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Dealing with contaminated land in England

Progress in 2002 with implementing the Part IIA regime

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The Environment Agency is the leading public body protecting and improving the environment in England and Wales.

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Our work includes tackling flooding and pollution incidents, reducing industry's impacts on the environment, cleaning up rivers, coastal waters and contaminated land, and improving wildlife habitats.

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Cover photo: remediation of creosote pollution from contaminated land in Mirfield, West Yorkshire (see case study on page 18)

Executive summary

This is our first statutory report, which is required under the Environmental Protection Act 1990, on the state of contaminated land in England. It gives an overview of progress made in identifying and remediating contaminated land since the Part IIA regime was introduced in 2000. As well as reporting on the statutory regime, we have assessed potential information sources about land that may be affected by contamination. We will publish a separate report for Wales, the timing of which will be agreed with the Welsh Assembly Government.

The Part IIA regime

The Part IIA regime, introduced in England in April 2000, requires local authorities to identify contaminated land in their area. It also provides a mechanism for remediating that land. Thus, for the first time, it will be possible to take stock of contaminated land in a consistent way and to start to remediate it. The statutory definition of contaminated land requires a contaminant source to be present, a pathway along which the contaminant can move and for that contaminant to be affecting, or potentially affecting, a specified receptor. Where a contaminant is present, but is not affecting a receptor, then that land would not meet the legal definition. The regime will address sites where there is currently an unacceptable risk to human health and the environment.

Sites already determined as contaminated land under Part IIA

Local authorities and the Environment Agency jointly regulate Part IIA. Since it was introduced, we have worked closely with local authorities and the Government to implement the new regime. Since 2000, local authorities have mostly concentrated on preparing a strategy for inspecting their land; the vast majority of these have now been published. For many authorities, inspection is now under way and they expect to finish inspecting their area between 2002 and 2006.

By the end of March 2002, local authorities had determined 33 sites as contaminated land, and remediation had already started at some of these. Eleven were designated as special sites, where the Agency becomes the enforcing authority. We have also agreed to inspect a further 31 potential special sites. The number of sites determined is low because local authorities have concentrated on preparing a strategy for inspecting their land and have not yet finished inspecting their areas. This number is expected to increase as the inspection progresses.

Information on land contamination

Various estimates exist as to the extent and number of sites that could be affected by contamination. However, there is no reliable estimate of the full extent of land affected by contamination. The Agency has estimated that there may be as many as 100,000 sites affected by contamination in England and Wales (Environment Agency, 2000). Between five and 20 per cent of these may require action to ensure that unacceptable risks to human health and the environment are minimised. As local authorities implement their inspection strategies and identify contaminated land, more accurate estimates will be made.

Contaminated land as defined under Part IIA is only part of a wider legacy of land that could be affected by contamination. We reviewed the reliability of nationally available data sets that could be used to assess the extent of the wider problem. We concluded that there is a lack of good quality, consistent, national data on land that could be affected by contamination.

Work is under way, in partnership with the Welsh Assembly Government and the Department for Environment, Food and Rural Affairs (DEFRA), to develop and publish a set of national indicators to measure progress in dealing with land affected by contamination. This will allow us to measure the effectiveness of the mechanisms put in place to reduce the environmental effects of historic contamination and to remove barriers to redeveloping land affected by contamination.

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Abbreviations

CIEH	Chartered Institute of Environmental Health
DEFRA	Department for Environment, Food and Rural Affairs
DETR	Department of the Environment, Transport and the Regions
DoE	Department of the Environment
EPA	Environmental Protection Act
IPC	Integrated Pollution Control
LGA	Local Government Association
NLUD	National Land Use Database
PPC	Pollution Prevention and Control
SCA	Supplementary Credit Approval scheme
Part IIA	Part IIA of the Environmental Protection Act 1990

Introduction

1.1 Aims of the report

This report fulfils a statutory duty to publish a report on the state of contaminated land in England (as defined by Section 78U, Part IIA, EPA 1990). The report:

- describes progress in implementing the Part IIA regime, including the development of local authority strategies for inspecting their area;
- gives the first report of the number of sites determined as contaminated land (as of 31 March 2002);
- presents some of the sources of national data that may be used to assess the nature and extent of the wider legacy of land affected by contamination (Section 6).

We will publish a separate report for Wales, the timing of which will be agreed with the Welsh Assembly Government.

Part IIA of the Environmental Protection Act 1990 and the associated Contaminated Land (England) Regulations 2000 were introduced in April 2000 (referred to as Part IIA throughout this report). They require local authorities to identify contaminated land in their areas. They also provide a mechanism to ensure sites that fall under Part IIA are remediated. Similar arrangements have subsequently been introduced in Scotland and Wales.

Here we report on progress in implementing the regime and the sites determined as contaminated land in England to date. In time, Part IIA will enable nationally consistent information to be compiled on contaminated land. However, much of the regulatory effort in the first two years has been strategic planning, so we have some way to go before we can report comprehensively on the state of contaminated land in England. Nearly all local authorities in England have now produced a strategy for inspecting their land and many have already begun assessing contaminated land. The inspections will generate much more consistent information about contaminated land.

1.2 Definitions

There are various ways of describing land and categorising the degree of contamination. There are few agreed definitions, with the obvious exception of Part IIA. The terms are often used interchangeably and to convey quite different meanings. In this report we use the following terms and definitions:

- **Contaminated land** – that determined as contaminated land under Part IIA, which meets the following statutory definition:

> *"…any land which appears to the local authority in whose area it is situated to be in such a condition, by reasons 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:*
>
> *and, in determining whether any land appears to be such land, a local authority shall…act in accordance with guidance issued by the Secretary of State…."*

Contaminated land, as defined under Part IIA is a sub-set of the wider legacy of land affected by contamination.

- **Special sites** – these are a sub-set of contaminated land sites which are regulated by the Agency under Part IIA. They are defined in detail in the Contaminated Land (England) Regulations 2000 and include, for example, sites that are affecting or could affect specified water bodies, Ministry of Defence land and sites the Agency regulates under the IPC and PPC regimes.
- **Land affected by contamination** – this includes Part IIA land, land where contamination exists but it has not formally been determined by the local authority under Part IIA, or it has been inspected but a significant pollution linkage does not exist.

Brownfield and derelict sites, and even some greenfield sites, may be affected by contamination, and may, or may not, meet the statutory definition of contaminated land.

- **Brownfield land** – more recently referred to as 'previously-developed' land. The following is taken from *Planning Policy Guidance Note 3 – Housing* (DETR, 2000a).

"There are various definitions of previously developed land in use. For the purposes of this guidance (PPG 3), such land is defined as follows:

Previously developed land is that which is or was occupied by a permanent structure (excluding agricultural or forestry buildings), and associated fixed surface infrastructure. The definition covers the curtilage [defined as the area of land attached to a building] of the development. Previously developed land may occur in both built-up and rural settings. The definition includes defence buildings and land used for mineral extraction and waste disposal where provision for restoration has not been made through development control procedures.

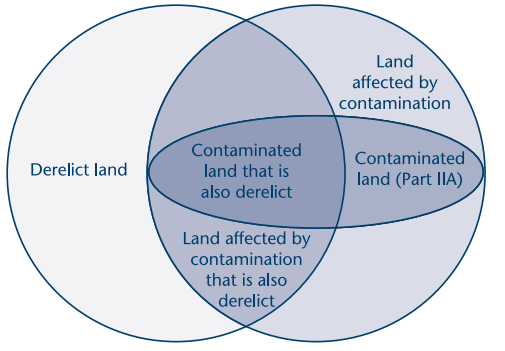
The definition excludes land and buildings that are currently in use for agricultural or forestry purposes, and land in built-up areas which has not been developed previously (e.g. parks, recreation grounds, and allotments – even though these areas may contain certain urban features such as paths, pavilions and other buildings). Also excluded is land that was previously developed but where the remains of any structure or activity have blended into the landscape in the process of time (to the extent that it can reasonably be considered as part of the natural surroundings), and where there is a clear reason that could outweigh the re-use of the site – such as its contribution to nature conservation – or it has subsequently been put to an amenity use and cannot be regarded as requiring redevelopment."

- **Derelict land** – "land that is so damaged by industrial or other development such that it is incapable of beneficial use without treatment" (DoE, 1988).
- **Greenfield land** – land that has not previously been developed; its current uses are usually for agriculture, forestry, recreation or nature conservation.

These terms are fundamentally different, but not mutually exclusive, and are often used to describe the same piece of land. For example, land can be derelict, brownfield and contaminated at the same time (**Figure 1.1**). Greenfield land, in some circumstances, may also be contaminated land.

The range of terms and their different uses makes it difficult to collect consistent information about the extent of contamination nationally. There are various sources of useful information, but these are often based on slightly different definitions. For example, local authorities receive information about land that is potentially and actually contaminated through their planning and pollution control activities. But different authorities have used slightly different descriptions of that contamination, making it extremely difficult to draw national conclusions. As they inspect their area under Part IIA, a more consistent categorisation of land will develop.

Figure 1.1 The relationship between derelict land, contaminated land and land affected by contamination



Source: Environment Agency

Background and legislation

2.1 History of land affected by contamination

Previously published estimates of the extent of land affected by contamination vary widely, from 50,000 to 300,000 hectares, amounting to as many as 100,000 sites. The Agency estimates that, of these, 5,000 to 20,000 may be expected to be problem sites. These will require action to ensure that they do not pose an unacceptable risk to human health or the environment. As local authorities progress with their inspection strategies, these estimates will be refined. Contamination does not only affect land quality; there are often important implications for surface water and groundwater at, near or below the site.

Land is affected by contamination because historical land-management practices have led to the deliberate or accidental release or disposal of substances onto the land. Naturally occurring contamination exists in certain parts of the country. Contamination problems can stem from historical activities dating back hundreds of years, such as spoil heaps from Roman lead mines. The larger-scale problems started with the acceleration of processing, manufacturing and waste-disposal activities associated with the industrial revolution at the end of the 18th century. As understanding of the importance of environmental management has increased, the release of contaminants to land has decreased. Current industrial practice should ensure that significant large-scale new contamination is not created, except where good practice is not followed or an accident occurs.

