

**UNIVERSITY OF PORTSMOUTH
SCHOOL OF EARTH & ENVIRONMENTAL SCIENCES**

1GS312 Contaminated Land

Site Reconnaissance & Walkover Surveys

Introduction

A range of *abiotic* and *biotic* indicators can be identified which, in combination, can provide useful clues concerning potential contamination in preliminary site inspections through site reconnaissance visits and walkover surveys. Biotic indicators are rarely of use unless considered in the context of abiotic indicators and information on site history.

Useful abiotic indicators include: the presence of debris and structures on site; physical appearance of waste materials; discontinuities in topography, and/or soil type between the site and adjacent land or within the site; and the presence of characteristic odours and colours. Indicators related to biological features of the site include the presence of tolerant species; appearance of species; species diversity and poor soil structure and greater depth of litter layer that may be related to reduced soil microbial activity.

Biotic indicators are only useful on sites in which the concentrations of contaminants are sufficient to affect biota; they are of little use where contaminants do not affect biota even though their levels may be above normal background concentrations. Most of the indicator species identified also occur on uncontaminated sites; their usefulness lies in the information to be gained from the whole biotic community present, rather than individual species, in combination with other features of the site.

Plants are generally the most useful biotic indicators since they are static, they root directly into the medium, and discontinuities in plant communities and any individual symptoms attributable to contamination are readily visible. Limitations of their use as indicators arise from their seasonality and the fact that their distribution and abundance and any symptoms they display are also influenced by other ecological factors. Also shallow rooting species may not reflect contamination at depth. Nevertheless plants are generally the best documented group. Among animals, invertebrates are more useful indicators than higher animals, and aquatic invertebrates (where present) more useful than terrestrial invertebrates as they are more visible.

Biotic indicators have been identified for some contaminant groups but not others. For metals and for waste material of extreme pH or salinity there are a number of indicator plant species; for high Biochemical Oxygen Demand (BOD) organic discharges and seepages into water bodies on or adjacent to the site, aquatic macroinvertebrates are useful indicators.

There are few reliable indicators (either tolerant species or visible symptoms) for most non-metals, synthetic organics or gases. However, there are some abiotic indicators that may provide evidence for these contaminants.

Metal indicator plant species are usually tolerant of several metals and their distribution and any symptoms they display may also reflect other environmental factors such as pH and soil texture. Therefore they tend to be indicative species rather than true indicators. Chlorosis of

young leaves is a typical symptom of metal contamination, but it can also be caused by other environmental factors such as nutrient deficiency.

Extremes of pH are indicated not only by certain characteristic plant species, but also frequently by overall plant diversity. As a rough guide a high pH soil is likely to support between 30 - 40 species, whereas a low pH soil is likely to support no more than 5 species.

Varying degrees of pollution by high BOD organics are indicated in fresh water by particular invertebrate groups, and also by overall invertebrate diversity: the lower the BOD the higher the diversity.

The use of invertebrates as heavy metal indicators is less well documented, although some authors consider the percentage of chironomids in invertebrate samples to be a useful index: a high percentage of chironomids in a sample may indicate metal contamination. However the value of freshwater invertebrates as indicators is limited as not all contaminated sites have water bodies on or associated with them.

Where possible the interpretation of biota on land which may be contaminated should be compared with biota on adjacent land, both semi natural and disturbed. Particular caution is required where no comparison is possible.

There are a number of relatively simple biotic indicators that can be used by inexperienced personnel. These include an assessment of vegetation cover, community discontinuities, the relative diversity of plants compared to similar uncontaminated sites; chlorosis of young leaves; stunting of root growth (where comparisons with healthy plants are available); relative diversity of invertebrates in water courses above and below the site, and absence of fauna from well established pools on the site.

