate contamination. pH values which differ from those which would be expected given the local soils and geology are particularly significant .

5. ASSESSMENT OF ON-SITE CHECKLIST DATA

The following sheets are intended to assist in the interpretation of information on biotic and abiotic indicators obtained during the preliminary site inspection.

Boxes are provided on either side of the page, and, where possible, these should be completed.

If there is a majority of ticks in the left hand boxes of the assessment sheet then the indication is that the site is unlikely to be significantly contaminated, and it can be classified as having a low priority for further investigation. However it is still possible that the site is contaminated by a substance such as asbestos which has no smell and no effect on plant growth.

A majority of ticks in the right hand boxes indicates that there are problems on the site which could well be attributable to contamination. Further investigation is a high priority. Some of the detailed answers to the Key Questions may help to indicate the source of the problems, and the potential type of contamination which could be present. This information can then help to identify the most appropriate types of sampling strategy and equipment to be used in further site investigations.
Guidance on sampling will be given in a forthcoming DoE report "Sampling Strategies for Site Investigation"

Where the summary assessment sheets show similar numbers of ticks on both the right and left hand sides, further investigations are advisable. Their urgency will be a matter of judgement.

ON SITE CHECKLIST: SUMMARY ASSESSMENT SHEETS

Tick either the left hand or right statement relating to the central boxes. If there is insufficient information available to make a judgement on which box is correct, leave both boxes blank.

FEATURES OF SITE AND SURROUNDING LAND

1) ☐	No evidence of previous potentially contaminating activities	Evidence of past potentially contaminating activities on site	☐
2) ☐	Little or no discontinuity between site and surroundings	Site appears significantly different from suroundings	☐
3) ☐	Site appears to be a uniform area	Obvious discontinuities exist within site	☐

VEGETATION

4) ☐	Soil generally covered by fairly uniform vegetative sward	Patches of bare or sparsely vegetated soil present	☐
5) ☐	Trees appear normal and healthy	Trees appear unhealthy or subject to stress	☐
6) ☐	Vegetation, including roots, has normal appearance	Vegetation shows yellowing or other discoloration on stems/ foliage; clover nodules small and white	☐
7) ☐	Herbaceous and woody perennial plants/shrubs present	Species mainly annuals and those typical of disturbed ground (ruderals)	☐
8) ☐	No obvious signs of 'indicator' plant species or assemblages	Presence of plant species or assemblages sometimes known to be associated with contaminants	☐

SOIL CHARACTERISTICS

9) ☐	No evidence of surface staining or deposits	Presence of surface or subsurface staining, deposits, or seepages	☐
10) ☐	Soil appears similar to that outside the site	Soil colour and texture different to that of surrounding area	☐
11) ☐	Soil structure good with no evidence of waterlogging	Poor soil structure; waterlogged areas on site	☐
12) ☐	Litter layer on soil surface similar to adjacent areas	Litter layer on soil surface thicker than on similar adjacent areas	☐
13) ☐	Soil pH between 3 to 8	pH value of soil less than 3 or greater than 8	☐
14) ☐	A good range of soil macroinvertebrates present	Few or no soil invertebrates present, eg. worms, insects, woodlice.	☐
15) ☐	No unusual odours noted	Unusual odours noted	☐

WATER IN PUDDLES, PONDS, STREAMS AND DRAINAGE DITCHES

16)	☐	Water is clear or colour of surrounding soil	Water and/or sediments are stained, particularly with dark or reddish colours ☐
17)	☐	Water is relatively clear	Water is cloudy or 'soupy' from presence of particles in suspension and algae ☐
18)	☐	Clean water surface	Oily smelling film or foam apparent on surface ☐
19)	☐	pH in the range 3.0 to 8.0	pH range above 8.0 or below 3.0 ☐
20)	☐	No bubbles evident	Bubbles emerging rapidly through water ☐
21)	☐	Abundant and diverse aquatic fauna obvious	Aquatic fauna absent or limited to large numbers of only one or two species e.g. midge larvae or worms ☐
22)	☐	Water quality downstream of site is no worse than that of streams entering the site	Water quality downstream from site appears worse than that of streams flowing into the site ☐

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