Environment Agency

GPLC2 – FAQs, technical information, detailed advice and references

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GPLC2 – FAQs, technical information, detailed advice and references

This document provides answers to a series of questions and includes numerous references to other published guidance. The answers are fairly technical but the topics they cover are issues for many land contamination projects.

These are also subjects where there is often uncertainty about how to proceed or where we don't always agree with the approaches taken. Having these reminders and advice 'up front' means you can satisfy yourself that you are doing things right and referring to the appropriate guidance.

The questions answered are listed on the following pages:

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Introduction

1. What is the Environment Agency's role in land contamination?

We have many roles and responsibilities which can, in some circumstances, be relevant to land contamination, for example environmental permitting, flood defence and conservation. *Local authorities take the lead on a lot of land contamination work*, but we have a number of important, complementary roles. Some key areas of work are explained below.

We have officers working in local area, regional and national roles. Not all are involved with every one of these tasks.

Preventing contamination
We work with businesses, industry and homeowners to help them understand when and how to take measures to prevent contamination and pollution. We raise awareness, give advice and guidance and ensure that the environmental permits we issue protect the environment and are appropriately enforced.

Dealing with incidents
Where incidents occur we give advice and sometimes take action to minimise the impact, particularly where the water environment is at risk. If an incident occurs on a site we regulate, we require the site to be thoroughly assessed and cleaned up, usually to the condition it was in before the incident occurred. With the other competent authorities for the Environmental Damage Regulations, we also ensure that serious environmental damage is prevented or, failing that, fully remediated.

Encouraging voluntary remediation
We try to influence major land owners to prioritise and manage the contaminated sites they own. We also provide generic and sometimes site-specific advice, particularly on water issues, when voluntary remediation is being proposed or undertaken.

Planning
We have a variety of significant roles in the planning process, but for land contamination the key one is to advise local authorities on the risks to, and protection of, the water environment. Sometimes we may agree to liaise directly with developers or their consultants to speed things up, but the final decision always rests with the local planning authority.

Regulation – Part 2A of the Environmental Protection Act 1990
Our main role under Part 2A is to take the lead on the regulation of designated special sites. Under this Act we have a duty to ensure these sites are dealt with. In some circumstances we also advise local authority officers on water issues on potential and determined (non-special) contaminated land.

Regulation – Water Resources Act 1991
In some cases where land contamination threatens or is affecting the water environment, we can use our powers under this Act to prosecute or take other enforcement action. We can use Anti-Pollution Works Notices to prevent pollution or require the remediation of land and/or groundwater affected by contamination.

Regulation – Environmental permits and waste management legislation
Permits issued by us are sometimes required when land affected by contamination is remediated. In particular, we are the authority responsible for enforcing waste management legislation. We encourage sustainable practices that prevent harm or pollution. We can set and enforce conditions requiring this, and can take action where the necessary permits are not obtained.

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Research and developing science
From time to time we publish research, technical guidance or tools that may be of interest to those working in this area, and which they may choose to use. These can cover a wide range of topics relevant to contaminated land, and many are listed in the ***Model Procedures*** and on our ***land contamination guidance web pages***.

Advising and working with government
We advise, support and work with English and Welsh government departments and agencies on land contamination matters. This can involve developing and influencing policy and work on new domestic and European legislation.

A brief explanation of the roles and responsibilities of various English government departments and agencies can be found on ***Defra's website***.

2. Where should I go for guidance on topics not covered by the *Guiding Principles*?

The ***Model Procedures for the Management of Land Contamination*** (CLR11) contains an extensive list of guidance covering most stages in the management of land contamination. Our ***land contamination guidance web pages*** also list all these documents and provide links to them where possible.

The *Guiding Principles* do not list all available guidance, and specifically do not cover the assessment of risks to human health or ecosystems where others have responsibility. For guidance on these subjects, in addition to referring to the ***Model Procedures*** we suggest the following:

Human health
For advice on the assessment of health risks from land affected by contamination, you should contact the relevant local authority for the site.

Local authorities take the lead on most land contamination matters, particularly on human health issues. Many authorities have one or more contaminated land officers, often in their environmental health department. On most land contamination projects it is important to involve them from the earliest possible stage.