Different historic processes and land uses may have affected the land with different substances. **Table 2.1** gives some examples of substances commonly associated with four industrial processes. More definitive lists are given in the Department of the Environment's *Industry Profiles* (DoE, 1995).

2.2 Risk management of land affected by contamination

Managing land affected by contamination involves identifying any unacceptable risks posed by the presence of contaminants, then acting to reduce and control those risks to an acceptable level so that the land is "suitable for use".

The process of managing land affected by contamination may be considered in three stages:

- risk assessment;
- evaluating and selecting remedial measures;
- implementing remediation.

Table 2.1 | Examples of substances commonly associated with four industrial activities

Industry/process	Potentially contaminating substances
Oil refineries	fuel oil, lubricants, bitumen, alcohols, organic acids, PCBs, cyanides, sulphur, vanadium
Lead works	lead, arsenic, cadmium, sulphides, sulphates, chlorides, sulphuric acid, sodium hydroxide
Pesticide manufacturing works	dichloromethane, fluorobenzene, acetone, methanol, benzene, arsenic, copper sulphate, thallium
Textile and dye works	aluminium, cadmium, mercury, bromides, fluorides, ammonium salts, trichloroethene, polyvinyl chloride

Source: Department of the Environment, 1995

Risks presented by any given level of contamination are assessed for each site, bearing in mind the relevant site-specific factors. These might include proposed and current land use, proximity to groundwater or surface water or receptors in adjacent dwellings or habitats.

Remedial techniques

There are many different technical approaches to remediating land affected by contamination. They can be categorised as either civil engineering or process-based technologies. Each of the different technologies may be capable of treating either a wide range of contaminants, or specific ones, so the remedial strategy needs to be carefully selected on a site-specific basis.

Historically, the most common form of remediation has been to remove the contaminated soil and dispose of it at a licensed landfill site. Clean material would then be imported to replace it. In 1999, the Agency undertook a survey of remedial techniques for dealing with contamination in England and Wales during 1996 to 1999. This identified that 80 to 90 per cent of all remediation undertaken during this period used excavation and disposal. This may sometimes be the most cost-effective solution, but it is often not the best option for the environment. The problem is not solved; it is merely moved from one site to another. Energy is consumed in transport, with associated emissions to atmosphere, road congestion is increased and valuable landfill space is used up. Other civil engineering options include installing barriers to contain contamination or to separate the source of the contaminant from the receptor.

A number of process-based remediation technologies to treat contaminated soils and groundwater are commercially available in England. These include bioremediation, air sparging, soil vapour extraction, soil washing, thermal treatment and permeable reactive barriers. This is a developing market in the UK. The new process-based technologies offer a more sustainable way of dealing with contaminants in soils. More information on remediation technologies can be found in a series of *Remedial Treatment Action Datasheets* (Environment Agency, 2001).

Voluntary remediation

Many owners of land affected by contamination have initiated work to investigate and undertake remediation on a voluntary basis. Incentives for voluntary remediation include the desire to increase the value of the land, perhaps with a view to selling it, and the removal of potential liabilities from the company ledger. The value of good, public, environmental credentials to major companies can also be a significant incentive, as can the threat of regulatory action.

Part IIA allows for voluntary remediation. Remediation Statements, setting out what is to be done and by when, are produced and placed on the public register, which provides transparency.

Government-supported assessment and remediation

The Government is encouraging the beneficial re-use of previously-developed land, and more specifically the remediation of land affected by contamination. It has set a national target for local planning authorities to increase the proportion of new homes built on previously-developed, brownfield land to 60 per cent by 2008. To encourage this, various grants are available, including the Land Reclamation Programme, which is administered in England by English Partnerships. Under certain circumstances, where remediation takes place voluntarily, the disposal of contaminated soil to licensed landfill may be exempt from landfill tax.

2.3 Legislation

As understanding of the issues has grown, the need to prevent contaminants reaching the soil in the first instance, and to remediate land that has become contaminated, has been enshrined in a number of legislative controls. The two principal controls associated with remediation are Part IIA and the Town and Country Planning regime. More detail on the interaction between these regimes and the management of contaminated sites is given in the DETR circular 02/2000 *Contaminated Land* (DETR, 2000b) and in the Government consultation paper on planning technical advice for *Development on Land Affected by Contamination* (ODPM, 2002), respectively. The Pollution Prevention and Control (PPC) regime is designed to prevent pollution occurring in the first place.

Part IIA regime

Part IIA is designed to deal with contaminated land that poses an unacceptable risk to human health and the environment, based on the current use of the land. Land is defined as contaminated only if:

- there is evidence of the presence of a contaminant, a pathway and a receptor that might suffer "significant harm";
- there is the "significant possibility of significant harm";
- pollution of controlled waters is occurring, or is likely to occur.

This is known as a significant pollutant linkage. The statutory guidance sets out what constitutes "significant harm" and the "significant possibility of significant harm" (DETR, 2000b).

Enforcing authorities

Local authorities and the Agency jointly regulate Part IIA; the different responsibilities are summarised in **Table 2.2**. The local authority is the lead regulator and has sole responsibility for identifying and determining contaminated land.

Once a significant pollutant linkage has been identified and the local authority has formally determined the site as contaminated land, the enforcing authority has a statutory duty to require its remediation. This can involve treating, altering or removing the contaminant, breaking the pathway or altering the behaviour of the receptor in some way. The local authority will be the enforcing authority for all sites except special sites. These are described in detail in the regulations and include, for example, sites that are affecting or could affect specified water bodies, Ministry of Defence land and sites the Agency regulates under the IPC and PPC regimes. Special sites are a sub-set of contaminated land, as defined in Part IIA.

Where a significant pollution linkage exists, the site may be determined as contaminated land by the local authority and formally designated as a special site. The Agency then becomes the enforcing authority. Where there is a reasonable possibility that a site may be contaminated, and it falls within the description of a special site, the Agency can, upon formal request from the local authority, inspect that potential special site before the local authority determines it as contaminated land.

Appropriate persons

The enforcing authority needs to identify and consult the people who may be responsible for remediating the site. This can be either those who caused or knowingly permitted the contamination, or in certain circumstances may be the owner or occupier of the land. The appropriate person may decide to carry out remediation voluntarily, in which case a remediation statement is agreed. This specifies what is to be done by way of remediation, by whom and by when. The enforcing authority ensures that the agreed actions are carried out.

Where the appropriate person does not agree to undertake voluntary action, or where the enforcing authority is not satisfied that the remediation

Table 2.2 Main responsibilities under Part IIA

Local authorities	Environment Agency
• Prepare and publish an inspection strategy • Inspect their areas to identify contaminated land • Consult the Agency on pollution of controlled waters • Ensure remediation of land identified as contaminated land • Transfer special sites to the Agency • Maintain a public register of regulatory action	• Provide relevant information held by the Agency to local authorities • Inspect potential special sites on behalf of the local authority • Ensure remediation of special sites • Maintain a public register of regulatory action for special sites • Prepare a national report on the state of contaminated land • Provide advice to local authorities on identifying and dealing with pollution of controlled waters • Provide advice to local authorities on the remediation of contaminated land

statement has been complied with, then the enforcing authority can serve a remediation notice on the appropriate person. This requires them to remediate the site in accordance with the detail of the notice.

Orphan sites are those where an appropriate person cannot be found. In this case, the enforcing authority ensures that the significant pollutant linkage is broken and uses its powers to carry out remediation. The Supplementary Credit Approval scheme (SCA) is available for local authorities to fund such work. The scheme is managed by the Agency on behalf of DEFRA. The Agency receives its funding for such work directly from DEFRA.

Where nothing "reasonable" can be specified by way of remediation, having regard for the cost of remediation and the seriousness of the harm or pollution, the enforcing authority cannot serve a notice. A remediation declaration is then produced and placed on the public register stating why no action was taken.

In carrying out any of the above, the enforcing authorities must have regard for the statutory guidance and, for specified actions, they must act in accordance with it.

Planning regime

Probably the most significant driver for remediating land affected by contamination is the desire to make use of the land and, in doing so, increase its value. This commonly involves a change in the use of the land, so would normally be controlled by the Town and Country Planning Act 1990, enforced by Local Planning Authorities (LPAs).

Contamination of the land is a material consideration under the Town and Country Planning Act. Planning authorities must consider the possible implications of contamination when developing structure or local plans and when determining individual applications for planning permission. The planning regime has regard for the current and proposed new use of the land when assessing the importance of contamination and determining remediation objectives. Planning permissions are likely to impose conditions on a developer to ensure that any contamination is remediated to a standard suitable for the proposed use. Remediation objectives, under planning, will relate to the risk associated with the assumed behaviour of the occupants of the land. For example, residential gardens are associated with the most sensitive group of society, children up to the age of six, who will play there. A healthy adult population, where the land use is to be industrial or commercial, would normally be considered a less sensitive group. The remediation objectives would reflect this. However, the developer may wish to remediate to a higher standard.

Where a site is affected by contamination, but its current use does not pose an unacceptable risk (that is, it does not meet the Part IIA definition of contaminated land), then it will probably be dealt with under planning when the site is to be redeveloped. Alternatively, voluntary remediation may be carried out. The remediation activity itself may require planning permission.

Associated legislation

Other regimes that interact with the management of land affected by contamination include:

- **Integrated Pollution Control (IPC) and Pollution Prevention and Control (PPC)** – by controlling the management of large industrial premises to reduce the risk of contamination occurring and to remedy harm caused by a breach of the authorisation;
- **Waste management licensing** – by controlling the way that waste management facilities are managed and by controlling the disposal or recovery of controlled waste;
- **Water Resources Act 1991** – the use of Works Notices that allow the Agency to take action to prevent or remedy the pollution of controlled waters.

Preparation for Part IIA

- Part IIA of EPA 1990 came into force in April 2000. Since then local authorities, the Agency and Government have worked closely to implement it.
- Procedural training for Part IIA has been delivered to local authorities. Feedback suggests this has been very well received.
- Joint training between the Agency and local authorities has covered technical aspects of site characterisation, risk assessment and remediation methodologies.