Walkover Surveys

Walkover surveys should be carried out after desk study information has been collected and prior to design of the Phase 2 site investigation. They comprise of walking around the site and its vicinity recording features on and around the site based on visual observation in order to:

- Confirm information collected during the desk study
- Collect additional information about the site and the surrounding area
- Assist in planning subsequent phases of site investigation including identifying health and safety issues

Limited measurement, sampling and testing may be carried out. This may include samples of vegetation which can act as indicators of certain types of contamination.

Care should be taken not to dig up species protected under Section 8 of the Wildlife and Countryside Act 1981 as this is an offence.

Limited sampling may be carried out eg:

- Surface deposits, surface waters

- Soil and water pH
- Gas sampling
- Vegetation

NB: pH <3 or >8 in soil or water is indicative of contamination.

This does not cover collection of asbestos samples that should be obtained during a separate asbestos survey taking required precautions against asbestos.

Prior to the visit the following procedures should be carried out:

- Health and safety risk assessment
- Review desk study
- Arrange access and accompaniment if possible
- Review relevant industry profile(s)

Recording Information

Use of an on-site checklist with space for notes is highly recommended (see below). One example of an onsite checklist can be found in section 4 of DoE (1994).

Standard checklists may need to be adapted or amended to deal with different types of sites.

A notebook should always be used to record additional information that does not fit on the form.

The location of all relevant features should be recorded on the site plan during the walkover.

Photographs cross-referenced to the site checklist and notebook should be taken. Photographs should record:

- Main features of site
- Typical site conditions
- Features indicating possible sources/pathways/receptors

Walkover Information to Record

Description of vicinity of site

Street/house/locality/pub names
Neighbouring land uses
Any signs of remedial measures
Any signs of site investigation

Locate and note condition of

Buildings/structures
Small buildings with hazard signs
Features suggesting current/former uses
Tanks contents/bund/staining
Outfalls to surface water and discharges
Remains from previous site investigations
Fences/security features
Depth of standing water, direction & rate of flow of water

Contamination indicators

Site appears different to surrounding area
Surface waste deposits and made ground
Signs of settlement, subsidence, disturbed ground or waterlogged areas
Stained ground, strange odours
Highly coloured soil/deposits
Polluted water, gas bubbling through water
Areas of unseasonal bare ground, or distressed vegetation including trees
Lack of species diversity, lack of soil fauna, lack of aquatic fauna
Presence of indicator species
Evidence of gas production or underground combustion
Seepages
Downstream water quality
Hazardous materials signs
Hazardous materials used on site

Health and Safety Issues

Personal security on isolated/derelict sites

Physical hazards eg from:

- Decaying or partly demolished structures, eg holes in floors in dark empty office blocks (created to speed removal of stripped interior materials)
- No electricity (no light in buildings)
- Vegetation and other debris

Site description

Type of land use/industry
Size
Topography
Main features

Immediate hazards

Public health or safety
Environment
Alert appropriate bodies ASAP

Planning site investigation

Services
Access
Facilities
Space
Health and safety

- Old mine shafts, basements, inspection pits, lift shafts etc

Exposure to:

- Gases/volatiles although information can be gained by smell, 'additional sniffing' should not be undertaken to try and deduce nature of odours
- Contaminants (mainly but not necessarily only when sampling)
- Pigeon droppings (inhalation of dried droppings can lead to aspergillosis, histoplasmosis and 'bird fanciers lung')
- Rat urine in water (can lead to Weil's disease)
- Asbestos

Use of On-Site Check Lists

A check list has been designed by the then DOE which can 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.