You can search for the relevant local authority using the web site ***www.direct.gov.uk***

Our ***human health risk assessment guidance*** page contains useful references, as do our ***contaminated land exposure assessment*** (CLEA) pages.

Ecological risk
Natural England and the Countryside Council for Wales are the authorities that lead on the protection of the natural environment. We advise you to contact them where ecological receptors may be at risk from land affected by contamination.

Where ecological receptors are in or could be affected by controlled waters you should also contact us. Local authorities will often have their own biodiversity or nature conservation officers who should also be involved in cases of potential harm to biodiversity in their area.

Our ***ecological risk assessment guidance*** page contains useful references, including an assessment framework.

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3. What legislation governs the management of land contamination?

A variety of European and domestic laws are relevant to the management of land affected by contamination. The legislation in England and Wales is broadly similar, but there are some differences in regulations, policy and guidance between the two countries.

Table 1 on the next page summarises some of the key legislative regimes and how each aims to prevent contamination, trigger its assessment or place controls on how it is managed.

Annex 1 of the ***Defra Circular 01/2006*** also provides a useful summary of the main regimes affecting land contamination and how they interact. The circular applies to England only, but the principles and regimes are broadly similar in Wales.

Note that some of the regimes discussed in this circular have now been replaced or revised. For example, the Environmental Permitting regime replaced Pollution Prevention and Control (PPC) and waste management licensing in 2008.

Further guidance on the licensing of remediation activities and waste issues associated with redevelopment can be found in questions 27–32 of this document.

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Table 1. Summary of some of the key regimes affecting the management of land contamination

Regime	Requirements			Lead bodies & information sources
	Prevent contamination, pollution or harm	Assess risks and impacts	Implement remediation	
Planning and development control Regional and local planning decisions can affect land contamination. Where development is proposed, conditions can be imposed requiring assessments and remediation. Building Regulations also require contamination to be dealt with. Remediation schemes can need planning permission in their own right.	Allows planners to appropriately locate polluting activities and sensitive land uses, and requires measures to prevent pollution.	Contamination is a material planning consideration – conditions can be imposed requiring assessment.	1. Conditions can be set requiring a site to be made suitable for intended use. 2. Remediation scheme itself may need permission.	Lead bodies – regional and local planning authorities See ***Communities and Local Government's PPS23*** or ***WAG's Planning Policy Wales*** web pages and Building Regulations ***Approved Document C***.
Environmental permitting Permits require the prevention of contamination and the clean-up, to a high standard, of any pollution that does occur. Remediation activities also often need to be permitted.	Allows regulators to set permit conditions and enforce them.	Permit conditions can require this where a permitted activity has caused contamination.	1. Permits can require remediation and that a site be returned to a satisfactory state. 2. Remediation activities themselves may need permitting.	Lead bodies – Environment Agency & local authorities See ***Defra's*** or ***WAG's Environmental Permitting*** web pages.

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Table 1. Summary of some of the key regimes affecting the management of land contamination (continued)

Regime	Requirements			Lead bodies & information sources
	Prevent contamination, pollution or harm	Assess risks and impacts	Implement remediation	
Environmental damage These regulations aim to prevent 'environmental damage'. This includes preventing new land contamination that will damage water or health. Where damage does occur, they require comprehensive clean-up.	Imposes a duty on operators to prevent damage.	Operators required to do this where damage is caused.	Requires remediation, often to pre-incident conditions, and in some cases compensation.	Lead bodies – local authorities, Environment Agency, Countryside Council for Wales, Natural England, Marine and Fisheries Agency See ***Defra's*** or ***WAG's environmental liability*** web pages.
Part 2A Local authorities inspect their areas to identify contaminated land causing pollution or significant harm. When found, it must be fully assessed and remediated.	Does not prevent contamination but can prevent pollution or harm. The 'threat' of Part 2A can be a deterrent.	1. Local Authorities are under a duty to inspect areas and prioritise detailed inspections. 2. Notices can require assessment actions.	Requires action to make land suitable for current use using agreed remediation strategy. This can be undertaken voluntarily, required through notices or carried out by regulators and costs reclaimed.	Lead bodies – local authorities (Environment Agency for 'special sites') See ***Defra's*** or ***WAG's contaminated land web pages***.
Anti-pollution works notices Where land contamination is causing, or is likely to cause, pollution, we may decide to serve a notice to prevent it or get it cleaned up.	1. Enables preventative notices to be served. 2. The 'threat' of prosecution or a notice can also be a deterrent.	Assessments required to define remedial requirements can be specified in a notice or undertaken and costs reclaimed.	Remediation actions can be specified in a notice or carried out and costs reclaimed.	Lead bodies – Environment Agency See our ***Netregs guidance page on water pollution legislation***.