This section outlines the main initiatives undertaken to ensure effective and consistent implementation of the Part IIA regime. An overview of the regime is given in Section 2.3. The work undertaken by local authorities to prepare their strategy for inspecting contaminated land is discussed in Section 4.

3.1 Local authority and Agency liaison

The Local Government Association (LGA) and the Agency agreed a *Protocol for Land Contamination* as part of the Memorandum of Understanding between the two organisations. This identifies the agreed roles and responsibilities as well as processes for information exchange, formal and informal consultation, co-operation and transparency.

The Agency provided all local authorities with a package of information to help them prepare their contaminated land inspection strategies. This included:

- catchment plans showing the location of features such as watercourses and settlements;
- plans showing the relationship of catchment management plans to local authority boundaries;
- plans showing features such as licensed landfill sites and bathing waters;
- locations of licensed water-abstraction points, consents to discharge, sites with waste management licences, IPC authorisations and licensed nuclear sites;
- information on river quality objectives.

The Agency also produced forms to help local authorities report data for operational purposes and to provide information for this report. Most authorities have been using the forms, which cover sites determined as contaminated land and remediation action taken for a site. These were agreed with the LGA and given to all local authorities soon after the regime started.

At a local level, good contacts have been developed between local authority and Agency officers. The majority of authorities have established working groups (Annex 1). These aim to develop consistent approaches to Part IIA, share ideas and develop a common understanding, and have shared the workload of implementation. The Agency has been represented on all these groups.

3.2 Procedures, guidance and training for implementing Part IIA

Collaboration between the Agency, the Chartered Institute of Environmental Health (CIEH), the Local Government Association (LGA) and the Department for Environment, Food and Rural Affairs (DEFRA) produced procedural guidance and training for local authorities. This was to support them in implementing Part IIA and to help achieve consistency between local authorities. The Agency has also developed internal procedures for Part IIA to ensure a nationally consistent approach to its roles and responsibilities. This documentation is available on our website.

We have developed and delivered procedural training packages for most of our staff involved in implementing Part IIA. As part of a joint Agency and

local authority training initiative, we have also delivered a series of regional seminars. These covered:

- site characterisation
- risk assessment
- remediation techniques.

The vast majority of local authorities were represented at these events, and the seminars were well received.

The Agency has also given presentations at a number of conferences and meetings for professional trade organisations, often sharing the platform with local authorities. This was a way of raising awareness about Part IIA and the management of land affected by contamination.

The Agency and DEFRA have developed and disseminated a wealth of guidance on this subject (Annex 2).

Local authority strategies for inspecting contaminated land

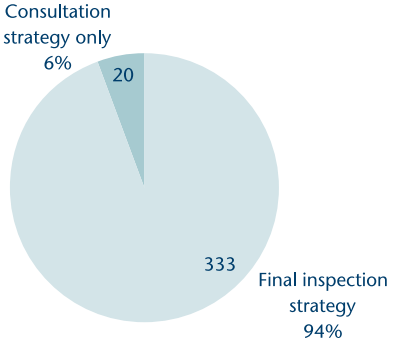
- Local authorities have focussed on producing strategies for inspecting contaminated land during the first two years of the Part IIA regime.
- By July 2002, the vast majority of local authorities had published their final inspection strategies.
- The majority of local authority strategies follow a broadly similar approach to inspecting their areas.
- Many authorities have now started to inspect their areas.

Under Part IIA, local authorities were required to set out their approach to inspecting their areas for contaminated land as a written strategy. This was to be formally adopted and published within 15 months of the statutory guidance being issued (that is, by July 2001). This section reports on the progress local authorities have made in publishing their strategies and gives a broad outline of their content.

4.1 Progress in producing inspection strategies

Most local authorities have responded well – 94 per cent had published their final inspection strategies by July 2002 (**Figure 4.1**). This has been achieved at a time when local authority staff have also been working on several other new initiatives, such as the new Pollution Prevention and Control regime. The remaining authorities have published a consultation strategy. Annex 3 lists all relevant local authorities in England and the progress on their inspection strategy by July 2002.

Figure 4.1 Local authority inspection strategies produced, July 2002



Source: Environment Agency

4.2 Contents of inspection strategies

The information presented on the contents of the inspection strategies relates to those published by 31 March, 2002. While the detailed contents of the inspection strategies vary, according to local circumstances, most local authorities have followed a broadly common approach in developing and presenting their strategies, including:

- presenting strategic objectives;
- preparing a strategic overview;
- identifying priority areas for inspection;
- evaluating areas;
- identifying key activities and dates for progress;

- dealing with urgent sites, local authority-owned sites and others outside the general prioritisation programme;
- setting a date or triggers for review of the strategy.

Strategic objectives

Most local authorities have clearly stated their objectives within the strategies. Various strategic objectives were presented, but they usually fell into the following six categories:

- comply with statutory requirements;
- communication/liaison/consultation;
- provide information to the Environment Agency;
- review the local authority's own contaminated land responsibilities;
- protect and improve the natural and built environment (including brownfield redevelopment);
- improve information about contaminated land.

Strategic overview and prioritising areas for inspection

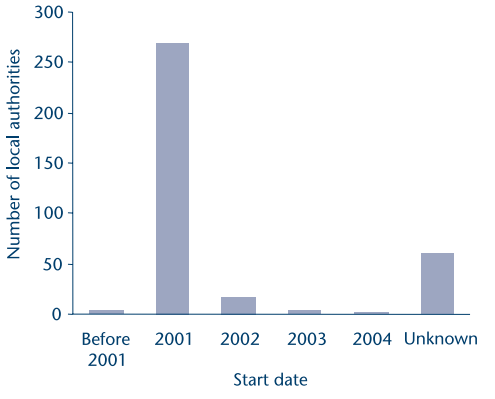
Most local authorities were due to begin their strategic overview in 2001 (**Figure 4.2**). The date they are due to finish inspecting their area varies from 2002 to 2006.

Most local authorities will use the information gathered during their strategic overview to identify priority areas for inspection. This will allow them to carry out detailed inspections in the highest-risk areas first to identify priority sites. Priority sites are those where a significant risk is thought to exist, and may need to be dealt with before the strategic overview is finished.

Reviewing inspection strategies

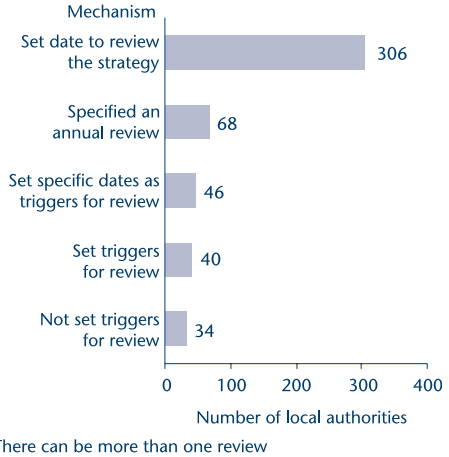
Most local authorities have set a date to review their inspection strategy (**Figure 4.3**). Others have either set triggers for review (such as a change in relevant legislation) or have specified an annual review. Only 34 have not identified a mechanism to review their strategy.

Figure 4.2 Local authority start dates for inspecting contaminated land



Source: Environment Agency

Figure 4.3 Local authority plans to review inspection strategies



There can be more than one review mechanism for each strategy

Source: Environment Agency

Progress in identifying contaminated land under Part IIA

- 33 sites were determined as contaminated land in England by 31 March, 2002. Of these, 11 were designated as special sites. Seven remediation statements have been agreed.
- The number of sites determined appears low because local authorities have been concentrating on preparing their inspection strategies and are only now inspecting their areas.
- The number of determined sites will increase once the inspections are well under way.
- To date, the Agency and local authorities have agreed that the Agency will inspect a further 31 potential special sites.

The next step, after producing an inspection strategy, is for local authorities to inspect their areas. Generally, this process is just starting, so relatively few areas have been identified under Part IIA to date. Sites identified are likely to be those that were already known by local authorities or the Agency. This section summarises the numbers of sites determined to date, how they have been classified and what progress there has been with their remediation. It is based on information provided by local authorities to the Agency. It is proposed that local authorities will report their progress in identifying and remediating contaminated land to the Agency each year from April 2003. We have provided forms to local authorities to aid in information gathering. These provide a standard template, which should ensure that the information generated is consistent, and will make it easier to compile a national status report.

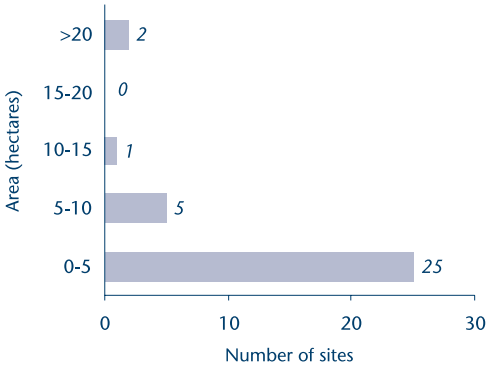
5.1 Sites determined as contaminated land

Some 33 sites were determined as contaminated land by 31 March, 2002. This figure might appear low, but resources in local authorities have been concentrated on the development, consultation and publication of their inspection strategies. From this limited data set, the following preliminary conclusions can be drawn:

- most of the sites are relatively small – less than five hectares (**Figure 5.1**);
- organic compounds and metals are the major contaminants of a large proportion of the sites (**Figure 5.2**);
- the fuel/oil storage, construction and waste management industries are among those thought to be responsible for causing the contamination (**Figure 5.3**);
- people and controlled waters are most commonly quoted as the receptor at risk from the sites (**Figure 5.4**).

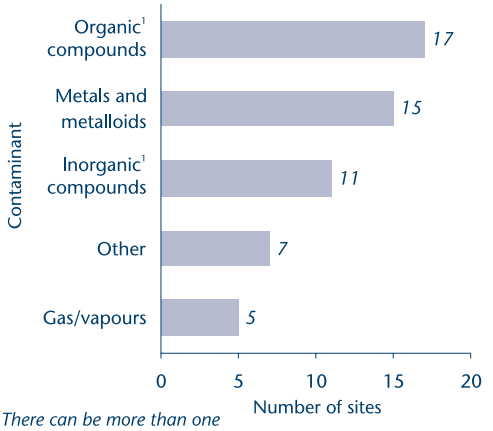
We do not yet know how many inspections will be carried out by local authorities.