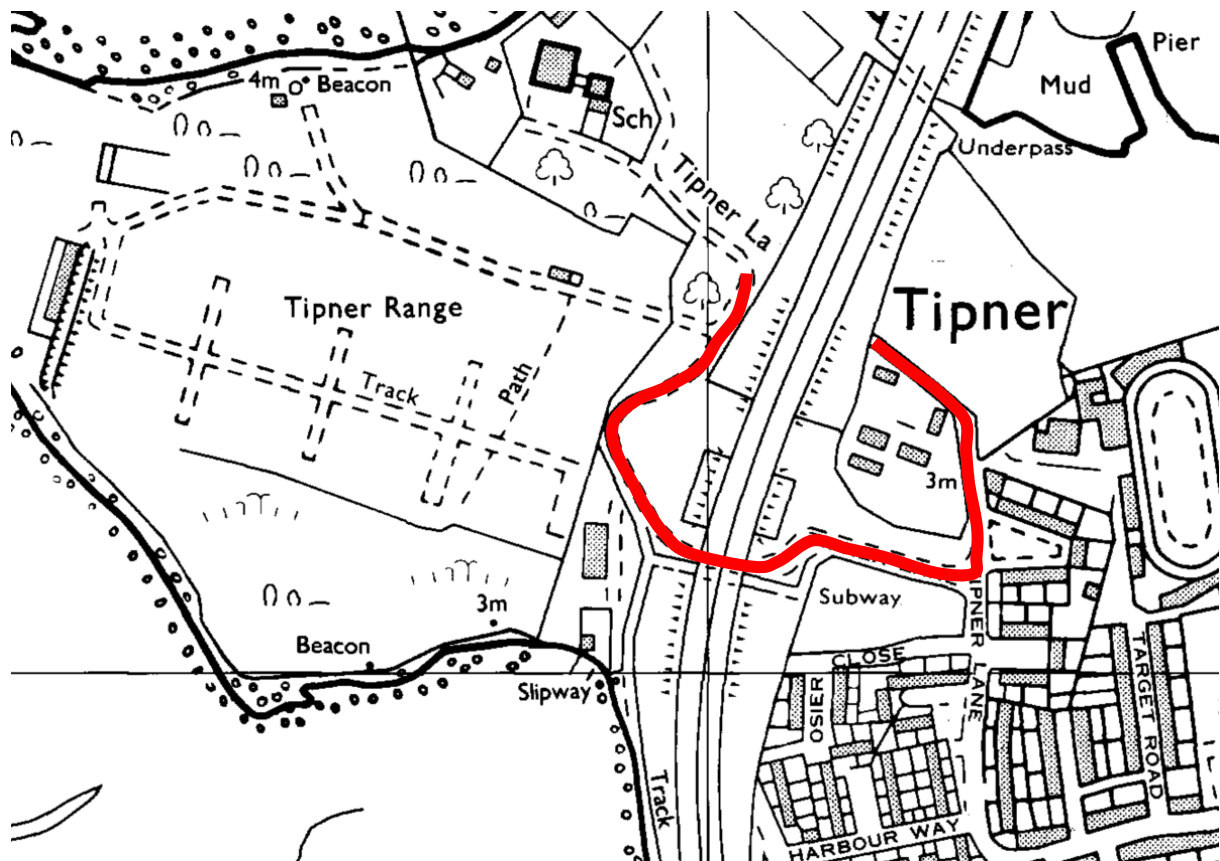
The check list incorporates spaces for the field officer to make his/her own notes, since a "Yes/No" answer by itself may be inappropriate. The questions in "bold" can be answered by those with more limited experience of contaminated land assessment. The other questions provide more detailed information 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 of the site visit can be found in CLR 2 (DOE, 1994) Volume 2. These include summary sheets for each of the main contaminants or groups of contaminants listing the principle abiotic and biotic indicators.

Task

The map extract below indicates a local site that is to be the subject of a mixed commercial and residential development. You are required to undertake a site reconnaissance visit to compile a walkover survey (utilising the DOE Checklist) reporting any possible contamination indicators that are present within the area visited.

The survey is to be undertaken from public access area only and under no circumstances are you to go onto private land. The site can be reached via the No. 6 bus from either Southsea or The Hard to Tipner Green.



References

Department of the Environment (1994) Contaminated Land Research Report 2, *Guidance on Preliminary Site Inspection of Contaminated Land* (Two volumes). DoE, London.

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Nathanail, J., Bardos, P. & Nathanail, P. (2002) *Contaminated land management: Ready reference*. Land Quality Press, Nottingham.

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