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4. What national policies are there?

For England, government policy concerning contaminated land is described in the ***Defra Circular 01/2006***. While the circular focuses on the Part 2A contaminated land legislation, Annex 1 covers land contamination more generally and sets out how the various legislative regimes that prevent or deal with it interact.

Where contamination is being managed as part of redevelopment in England, Communities and Local Government's ***Planning Policy Statement (PPS)*** No. 23 provides important guidance to developers and regulators. ***Annex 2: Development on Land Affected by Contamination*** is particularly relevant.

Planning Policy Wales (2002) includes guidance on 'minimising and managing environmental risks and pollution'. This describes how land contamination should be considered in land use planning in Wales, but a supporting technical advice note (TAN) has not been issued to date. The Welsh Office Circular 22/87 *Development of Contaminated Land* also provides guidance on the planning and other aspects of the development of contaminated land.

Groundwater is often at risk from land affected by contamination, and it can also be a pathway through which contaminants reach other receptors. Our framework for regulating and managing groundwater in England and Wales is set out in a series of documents collectively known as ***Groundwater Protection: Policy and Practice or GP3***. Where the management of land contamination involves groundwater issues, the technical framework, tools and position statements in GP3 will be significant.

5. What general guidance can I refer to?

Model Procedures for the Management of Land Contamination (CLR11) is a key document covering most aspects of the management process. Other general guidance covering multiple stages in the process are described below.

We published ***Building a better environment – a guide for developers*** (available as a ***download*** or ***online version***) in September 2006. This guide should help you understand the key environmental issues that may affect your site. It includes sections on 'managing waste' and 'land affected by contamination'.

Guidance focused on housing development is contained in the document ***Guidance for the Safe Development of Housing on Land Affected by Contamination***. Sometimes referred to as *R&D66*, this guidance (originally published in 2000) was updated in 2008 through a partnership between the National House-Building Council, Chartered Institute of Environmental Health and us.

To support developers in Wales, the Welsh Assembly Government, Welsh Local Government Association and Environment Agency Wales published ***Land Contamination: A Guide for Developers***. This guide promotes the approach detailed in the *Model Procedures* and provides advice and checklists.

1.0 Risk assessment (focusing on risks to water)

To assess risks to water, you must develop and refine a conceptual model. You should also identify appropriate compliance points and set compliance values that adequately protect the receptors. You can then compare contaminant concentrations, either measured or predicted, to these compliance values. The following sections provide information about doing these and other steps in the risk assessment process.

6. Why do I need a conceptual model?

You cannot successfully carry out a risk assessment without a good conceptual model. It describes the sources, pathways and receptors relevant to the site ('pollutant linkages') and helps you identify gaps in information. You continue to develop and refine the conceptual model as new information comes to light.

The conceptual model helps you understand the sensitivity of the site, which will be affected by factors such as:

- the strategic importance of the underlying aquifer, that is, **principal** or **secondary**;
- proximity to critical potable surface water or groundwater supplies (as defined by Source Protection Zones for the latter) or other abstractions;
- groundwater vulnerability (depth of water table, presence of protective cover, rapid fissure flow, etc.) now, and in likely future scenarios;
- the proximity, type and degree of hydraulic continuity between groundwater and surface water;
- whether there are bathing waters nearby;
- recreational uses of the water, including fisheries;
- protected status because of the presence of salmon or shellfish.

To properly protect the water environment it is important you consider:

- contamination present at the surface, in the soil or elsewhere in the unsaturated zone; AND
- pollutants that have already entered or are in contact with the water (including sediments in surface waters).