Figure 5.1 Sites determined as contaminated land (Part IIA), 31 March 2002



Source: Environment Agency

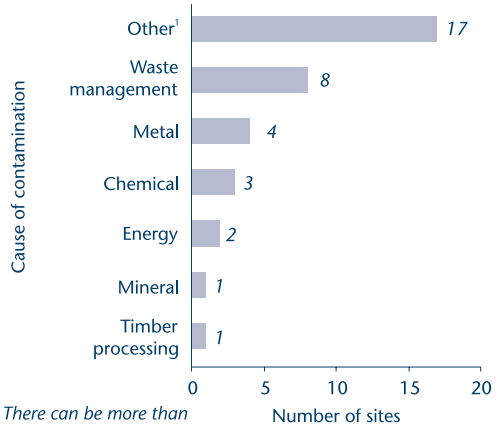
Figure 5.2 Priority substances at sites determined as contaminated land (Part IIA), 31 March 2002



There can be more than one contaminant at each site
[1]In liquid or solid form

Source: Environment Agency

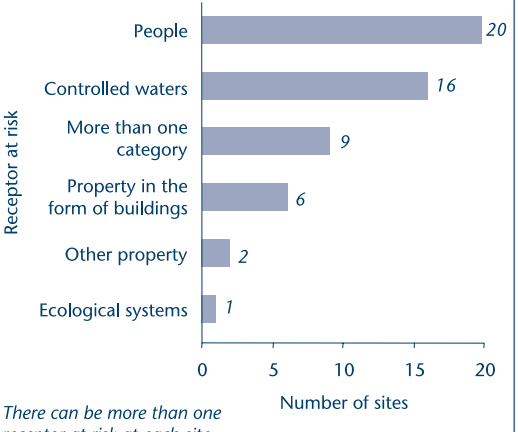
Figure 5.3 Industrial uses thought to have caused contamination of Part IIA sites, 31 March 2002



There can be more than one cause of contamination at each site.
[1]Includes fuel/oil storage and construction.

Source: Environment Agency

Figure 5.4 People, property and the environment at risk from contaminated land sites (Part IIA), 31 March 2002



There can be more than one receptor at risk at each site

Source: Environment Agency

5.2 Contaminated land designated as special sites

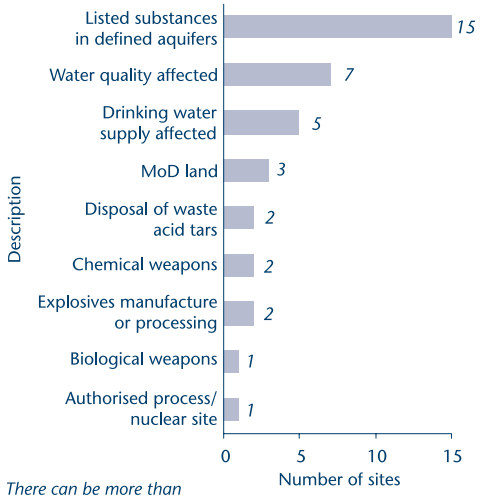
Of the 33 sites determined as contaminated land, 11 have been designated as special sites. All these special sites were designated because controlled waters are being, or are likely to be, polluted.

As of April 2002, the Agency had agreed with local authorities to inspect a further 31 potential special sites. In many cases, water quality is affected or listed substances have been found in, or are likely to enter, a listed aquifer (**Figure 5.5**). Most sites are currently derelict or being used for housing, industrial premises or agriculture (**Figure 5.6**). Most of the sites (26) are relatively small – less than 10 hectares (**Figure 5.7**). Common reasons for inspecting these sites are potential contamination with organic and inorganic compounds (**Figure 5.8**). People and controlled waters are the receptors most often thought to be at risk from these sites (**Figure 5.9**).

At any one site, there may be more than one substance that may be affecting different receptors. Furthermore, the site may meet more than one of the special site descriptions set out in the regulations.

Local authorities can ask the Agency to play a more formal role at the inspection stage of a potential special site. This may require anything from providing information from the potential appropriate person(s) to carrying out an intrusive site investigation, specific to the significant pollution linkage of concern.

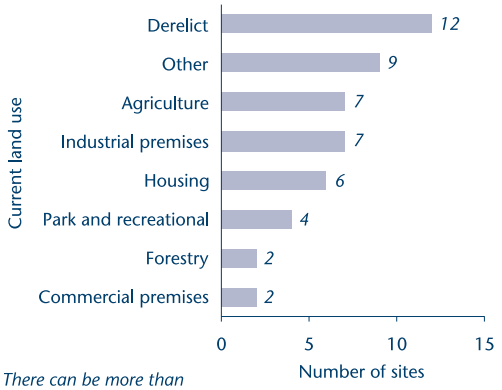
Figure 5.5 Description of potential special sites, 31 March 2002



There can be more than one cause of contamination at each site

Source: Environment Agency

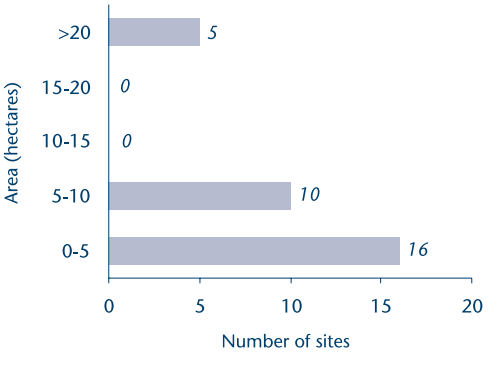
Figure 5.6 Current land use on potential special sites, 31 March 2002



There can be more than one land use at each site

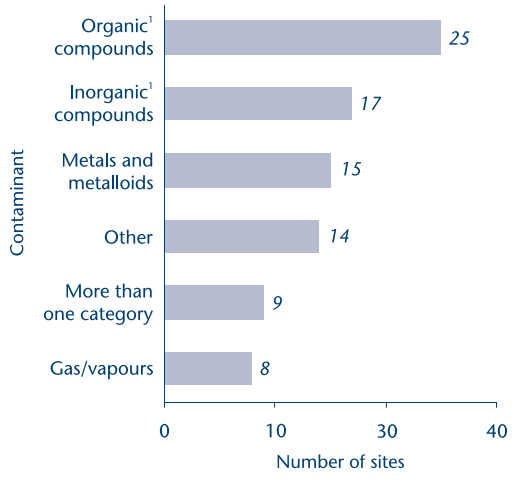
Source: Environment Agency

Figure 5.7 Potential special sites, 31 March 2002



Source: Environment Agency

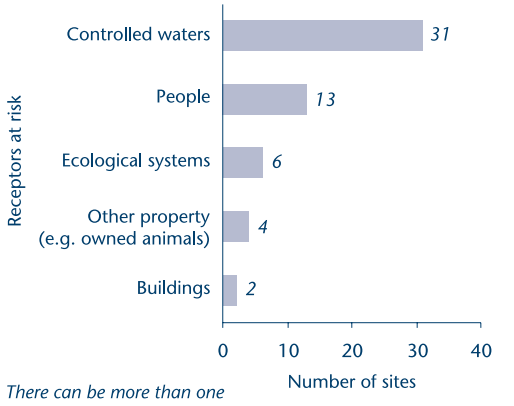
Figure 5.8 Priority substances at potential special sites, 31 March 2002



[1] *In liquid or solid form*

Source: Environment Agency

Figure 5.9 People, property and the environment at risk from potential special sites, 31 March 2002



There can be more than one receptor at risk at each site

Source: Environment Agency

5.3 Remediation of contaminated land sites

As of 31 March 2002, remediation had started at seven of the 33 determined sites (for example, see case study). They are all being dealt with voluntarily under an agreed remediation statement. The persons responsible for remediating the sites include:

- those who caused the contamination;
- the current landowner;
- the enforcing authority where the site is an orphan site.

Remedial treatments used to break the significant pollution linkages include:

- *in situ* bioremediation;
- excavation and disposal at controlled landfills;
- cover barrier.

Case study

Remediation of creosote pollution from contaminated land in Mirfield, West Yorkshire

The River Calder at Mirfield had been polluted for many years by creosote from a former tar works. The creosote was seeping through the soil into the underlying groundwater, then entering the nearby river. The Agency has worked successfully with partners to remediate the site.

We worked with Kirklees Metropolitan Council to find a solution. The council determined the site as contaminated land and designated it a special site. The Agency then became the lead regulator and agreed a remediation statement with the current site occupiers to secure remediation voluntarily.

Remedial treatment works were completed in January, 2001. An interception trench was installed at the riverbank to collect the creosote below ground (see front cover photo). The creosote is pumped into a secure holding tank for appropriate disposal off-site. The trench has almost entirely prevented creosote entering the river. There is some residual creosote between the trench and the river, but this does not pose a long-term threat to water quality. The site occupiers are monitoring the quality of the river and groundwater. Depending on the results, future treatment actions may be needed.

Other sources of information about land that may be affected by contamination

- There is a lack of good-quality, consistent, national data on sites affected by contamination in England.
- A lot of information is held locally, based on different definitions and often in paper form. Some of these, such as planning records, are potentially very valuable, but are not held in a format that allows easy access or for national comparisons to be drawn.
- Existing national data sets do not relate to actual land affected by contamination. Coverage is often incomplete.

There is currently an incomplete understanding of the nature and extent of land affected by contamination. The inspection of land under Part IIA will fill this gap for land that meets the statutory definition of contaminated land. Estimates of the extent of land affected by contamination in England do exist (Section 2.1), but vary considerably because they are based on different definitions of contamination and incomplete coverage. There has been no national survey of land affected by contamination. Potentially valuable sources of data, such as planning records, are not nationally consistent as the contamination aspects are based on criteria that vary. Accessibility and collation of records may also be limited as such records are held locally and often in paper form only.