You can undertake risk assessments using generic criteria and assumptions, or detailed, site-specific information. In either case you should consider the information in questions 7–17 in this document.

7. What contaminants should I look for, and where?

Your desk study and site reconnaissance will help you decide what contaminants you are likely to encounter and where they may be.

Information you gather about the nature and history of the land in question, and the surrounding area, helps you make some judgements about the contaminants likely to be present. Guidance such as the former Department of the Environment's ***Industry Profiles*** can help with this. They describe the processes, activities and types of contaminants associated with a range of industrial land uses. Considered with site records and plans, they can help you to identify areas where contamination is likely, so that you can target them for further investigation.

A summary of the contaminants identified in these profiles is presented in the ***2008 revision of the R&D66 guidance*** (Annex 3 of Volume 2).

In some cases more detailed guidance may be available about an industry sector or the operations at a particular site. For example:

- Our ***Technical Guidance on Special Sites*** series provides information about typical activities at seven specific types of site.

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1.0 Risk assessment (focusing on risks to water) (continued)

- Archived planning application, permit or operational records may describe site activities or layout in detail.

You should remember that not all contamination will be associated with former industrial activities, and may have resulted from naturally elevated levels or diffuse anthropogenic input. In addition, many urban sites may have been landscaped with imported fills (that is, made ground), which may themselves be contaminated.

8. How should I take climate change into account?

It is now widely accepted that our climate is changing and will continue to do so. Such changes could result in new pollutant linkages being formed, as well as cause changes to those you identify in your conceptual model.

Specific research about the effects of climate change on land contamination is limited, but the general principles can be considered qualitatively. For example, you can consider the likely impacts of changing temperature and water balance on the sources, pathways and receptors identified in the conceptual model. Where necessary, complete risk assessments for likely 'what if..?' scenarios, to 'future-proof' your actions.

Risks from contamination that are acceptable now might not be in the future – you need to factor climate change into your risk assessments.

Potential environmental effects of climate change should be considered when a site is developed. This is stated in planning policy and guidance, for example:

- ***Planning Policy Wales 2002***;
- Communities and Local Government's (CLG's) ***Planning Policy Statements 1*** and ***23***;
- CLG's ***The Planning Response to Climate Change: Advice on Better Practice***.

The ***UK Climate Impacts Programme*** (UKCIP) provides climate projections, guidance and tools to support decision making. For example:

- ***UK Climate Projections 2009;***
- ***Climate Adaptation: Risk, Uncertainty and Decision-making*** (Technical Report, UK Climate Impacts Programme, Environment Agency/Defra, May 2003).

9. What risk assessment methods or tools can I use?

There are many methods and tools available, but you should ensure that the ones you choose are appropriate for the UK risk management framework (as described in the *Model Procedures*). Documents that describe approaches or tools for water risk assessments include:

- ***Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination*** (Environment Agency 2006);
- ***Technical Advice to Third Parties on Pollution of Controlled Waters for Part 2A of the Environmental Protection Act 1990*** (Environment Agency 2002);
- ConSim 2 ***Contamination Impact on Groundwater: Simulation by Monte Carlo Method***;
- CLR1 ***A Framework for Assessing the Impact of Contaminated Land on Groundwater and Surface Water*** (Department of the Environment 1994) (***Volumes 1*** and ***2*** available to download).

Tools and models developed in other countries or for other purposes will not always fit the UK framework well and should not be used without appropriate adjustment or refinement.

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1.0 Risk assessment (focusing on risks to water) (continued)

10. How do I decide what information I need?

The type, quality and amount of information you need will depend on factors such as how much you already know, your choice of method or tool and how much certainty you need in the findings. Information might be required to confirm the presence of particular sources, pathways and receptors, or to obtain more information about them.

The quality of a risk assessment depends on the quantity and quality of information supporting it – collecting this is a significant stage in the process. Where this involves site investigations, they should be planned and implemented in accordance with good practice guidance, for example:

- ***Secondary Model Procedures for the Development of Appropriate Soil Sampling Strategies for Land Contamination*** (Environment Agency 2001);
- ***Technical Aspects of Site Investigation in Relation to Land Contamination*** (Environment Agency 2000) (***Volumes 1*** and ***2*** available to download).;
- ***Investigation of Potentially Contaminated Sites***, Code of Practice BS10175 (British Standards Institution 2001; must be purchased).

You should ensure that the sampling strategy you adopt will provide you with representative data of an appropriate type, quantity and quality. You should also be clear about remaining uncertainties.

It is often a good idea to sample and analyse material in a way that will later allow you to characterise and classify any waste you produce.

Where intrusive investigations (for example drilling boreholes) are undertaken you should ensure you do not cause pollution or create new pathways which could allow contaminants to migrate. It is also important to obtain any necessary permits and fulfil any other regulatory requirements (see questions 27–32).

You can find more information about sampling strategies and approaches in the documents referenced in the ***Model Procedures*** and on our ***site characterisation guidance web page***.

11. How do I choose which data to use in my assessment?

In most assessments you will require physical and chemical data for the contaminants present, the soils, underlying rock, and groundwater and surface waters. Ideally this will be based on site data, but you may get values for some parameters from books, the internet or other references, if appropriate for that site.

You must be prepared to justify your choice of parameters. You should also record your decisions for future reference.

When choosing data you should aim to be realistic, bearing in mind the actual scenario being considered. However, where there is a range of possibilities and confidence in which to select is low, a precautionary approach is advisable. In such cases you should select conservative values – those that will be more protective of the environment.

Some methods or tools allow you to input a range of values for certain parameters, in the form of a **probability density function**. This lets you consider a greater range of scenarios and may better reflect the natural variability of the real environment.

Parameters that have the most significant impact on a risk assessment are those that you must have greatest confidence in.

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1.0 Risk assessment (focusing on risks to water) (continued)

In some scenarios the 'key' parameters are obvious, but in other cases you can complete a **sensitivity analysis** to identify which have the greatest impact on the outcome of the assessment. Where a parameter is particularly critical, such as the degradation rate for degradable contaminants, you should be conservative unless you have robust site data that support a different approach.

12. What should I ask the laboratory to do when I send them samples?

This will be based largely on what your desk study, site investigations and developing conceptual model tell you and what risk assessment tools or methods you are using. You may need advice from an analytical chemist. As well as selecting an appropriate analytical suite, in some cases you may have specific requirements for speciation, availability testing, limits of detection or the use of particular preparatory or analytical methods.

You would normally expect the laboratory to be accredited with ***The United Kingdom Accreditation Service (UKAS)***. Where investigation includes the chemical testing of soils, we also strongly recommend that you use laboratories accredited through our Monitoring Certification Scheme (MCERTS) for the tests being undertaken. The use of MCERTS-accredited methods is an absolute requirement if you are submitting results to us for regulatory purposes.

Information on MCERTS for soil testing is available ***on our web site***.

You need to understand how much of a substance has been or is likely to be released from the land, in order to understand the risk it poses to the water environment.

There are a number of ways of doing this, outlined in our ***Remedial Targets Methodology*** guidance and repeated here:

1. Analysis of pore water or perched water quality – that is, a direct measurement of what the water contains.
2. Results of leaching tests on the contaminated soil. The ***Remedial Targets Methodology*** document recommends that, where appropriate, the test should be undertaken according to the ***BS EN 12457*** series of four methods (mainly for inorganic contaminants). It also states that '**these replace the Environment Agency (NRA) R&D Note 301 leaching test methodology, 1994 (NRA, 1994a)**'.
3. Theoretical calculation of the 'pore water' concentration that would be expected from contact with the soil or a discrete contaminant phase. This is particularly appropriate for organic contaminants, for which a standard leach test is not currently available.

Concerning leaching tests, more recent guidance is contained in BS ISO 18772 ***Guidance on leaching procedures for subsequent chemical and ecotoxicological testing of soils and soil materials*** (2008). It specifically includes information on:

- assessing leaching behaviour;
- the choice of leaching tests, including consideration of organic substances;
- the interpretation of test results.