We have begun to explore, with the Department for Environment, Food and Rural Affairs (DEFRA) and the Welsh Assembly Government, how to address the incomplete understanding of the nature and extent of land affected by contamination. The *Identification and Development of a Set of National Indicators for Measuring Progress in Dealing with Potentially Contaminated Sites* (Scott Wilson Kirkpatrick & Co Ltd, 2001) report details possible national indicators for land affected by contamination, while assessing the availability of information and the feasibility of populating the indicators. It also identifies some potentially useful sources of information. We have investigated some of these and present them in this section. This is not an exhaustive list, but it indicates the difficulty of assessing the extent of the problem nationally.

6.1 Potential data sets

We have identified data sources about land that could be affected by contamination in England using two approaches:

(1) **bottom up** – identifying and recording sites with known land uses that may cause contamination. This information is accessed through specialist databases, which may be regionally or nationally aggregated;

(2) **top down** – identifying areas, based upon a national assessment, that are potentially contaminated based on historical land uses.

The quality of the data has been assessed in terms of data coverage, variability, format and accessibility. Details of data characteristics, in particular any limitations on accuracy, coverage or interpretation are either described within individual figures relating to these data sets within this report or in Annex 5. These data sets only indicate potential contamination, not actual contamination. The nature of the potentially contaminative use and how well sites are managed will both affect the probability that a site is actually contaminated.

In assessing the nature and extent of land that could be affected by contamination, landfill sites often figure prominently. This is, at least in part, because we have reasonably good information about where landfill sites are. We have considerably less information about other potentially contaminative uses. So landfill sites' contribution to the overall number of sites may seem greater than it actually is because they dominate the available data.

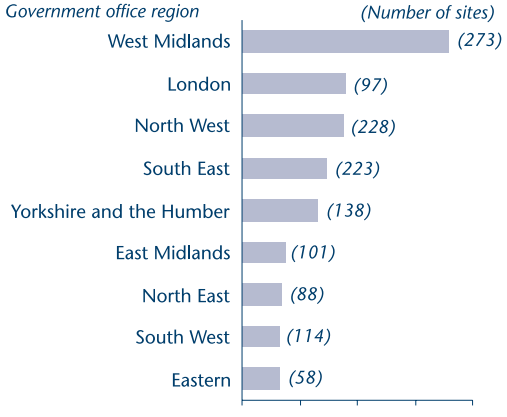
The Supplementary Credit Approval scheme

DEFRA's Supplementary Credit Approval scheme (SCA) provides funds for local authorities or the Agency to deal with land affected by contamination. The database of bids put to DEFRA is held by the Agency. Most bids are successful, but sites where the bid was unsuccessful are included in this data set. These sites may or may not have received remedial action.

Most current SCA sites are closed landfills where historical contamination may be an issue. They are owned mainly by local authorities as a result of their historic responsibilities for providing waste-disposal facilities. Before Part IIA was introduced, the SCA scheme funded remediation of old landfill sites only where landfill gas was an issue. Most SCA-registered sites are in the West Midlands, closely followed by the North West and South East (**Figure 6.1**). The greatest area of SCA sites is also in the West Midlands.

The SCA sites are a small sub-set of land that is affected by contamination, where the site needs remediation or investigation to assess the level of contamination and the risk posed.

Figure 6.1 Sites registered under the Supplementary Credit Approval scheme for funding of remediation, 2002



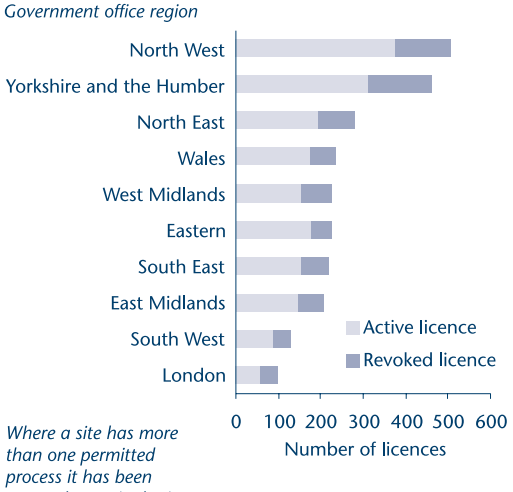
30 records do not have enough detail to assign them to a region. 235 records have no surface area given.

Source: Environment Agency

Major industries regulated under Integrated Pollution Control and Pollution Prevention and Control

The Agency regulates the environmental impact of more than 2,000 major industrial processes in England and Wales under Integrated Pollution Control (IPC) and the new Pollution Prevention and Control (PPC) regime that is replacing IPC. This includes, for example, the chemical, power generation and petroleum industries. Most authorised sites are in the North West, while Yorkshire and the Humber has the most sites with revoked authorisations (**Figure 6.2**). Local authorities regulate about 13,000 industrial sites under IPC (Chartered Institute of Public Finance and Accountancy, 2000). By 2007, around 7,000 installations should be regulated by the Agency under PPC.

Figure 6.2 Major industry regulated under IPC and PPC, 2001



Where a site has more than one permitted process it has been counted as a single site

Source: Environment Agency

The types of industry that operate under IPC and PPC authorisations could cause contamination through poor management practice or accidental spills. Different industry sectors will pose different levels of risk. However, since these sites are controlled, inspected and monitored by the Agency and local authorities, the risk of future contamination is significantly reduced.

Activities that were operational before these controls were introduced may pose more of a risk. It is not possible to estimate reliably what proportion of these sites are affected by contamination.

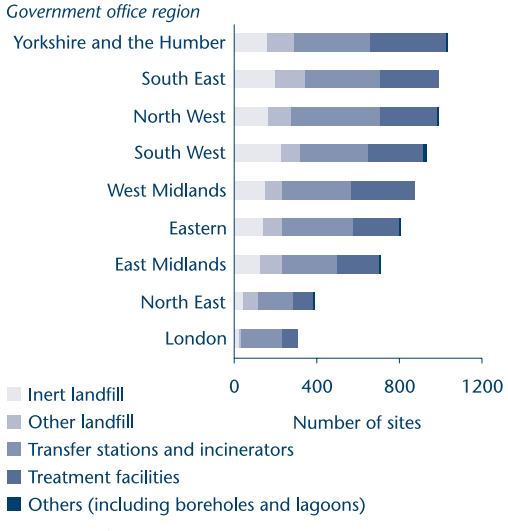
Local authorities have legal powers to control emissions to the atmosphere only at sites they regulate under Part B of IPC and not emissions to land. However, at sites that local authorities will regulate under Part A of the PPC regime they have powers to control emissions to land, water and air.

Regulation Information System for Waste Management (REGIS)

Waste management sites, where waste is recovered, recycled, treated or disposed of, can become contaminated. Licensed and exempt waste management sites are recorded on the Agency's Regulation Information System for Waste Management (REGIS). Not all closed sites are on the system as the Agency took responsibility for waste regulation only when it was formed, in 1996.

Most licensed waste management sites are in Yorkshire and the Humber, although most regions have broadly similar numbers, with the exception of the North East and London (**Figure 6.3**). The North East has by far the most closed waste management sites in England (**Figure 6.4**). The largest area of currently licensed landfill sites is in the South East, (excluding London) (**Figure 6.5**).

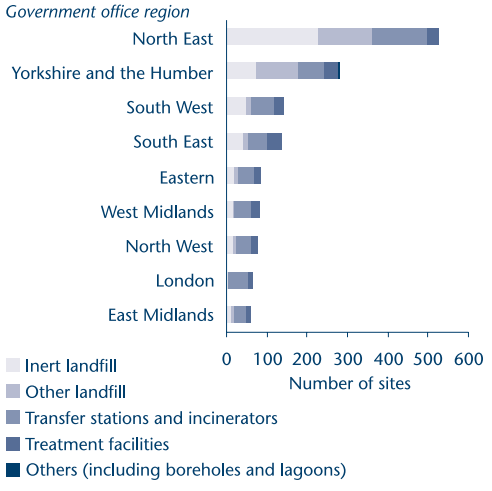
Figure 6.3 Open, licensed or exempt waste-management sites, 2001



See Annex 5 for accompanying notes

Source: Environment Agency

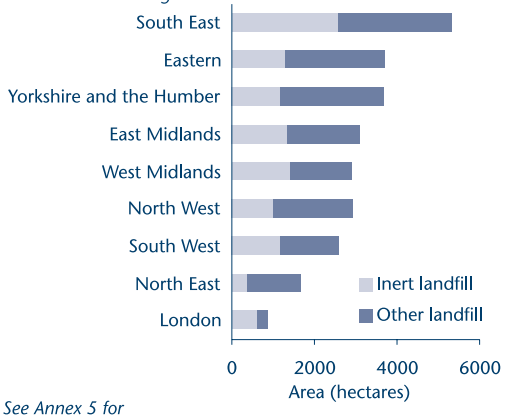
Figure 6.4 Waste-management sites that closed between 1994 and 2001



Data relate to sites that have surrendered a licence
See Annex 5 for accompanying notes

Source: Environment Agency

Figure 6.5 Area of currently licensed landfill sites, 2001



See Annex 5 for accompanying notes

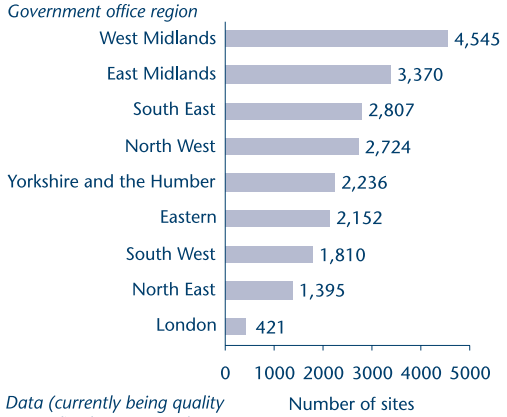
Source: Environment Agency

Waste management practice has improved over the last 25 years. Older sites are therefore likely to pose a higher risk than more recently constructed ones. Different types of site pose different levels of risk. It is not possible to make confident estimates of what proportion of waste management sites will be defined as contaminated under Part IIA.