Any new or revised guidance we issue in the future is likely to refer to this 2008 standard. We advise you to

1.0 Risk assessment (focusing on risks to water) (continued)

review it and work towards adopting the approaches it recommends. We believe the appropriate use of this standard will lead to improved conceptual understanding of the leaching process and reduce uncertainty in risk assessments for the protection of controlled waters.

For more information please refer to the British Standard documents and our guidance ***Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination***. Our new guidance on ***Petroleum Hydrocarbons in Groundwater: Supplementary Guidance for Hydrogeological Risk Assessment*** is due out in 2010.

13. When should I notify the Environment Agency of contamination or pollution?

If the law requires you to notify us, for example under the Environmental Damage Regulations, you always should. Similarly, at sites that we permit, you should comply with any relevant conditions concerning notification and reporting.

In other cases, you should notify us promptly if you believe there is an imminent risk of pollution of the environment, if it is happening now or if it has already occurred. You may discover this through investigations and monitoring or it could happen as a result of an incident or accident. Even in non-urgent cases it may still be appropriate for you to notify us.

You should bear in mind that in most cases local authorities take the lead on land contamination matters. They are likely to be your main point of contact – see questions 1 and 2.

Report incidents or cases of pollution on our Incident Hotline: 0800 80 70 60.

Lines are open 24 hours and it is free to call from a landline. The types of incidents we deal with are ***summarised on our web site***.

For general enquiries speak to your local officer or inspector, but if you don't have a contact you can use:

- **Telephone:** 08708 506 506
  (Monday–Friday, 8am–6pm)
  Weekday Daytime calls cost 8p plus up to 6p per minute from BT Weekend Unlimited. Mobile and other providers' charges may vary.
- **Email:** enquiries@environment-agency.gov.uk
- **Post**: Environment Agency
  National Customer Contact Centre
  PO Box 544
  Rotherham
  S60 1BY

Please do not use email or post to report an incident.

We will normally acknowledge receipt of your notification as a minimum, but we will not always review submissions (for example investigation reports) or provide site-specific input or advice.

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1.0 Risk assessment (focusing on risks to water) (continued)

Compliance values or target concentrations are based on consideration of the natural background concentrations, the current and potential use of the water resource and the 'environmental standard' that applies to the receptor at risk.

14. How do I decide what my compliance values should be?

Compliance values are referred to as target concentrations in some risk assessments. A logical approach to deriving an appropriate target concentration is suggested in figure 4.1 of our document ***Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination***.

A list of environmental standards can be found on page 27 of the *Remedial Targets Methodology* document. In some cases there are overriding legislative demands, such as:

- For hazardous substances, the requirement is that there is no discernible entry of the substance into groundwater.
- The Water Framework Directive also sets objectives for no deterioration in the status of groundwater bodies and no sustained and upward trends in pollutant concentrations.

15. What compliance point should I use?

The choice of compliance point depends firstly on the level or tier of risk assessment being undertaken. At its most precautionary, the compliance point would normally be groundwater immediately below or down hydraulic gradient from the site. Where the assessment is supported by more data and takes account of the effects of dilution and attenuation, there may be an option to locate the compliance point further 'downstream' in the groundwater flow, either at the receptor itself or at some point between the receptor and the contaminant source.

A number of specific constraints also apply:

- Where the contaminant source contains hazardous substances and they have not yet reached groundwater, the compliance point would normally be immediately above the water table beneath the site.
- Where the contaminant source falls within a Source Protection Zone (SPZ) I or II, the compliance point would normally be groundwater at the site boundary.

Guidance on setting compliance points is presented in our document ***Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination***. Further guidance will be provided in our document ***Supplementary guidance on compliance criteria and setting of compliance points***, due out in 2010.

Wherever possible the compliance point should be located where you can obtain samples of water and hence verify the effectiveness of remedial action or prediction of the fate of contaminants.

1.0 Risk assessment (focusing on risks to water) (continued)

16. How do I do risk assessments for hydrocarbons?

Total petroleum hydrocarbon (TPH) measurements provide very general information on the extent and degree of contamination, but by themselves are of limited use in controlled waters risk assessment.

TPH includes a wide range of compounds, but the risk to controlled waters is likely to be driven by the presence of specific compounds. These 'risk drivers' can be identified as follows:

- They will be the more toxic, soluble and mobile components within a mixture (generally the lower molecular weight aromatic compounds).
- They will also form a reasonable proportion of the mixture (that is, they will be representative).