Landfill sites closed since 1976

The Agency holds historical information on the number of landfill sites that have closed since 1976. The West Midlands has the most historical landfill sites and London has the least (**Figure 6.6**). These data are from a different source than that presented above and are currently being quality-assured. We will make this data set available for reference once this has been completed.

Figure 6.6 Landfill sites that closed between 1976 and 1994



Data (currently being quality assured) relate to sites that have surrendered a licence.

Source: Environment Agency

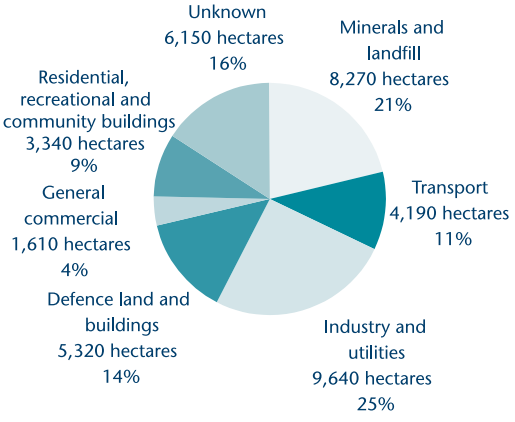
Some of the older sites may have been regulated only towards the end of their operational lives. Advances in knowledge and regulation have led to a move away from uncontained landfill sites. Modern landfill sites are engineered to contain leachate and landfill gas. This means that these historic sites pose a greater risk than more recent ones, unless they have stabilised physically, biologically and chemically. The level of risk posed will depend on the specific nature of the site, the type of waste landfilled, the nature of the surroundings and how well it was managed by the operator.

The National Land Use Database (NLUD)

The National Land Use Database (NLUD) aims to provide a record of land use in England. The NLUD is under development and at present data are available for previously developed land. This is a joint venture between the former Department for Transport, Local Government and the Regions (DTLR), English Partnerships, the Improvement and Development Agency and the Ordnance Survey. The database records the amount of previously developed land and buildings that are unused or may be available for redevelopment. Contamination is not recorded, but previous use may indicate the potential for contamination. A site might have had a succession of uses that may well have included one or more potentially contaminative uses.

Figure 6.7 shows the area of previously developed land in land use/type categories for England. While the categories are broadly defined, some, such as "minerals and landfill", contain sites that are more likely to be affected by contamination than others. Note that truly inert landfills do not pose a problem and some mineral workings may subsequently be used for recreational purposes or forestry. Yorkshire and the Humber and the North West have the largest pools of vacant and derelict land (**Figure 6.8**). London has by far the lowest, which may reflect the higher demand for land for redevelopment.

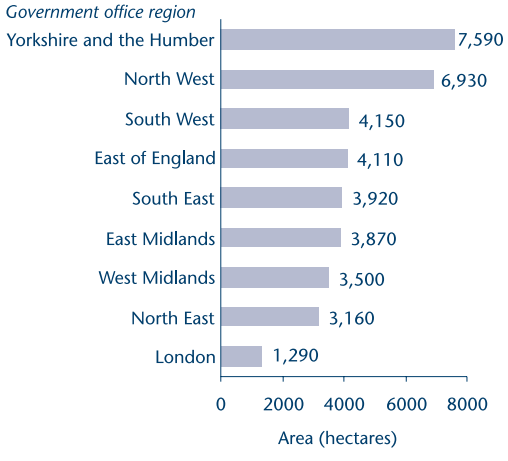
Figure 6.7 Area of vacant and derelict land and vacant buildings by land use, 1998



See Annex 5 for accompanying notes

Source: Department for Transport, Local Government and the Regions, Crown Copyright

Figure 6.8 Area of vacant and derelict land and vacant buildings, 1998



See Annex 5 for accompanying notes

Source: Department for Transport, Local Government and the Regions, Crown Copyright

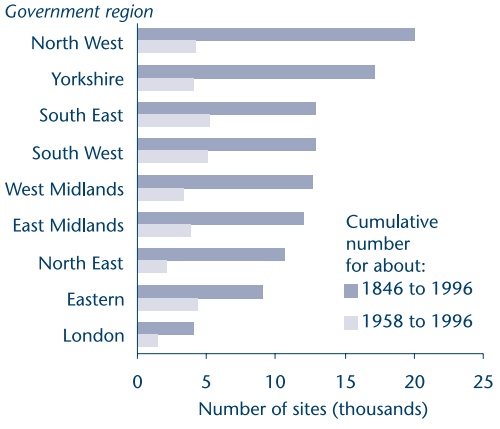
This data set covers only land that may be available for development, so will not include any currently in use that could be affected by contamination. The sites included remain unused for a number of reasons, many of which may be economic or social. Contamination may be an issue that discourages development of some sites, but there is no indication as to what proportion. The database is potentially of enormous use in promoting redevelopment, but its use in assessing contamination is limited to describing the location of the historical, potentially contaminative uses. However, local authorities are being encouraged by the Office of the Deputy Prime Minister to use standard geographical referencing to link this data set to records on contamination.

Commercial information on historic land uses

Information on historical land uses can be used to identify sites across England that may be affected by contamination. Data are available commercially from a number of sources. Information in this section is based on data provided by Landmark Information Group Ltd. As with other data sets, it does not identify actual contamination, just sites and areas where a potentially contaminating land use has taken place. Details of the analysis are provided in Annex 4.

Current use does not necessarily reflect all historic uses, so Landmark has identified the cumulative number and extent of all sites, which have existed from about 1846 to 1996, that may be affected by contamination (**Figures 6.9** and **6.10**). It has also identified the number and extent of sites for the more recent period (1958 to 1996), which allows a comparison of the relatively recent sites with the historical data.

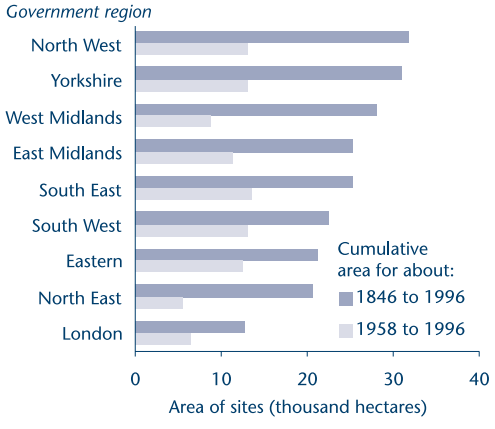
Figure 6.9 Number of potentially contaminated sites for all industrial uses, 1846 to 1996



See Annex 5 for accompanying notes

Source: Landmark Information Group Ltd

Figure 6.10 Area of potentially contaminated sites for all industrial uses, 1846 to 1996



See Annex 5 for accompanying notes

Source: Landmark Information Group Ltd

The current or recent number of sites and area of industrial land use are less than the total since 1846 (**Table 6.1**). This is not surprising, but does suggest that looking at current land uses is an imperfect approach to understanding contamination risk. Railway land is by far the biggest land use, both in terms of area and number of sites. Ceramics and cement manufacturing, garages and filling stations, gas works, sewage works and engineering works are all also major industrial uses of land.

As with all the previous data sources, these data tell us only about land that has been, or is, subject to potentially contaminative uses. Site area may vary over time, and the current extent of a site may be less than its historical extent. The method of analysis has assumed that the maximum area of a site over time indicates the extent of land that could be affected by contamination. The maximum extent of each site has therefore been captured and presented in the relevant figures. The data does not allow for the different levels of risk posed by the different industrial sectors. This and other sources of data demonstrate how difficult it is to obtain consistent, national information on land affected by contamination. However, they do give a broad picture of the potential extent of the problem.

Table 6.1 | Land uses that can cause contamination, 1846 to 1996

Industry profile	Number of sites		Area (hectares)	
	1846 to 1996	1958 to 1996	1846 to 1996	1958 to 1996
Railway land	31,759	10,510	71,148	31,817
Engineering works: shipbuilding, repair and shipbreaking (including naval shipyards), airports and railway engineering works	4,015	1,273	30,104	21,271
Gas works, coke works and other coal carbonisation plants	13,716	424	29,117	5,176
Ceramics, cement and asphalt manufacturing works	17,432	576	28,355	5,834
Sewage works and sewage farms	11,559	6,997	17,197	10,877
Road vehicle fuelling, service and repair: garages and filling stations	9,181	8,393	10,613	9,390
Metal manufacturing, refining and finishing works: iron and steelworks, lead works and non-ferrous metal works	2,512	173	7,266	1,321
Power stations (excluding nuclear power stations)	2,421	2,063	4,390	4,229
Oil refineries and bulk storage of crude oil and petroleum products	1,774	601	3,842	3,443
Chemical works (cosmetics and toiletries, fertiliser, soap and detergent, organic chemicals and mastics, sealants, adhesives and roofing felt manufacturing works)	1,351	124	3,227	886
Timber treatment works	3,146	743	2,419	744
Engineering works: mechanical engineering and ordnance works and vehicle manufacturing works	1,351	206	2,013	370
Textile works and dye works	3,858	55	1,896	62
Food and drink (no industry profile)	2,167	399	1,677	692
Waste recycling, treatment and disposal sites: landfills and other waste treatment or waste disposal sites	612	413	1,433	1,230
Animal and animal products processing works	1,500	266	612	133
Pulp and paper manufacturing works	426	48	510	171
Engineering works: electrical and electronic equipment manufacturing works (including works manufacturing equipment containing PCBs)	198	17	502	32
Chemical works: explosives, propellants and pyrotechnics manufacturing works	835	78	432	84
Glass manufacturing works	157	2	360	39
Printing and book-binding works	234	8	235	12
Chemical works: linoleum, vinyl and bitumen-based floor covering manufacturing works	115	14	225	51
Chemical works: rubber processing works (including works manufacturing tyres or other rubber products)	82	4	159	15
Chemical works: coatings (paints and printing inks) manufacturing works and mastics, sealants, adhesives and roofing felt manufacturing works	146	1	142	4
Asbestos manufacturing works	70	4	110	22
Dry cleaners	725	17	80	2
Waste recycling, treatment and disposal sites: metal recycling sites	56	42	50	39

See Annex 5 for accompanying notes

Source: Landmark Information Group Ltd

7

The way forward

- The next report on contaminated land will be published in 2007.
- Over the next five years more contaminated land sites will be identified and remediated.
- We will have developed indicators to assess the extent of land affected by contamination.
- We will explore ways of collating national data with others.