On this basis, the more common risk drivers are often benzene, toluene, ethylbenzene, and xylenes (BTEX) and naphthalene, but this will depend on the hydrocarbon source. Other polycyclic aromatic hydrocarbons (PAHs) and semi-volatile organic compounds (SVOCs) can also be common drivers.

You could also consider grouping compounds with similar properties and numbers of carbon atoms ('carbon bands') and assessing them, or use a mixed approach considering a combination of carbon bands and key indicator species. Further guidance will be provided in our document ***Petroleum Hydrocarbons in Groundwater: Supplementary Guidance for Hydrogeological Risk Assessment***, due out in 2010.

17. What do I do once I've completed the assessment at this tier?

The UK risk management framework is built around a tiered or stepped approach to risk assessment, so you must approach controlled waters assessments in this way.

If a risk assessment shows there is an unacceptable risk at a particular tier, you have the following choices:

- review or revise the current assessment using justifiable site-specific data;
- undertake an assessment at the next tier of complexity;
- decide to remediate the site and so commence options appraisal.

If a risk assessment shows there is an unacceptable risk, you can not decide to 'do nothing'.

2.0 Options appraisal

During this stage you look at the options available and decide on your remediation strategy. As with every stage in the process, you should document your options appraisal in a transparent and auditable way.

18. How do I set remediation targets?

In some cases remedial targets will have been established during the risk assessment process, as some of the tools used can support both functions. You can use our publication ***Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination*** like this.

> If remedial targets have not been established then this must be done BEFORE appropriate remedial options can be considered.

If you are setting targets you should refer back to the guidance on methods and tools, compliance points and compliance values in the previous section (questions 9, 14 and 15).

A precautionary approach is to aim for natural, uncontaminated, background quality. There can then be no significant deterioration in water quality at the receptor beyond that attributable to natural background variation.

Where this is not feasible, as is often the case, alternative approaches must be considered. These might vary depending on what the most significant receptor is.

For groundwater the main objectives in deriving remedial targets are described in the *Remedial Targets Methodology* document as:

1. Where groundwater contamination has not yet occurred:
   - no discernible entry of hazardous substances into groundwater;
   - no new risk of pollution of groundwater by non-hazardous pollutants;
   - no pollution or damage of dependent surface water bodies or groundwater dependent terrestrial ecosystems.
2. Where groundwater contamination already exists:
   - the further entry of hazardous substances to groundwater should be minimised;
   - minimise expansion of the groundwater contaminant plume to prevent further pollution (protect groundwater uses, avoid damage to dependent surface water bodies or groundwater-dependent terrestrial ecosystems etc., and when applicable meet Water Framework Directive objectives noted below);
   - the effects of the contamination should be reduced or removed.
3. When the Water Framework Directive is fully implemented:
   - no deterioration in status of the groundwater body;
   - no input of pollutants to groundwater that could cause an environmentally significant and sustained upward trend in groundwater quality, subject to any applicable exemptions.

2.0 Options appraisal (continued)

You can find more information about groundwater legislation including the Water Framework and Groundwater Directives in our ***GP3 document, Part 4 chapter B Legislative overview***.

For **surface water**, when considering inputs from groundwater plumes or direct discharges (which may need to be consented – see question 27) from land affected by contamination, the aim should be:

1. Where the current water quality is better than the relevant water quality standard, a concentration better than or equal to the 'upstream' quality at the point of entry to the river (that is, before dilution).
2. Where the relevant water quality standard is already exceeded in the water body, a concentration not exceeding that standard at the point of entry to the river (that is, before dilution).
3. Compliance with the requirements of the Water Framework Directive:
   - no deterioration in status of the water body;
   - compliance with the objectives for chemicals designated as priority substances, priority hazardous substances and specific pollutants, for which quality standards have been set at a European level.

Further information on ***priority substances (and priority hazardous substances)*** and ***environmental quality standards*** under the Water Framework Directive can be found on the corresponding pages on our web site.