As the Part IIA regime develops, local authorities and the Agency will get more and more involved in identifying sites, and securing real environmental benefits by remediating those sites. The time scales for remediating a site can be long, often between one and three years. The Agency is therefore currently proposing to publish the next report on contaminated land for England in 2007, with interim reports as new and improved information becomes available.

There are large gaps in our knowledge about the nature and extent of land affected by contamination. We can estimate how much land might be affected, but the uncertainty around these estimates is large. There are little nationally consistent data on actual contamination of land, beyond that which Part IIA is beginning to provide.

In December 2000, the Agency, DEFRA and the Welsh Assembly Government jointly led a project to identify and develop a set of national indicators to measure progress in dealing with land affected by contamination (Scott Wilson Kirkpatrick & Co Ltd, 2001). The first phase of the project has identified possible national sources of data. The next phase, starting in 2002, will use what has been learned and develop meaningful indicators that will allow us to measure progress.

Undertaking research to develop possible indicators will not, in itself, deliver better information. The population of these indicators may require some national mechanism to harmonise the way data is collected and analysed. For example, there is the potential to make better use of data collected under the planning regime, but this would require agreement from local authorities to record data in a consistent manner and to report summary data to Government. The Agency will explore, with DEFRA, the Welsh Assembly Government and local authorities, the possibility of improving the way data are collected and reported, to ensure better management information is available to inform national decision making.

Annex 1:

Local authority liaison groups for contaminated land

Bristol and Somerset
Cambridgeshire
Cheshire
Cornwall
Cumbria
Derbyshire
Devon
Dorset
East London
Essex
Gloucestershire
Hampshire
Hereford and Worcester
Hertfordshire and Bedfordshire
Kent
Lancashire
Leicestershire
Lincolnshire
Greater Manchester
Merseyside
Norfolk
North East England
Northamptonshire
Nottinghamshire
Shropshire
South London
Staffordshire
Suffolk
Surrey
Sussex
Thames
Warwickshire
West London
West Midlands
Wiltshire
Yorkshire and Humberside

Annex 2:

Environment Agency research outputs on land affected by contamination

Topic	Project	Reference	Published
Management of land contamination	Model procedures for the management of contaminated land	CLR 11	In prep
Part IIA specific	Local authority guide to the application of Part IIA of the Environmental Protection Act 1990	Issue 01 rev 0	2001
	Land contamination: technical guidance on special sites: Ministry of Defence land Chemical weapons Explosives manufacturing Acid tar lagoons Petroleum refineries Nuclear establishments Prescribed processes designated for central control	 P5-042/TR/01 P5-042/TR/02 P5-042/TR/03 P5-042/TR/04 P5-042/TR/05 P5-042/TR/06 P5-042/TR/07	2001
	A review of current MTBE usage and occurrence in groundwater in England and Wales	P97	2000
	Environment Agency guidance to third parties on pollution of controlled waters for Part IIA of the EPA (1990)	Version 2	2002
Site investigation	Guide to good practice for the development of conceptual models and the selection and application of mathematical models of contaminant transport processes in the subsurface	NC/99/38/2	2001
	Technical aspects of site investigation Volume I (of II): overview	P5-065/TR	2000
	Technical aspects of site investigation Volume II (of II): text supplements	P5-065/TR	2000
	Assessing risks to ecosystems from land contamination	P299	2002
	Review of ecotoxicological and biological test methods for the assessment of contaminated land	P300	2002
	Secondary model procedure for the development of appropriate soil sampling strategies for land contamination	P5-066/TR	2000
	Remediation of toxic metal pollution in soil using bone meal	P234	2000
	Guidance for the safe development of housing on land affected by contamination	P66	2000
Risk assessment	Assessment of the risks to human health from land contamination: an overview of the development of soil guideline values and related research	CLR 7	2002

Topic	Project	Reference	Published
	Potential contaminants for the assessment of land	CLR 8	2002
	Contaminants in soils: collation of toxicological data and intake values for humans. Consolidated main report	CLR 9	2002
	Contaminants in soils: collation of toxicological data and intake values for humans for first ten substances	CLR 9 TOX 1-10	2002
	The Contaminated Land Exposure Assessment Model (CLEA): technical basis and algorithms	CLR 10	2002
	Soil guideline values (SGVs) for first ten substances contamination in soils	CLR 10 SGV 1-10	2002
	Contaminated Land Exposure Assessment computer model: generic soil guideline programme	CLEA2002 software, version 1	2002
	Vapour transfer of soil contaminants	P5-018/TR	2002
	Risk assessment fact sheets		In prep
	Guidance on site specific risk assessment for land contamination	P5-041	In prep
	Sensitivity analysis of the Contaminated Land Exposure Assessment model	P5-045	In prep
	Bioavailability of soil arsenic	P5-062	Available 2002
	Collation of toxicological data and development of guideline values for explosive substances	P5-036	2001
	Benchmarking and guidance on the comparison of selected groundwater risk assessment models	NC/00/14	2001
	Guidance on the assessment and interrogation of the subsurface analytical contaminant fate and transport models	NC/99/38/1	2001
	Technical guidance on assigning values to uncertain parameters in environmental risk assessments	NC/99/38/3	2000
	Assessment and management of risks to buildings, building materials and services from land contamination	P5-035/TR/01	2001
	Land contamination risk assessment tools: an evaluation of some commonly used methods	P260	2000
	Methodology for derivation of remedial targets for soil and groundwater to protect water resources	R&D P20	1999
	ConSim: Contamination impacts on groundwater: Simulation by Monte-Carlo method	NC/99/	1999
	Biological stress indicators of contaminated land; Ecological assessment of contaminated land using earthworm biomarkers	P311	1999
	Understanding public perception of risk: Report of an Agency Workshop	P5-040/TR/1	2002
	Communicating understanding of contaminated land risks: A handbook.	P142	1999
Remediation	Source treatment for dense non-aqueous phase liquids	P5-051/TR/01	2002
	Verification of remediation treatments	NC/00/38	Available 2002
	Guidance on the design, construction, operation and monitoring of permeable reactive barriers	NC/01/51	Available 2002
	Ecological and operational parameters for bioremediation	P2-172/TR	2002
	Guidance for the risk-based design and use of cover layers	P5D(01)06	Available 2002
	Guidance on the assessment and monitoring of natural attenuation of contaminants in groundwater	P95	2000

Topic	Project	Reference	Published
	Project SIREN: Phase 1 Report	P358	2000
	Project SIREN: Phase 2a – Benchmarking of monitored natural attenuation procedures	P2-208/TR/1	2001
	Project SIREN: Phase 2a – Conceptual site model and groundwater model.	P2-208/TR/2	2001
	Natural attenuation in the unsaturated zone	P5D(00)01	In prep
	Remedial treatment action data sheets	NC/00/04/01	2001
	Piling and penetrative ground improvement methods on land affected by contamination: guidance on pollution prevention	NC/99/73	2001
	Assessing the wider environmental value of remediating land contamination: a review	P238	2000
	Survey of remedial techniques for land contamination in England and Wales	P401	2000
	Costs and benefits associated with the remediation of contaminated groundwater: A review of issues	P278	1999
	Costs and benefits associated with the remediation of contaminated groundwater: a framework for assessment	P279	1999
	Cost-benefit analysis for remediation of land contamination	P316	1999

R&D technical reports are available from the Environment Agency R&D Dissemination Centre, managed by WRc plc. Tel. 01793 865000.

Annex 3:

Production of local authority inspection strategies, July 2002

Local authority	Consultation draft only published	Final strategy published
Adur		✓
Allerdale		✓
Alnwick		✓
Amber Valley		✓
Arun		✓
Ashfield		✓
Ashford		✓
Aylesbury Vale		✓
Babergh		✓
Barking and Dagenham		✓
Barnet		✓
Barnsley		✓
Barrow-in-Furness		✓
Basildon		✓
Basingstoke and Deane		✓
Bassetlaw		✓
Bath and North East Somerset		✓
Bedford		✓
Berwick-upon-Tweed		✓
Bexley		✓
Birmingham		✓
Blaby		✓
Blackburn with Darwen		✓
Blackpool		✓
Blyth Valley		✓
Bolsover		✓
Bolton		✓
Boston		✓
Bournemouth		✓

Local authority	Consultation draft only published	Final strategy published
Bracknell Forest		✓
Bradford		✓
Braintree		✓
Breckland		✓
Brent		✓
Brentwood		✓
Bridgnorth		✓
Brighton and Hove		✓
Bristol		✓
Broadland		✓
Bromley		✓
Bromsgrove		✓
Broxbourne		✓
Broxtowe		✓
Burnley	✓	
Bury		✓
Calderdale		✓
Cambridge		✓
Camden		✓
Cannock Chase		✓
Canterbury		✓
Caradon		✓
Carlisle		✓
Carrick		✓
Castle Morpeth		✓
Castle Point		✓
Charnwood		✓
Chelmsford		✓
Cheltenham		✓

Local authority	Consultation draft only published	Final strategy published
Cherwell		✓
Chester		✓
Chester le Street	✓	
Chesterfield		✓
Chichester		✓
Chiltern		✓
Chorley		✓
Christchurch		✓
City of London		✓
Colchester		✓
Congleton		✓
Copeland		✓
Corby		✓
Cotswold		✓
Coventry		✓
Craven		✓
Crawley		✓
Crewe and Nantwich		✓
Croydon		✓
Dacorum		✓
Darlington		✓
Dartford		✓
Daventry		✓
Derby		✓
Derbyshire Dales		✓
Derwentside		✓
Doncaster		✓
Dover		✓
Dudley		✓
Durham	✓	
Ealing		✓
Easington		✓
East Cambridgeshire		✓
East Devon		✓
East Dorset		✓
East Hampshire		✓
East Hertfordshire		✓
East Lindsey		✓
East Northants		✓
East Riding of Yorkshire		✓
East Staffordshire		✓
Eastbourne		✓
Eastleigh	✓	

Local authority	Consultation draft only published	Final strategy published
Eden		✓
Ellesmere Port and Neston		✓
Elmbridge		✓
Enfield		✓
Epping Forest		✓
Epsom and Ewell		✓
Erewash		✓
Exeter		✓
Fareham		✓
Fenland	✓	
Forest Heath		✓
Forest of Dean		✓
Fylde		✓
Gateshead		✓
Gedling		✓
Gloucester		✓
Gosport	✓	
Gravesham		✓
Great Yarmouth		✓
Greenwich	✓	
Guildford		✓
Hackney		✓
Halton		✓
Hambleton		✓
Hammersmith and Fulham		✓
Harborough		✓
Haringey		✓
Harlow		✓
Harrogate		✓
Harrow		✓
Hart		✓
Hartlepool		✓
Hastings		✓
Havant	✓	
Havering		✓
Herefordshire		✓
Hertsmere		✓
High Peak		✓
Hillingdon		✓
Hinckley and Bosworth		✓
Horsham		✓
Hounslow		✓
Huntingdonshire		✓

Local authority	Consultation draft only published	Final strategy published
Hyndburn		✓
Ipswich		✓
Isle of Wight		✓
Islington		✓
Kennet		✓
Kensington and Chelsea		✓
Kerrier		✓
Kettering		✓
Kings Lynn and West Norfolk		✓
Kingston upon Thames		✓
Kingston-upon-Hull		✓
Kirklees		✓
Knowsley		✓
Lambeth		✓
Lancaster	✓	
Leeds		✓
Leicester		✓
Lewes		✓
Lewisham		✓
Lichfield		✓
Lincoln		✓
Liverpool	✓	
Luton		✓
Macclesfield		✓
Maidstone		✓
Maldon		✓
Malvern Hills		✓
Manchester		✓
Mansfield		✓
Medway	✓	
Melton		✓
Mendip		✓
Merton		✓
Mid Bedfordshire		✓
Mid Devon		✓
Mid Suffolk		✓
Mid Sussex		✓
Middlesbrough		✓
Milton Keynes		✓
Mole Valley		✓
New Forest	✓	
Newark and Sherwood		✓
Newcastle-under-Lyme		✓
Newcastle-upon-Tyne		✓
Newham		✓
North Cornwall		✓
North Devon		✓
North Dorset		✓
North East Derbyshire		✓
North East Lincolnshire		✓
North Hertfordshire		✓
North Kesteven		✓
North Lincolnshire		✓
North Norfolk		✓
North Shropshire		✓
North Somerset		✓
North Tyneside		✓
North Warwickshire		✓
North West Leicestershire		✓
North Wiltshire		✓
Northampton		✓
Norwich		✓
Nottingham		✓
Nuneaton and Bedworth		✓
Oadby and Wigston		✓
Oldham		✓
Oswestry		✓
Oxford		✓
Pendle		✓
Penwith		✓
Peterborough		✓
Plymouth		✓
Poole		✓
Portsmouth		✓
Preston		✓
Purbeck		✓
Reading	✓	
Redbridge		✓
Redcar and Cleveland		✓
Redditch		✓
Reigate and Banstead	✓	
Restormel	✓	
Ribble Valley		✓
Richmond		✓
Richmondshire		✓
Rochdale		✓

Local authority	Consultation draft only published	Final strategy published
Rochford		✓
Rossendale		✓
Rother		✓
Rotherham		✓
Rugby		✓
Runnymede		✓
Rushcliffe		✓
Rushmoor		✓
Rutland		✓
Ryedale		✓
Salford		✓
Salisbury		✓
Sandwell		✓
Scarborough	✓	
Sedgefield	✓	
Sedgemoor		✓
Sefton		✓
Selby		✓
Sevenoaks		✓
Sheffield		✓
Shepway		✓
Shrewsbury and Atcham		✓
Slough		✓
Solihull		✓
South Bedfordshire		✓
South Buckinghamshire		✓
South Cambridgeshire		✓
South Derbyshire		✓
South Gloucestershire		✓
South Hams		✓
South Holland		✓
South Kesteven		✓
South Lakeland		✓
South Norfolk		✓
South Northamptonshire		✓
South Oxfordshire	✓	
South Ribble		✓
South Shropshire		✓
South Somerset		✓
South Staffordshire		✓
South Tyneside		✓
Southampton		✓
Southend		✓

Local authority	Consultation draft only published	Final strategy published
Southwark		✓
Spelthorne		✓
St Albans		✓
St Edmundsbury		✓
St Helens		✓
Stafford		✓
Staffordshire Moorlands		✓
Stevenage		✓
Stockport		✓
Stockton-on-Tees		✓
Stoke-on-Trent		✓
Stratford-on-Avon		✓
Stroud		✓
Suffolk Coastal		✓
Sunderland		✓
Surrey Heath		✓
Sutton		✓
Swale		✓
Swindon		✓
Tameside		✓
Tamworth		✓
Tandridge		✓
Taunton Deane		✓
Teesdale	✓	
Teignbridge		✓
Telford and Wrekin		✓
Tendring		✓
Test Valley		✓
Tewkesbury		✓
Thanet		✓
Three Rivers		✓
Thurrock		✓
Tonbridge and Malling		✓
Torbay		✓
Torridge		✓
Tower Hamlets		✓
Trafford		✓
Tunbridge Wells		✓
Tynedale		✓
Uttlesford		✓
Vale of White Horse		✓
Vale Royal		✓
Wakefield	✓	

Local authority	Consultation draft only published	Final strategy published
Walsall		✓
Waltham Forest		✓
Wandsworth		✓
Wansbeck		✓
Warrington		✓
Warwick		✓
Watford		✓
Waveney		✓
Waverley		✓
Wealden		✓
Wear Valley		✓
Wellingborough		✓
Welwyn Hatfield		✓
West Berkshire		✓
West Devon		✓
West Dorset		✓
West Lancashire		✓
West Lindsey		✓
West Oxfordshire		✓
West Somerset		✓
West Wiltshire		✓
Westminster City		✓
Weymouth and Portland		✓
Wigan		✓
Winchester		✓
Windsor and Maidenhead		✓
Wirral		✓
Woking		✓
Wokingham		✓
Wolverhampton		✓
Worcester		✓
Worthing		✓
Wychavon		✓
Wycombe		✓
Wyre		✓
Wyre Forest		✓
York		✓

Annex 4:

Analysis of historic land uses

The data presented in **Figures 6.9** and **6.10** and **Table 6.1** have been provided by Landmark Information Group Limited. The data have been derived from a systematic analysis of a historical map database created under a joint venture between Landmark and the Ordnance Survey. This historical map database consists of more than 700,000 individual maps dating from around 1850 to the present day, comprising all available pre and post-war Ordnance Survey mapping at 1:500, 1:2,500 and 1:10,000 scale. This systematic analysis has created a database of historical land use and potentially contaminative industries. More than 60,000 map sheets over six epochs (see Annex 5) taken from the historical map database were analysed.

The land-use categories used in the analysis were linked to the DoE's Industry Profiles (DoE, 1995). Characteristic features of the data and details of the method of analysis are recorded in the notes to the figures in Annex 5.

Annex 5:

Notes to accompany figures in Section 6

Figures 6.3, 6.4 and 6.5

- Inert landfill sites include those that receive non-biodegradable wastes (excluding construction) and those that receive other wastes (construction, demolition and dredgings).
- Other landfill sites include co-disposal sites and those receiving special waste, household, commercial and industrial waste.
- Transfer stations and incinerators include special waste transfer stations, in-house storage facilities, household, commercial and industrial waste transfer stations, clinical waste transfer stations, household waste amenity sites, transfer stations taking non-biodegradable wastes and incinerators.
- Treatment facilities include physical, chemical, physico-chemical and biological treatment facilities, metal recycling sites (including vehicle dismantlers), mixed metal recycling sites, material recycling treatment facilities and composting facilities.

Figures 6.7 and 6.8

- Previously developed vacant and derelict land comprises vacant buildings (excluding single dwellings except where they could be developed into 10 or more dwellings) and land or buildings currently in use, which are allocated in the local plan for any developed use, have planning permission for housing or with known potential for redevelopment.
- Figures are grossed, taking into account non-responding local authorities (95 per cent response). Adjustments have also been made when a local authority has not been able to provide complete coverage for a particular category of land.
- Previous use is unknown for some sites that have been recorded as previously developed vacant and derelict land and buildings.
- Land type definitions are in Annex C of the information bulletin *National Land Use Database: Final Estimates of Previously Developed Land in England 1998* (DETR, 2000c).

Table 6.1 and Figures 6.9 and 6.10

- The dates for the individual epochs used in the analysis are as follows:
  Epoch 1 – 1846 to 1899,
  Epoch 2 – 1888 to 1914,
  Epoch 3 – 1903 to 1944,
  Epoch 4 – 1922 to 1955,
  Epoch 5 – 1948 to 1977,
  Epoch 6 – 1958 to 1996.
- The analysis has created three different kinds of feature: point features, linear features and area features.
- The Ordnance Survey maps available do not represent complete coverage of all time periods as not all areas would have been resurveyed in each epoch. The allocation to industry profile is based on text on the Ordnance Survey maps.
- Where a feature appears in more than one epoch, it has been counted only once in the cumulative number data.
- The largest extent of sites over time has been recorded in the cumulative area data. Where a persistent feature appears in more than one epoch, only its largest extent has been included in the cumulative site area data.

- Features covering a definable area have been digitised as polygons around the boundary of the site. Those features covering an area of less than 100m x 100m on the ground have been digitised as points. Points have been allocated a nominal area of 50m^2. Area of linear features has been calculated as 20m x the length of the feature.
- Railways of up to four tracks or 30m wide have been digitised as linear features. Any feature larger than this has been digitised as an area.
- There may be a small element of double counting of regional data if sites cross regional boundaries, as they will be counted in both regions when the data is aggregated.

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