There may be rare situations where dilution in the river has to be accounted for. In such cases your discharge should not result in a discernible deterioration in the water quality, or you risk causing pollution.

For more information about the Water Framework Directive and implementation in England and Wales, please see ***Defra's, WAG's*** and ***our web pages.***

19. How do legislative requirements affect my decision?

A key factor in determining your remediation strategy will be the requirements of the legislation that you are working under. For example, in England ***Planning Policy Statement (PPS) 23*** states that for the planning regime the standard of remediation:

'...is the removal of unacceptable risk and making the site suitable for its new use, including the removal of existing pollutant linkages. All receptors relevant to the site should be protected to an appropriate standard. As a minimum, after carrying out the development and commencement of its use, the land should not be capable of being determined as contaminated land under Part 2A of the EPA 1990.'

Under Part 2A the standard of remediation for a pollutant linkage is that which, using the best practicable techniques:

a) ensures that the linkage is no longer a significant pollutant linkage;

b) remedies the effect of any significant harm or pollution of controlled waters from the significant pollutant linkage.

GPLC2 – FAQs, technical information, detailed advice and references

2.0 Options appraisal (continued)

Where work is voluntarily undertaken this equally applies, as a goal should be to prevent legislation such as Part 2A from applying in the future.

20. How do I identify remediation options?

The *Model Procedures* provide guidance on how to identify and select options to meet your remedial objectives and targets, and provide references to other useful documents including:

- our ***Remedial Treatment Data Sheets***;
- ***Selection of remedial treatments for contaminated land. A guide to good practice*** (CIRIA C622, 2004; must be purchased);
- ***Remedial Treatment of Contaminated Land*** (CIRIA Volumes I–XII; must be purchased);
- ***Technical Options for Managing Contaminated Land*** (Safegrounds/CIRIA W18, 2004).

In many cases contamination problems will involve consideration of current pollution and the possibility of future discharges. For this reason it will often be necessary to look for remedial options that deal with both, or consider several options to achieve the remediation objectives.

21. What is sustainable remediation?

Sustainable remediation is part of the wider concept of sustainable development. This is a **core principle in contaminated land policy and planning legislation** and can be considered to be:

'development which meets the needs of the present without compromising the ability of future generations to meet their own needs'.

A sustainable approach has to balance social, environmental and financial aspects, taking into account sound, scientific evidence and good governance.

Guidance on how to assess sustainability in remediation is limited, but this is a developing area. The ***SuRF UK*** (Sustainable Remediation Forum) initiative has been established to improve understanding in this area, and they have developed ***A framework for assessing the sustainability of soil and groundwater remediation.***

When comparing remediation options, you should think about environmental factors, such as:

- resource use (for example raw materials, energy and water);
- emissions (to all environmental media and waste generation);
- the costs (not only financial) of the options verses the benefits.

Some of these issues and suggestions for how to undertake an assessment are reviewed in the following guidance:

- ***Assessing the Wider Environmental Value of Remediating Land Contamination: A Review*** (Environment Agency R&D Technical Report P238, 2000)

In the United States, an approach to considering the wider environmental effects and maximising the benefits of remediation has been developed called ***'Green Remediation'***:

- ***Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites*** (EPA/OSWER Office of Superfund Remediation and Technology Innovation 2008)

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2.0 Options appraisal (continued)

22. Is climate change something I need to consider?

Climate change is an important consideration, both in terms of choosing options which minimise greenhouse gas (GHG) emissions and ones that will remain effective under future climate conditions. Question 8 explains why it is important and how planning policy and guidance covers it.

Minimise greenhouse gas emissions (mitigation)
One way to measure the environmental impact of a remediation option is to consider its carbon footprint. A carbon footprint is:

'the total set of GHG emissions caused directly and indirectly by an individual, organisation, event or product' (UK Carbon Trust 2008).

So for a particular remediation option, its carbon footprint is an integrated estimate of the direct and indirect emissions that will result from the associated resource use, construction, transportation, etc. You can compare this with the footprint of alternative options to help determine the solution that is the best balance of effectiveness versus carbon footprint.

A number of proprietary tools are available to help you assess the carbon footprint of remediation options, and others are in development.

Selecting durable options (adaptation)
As with the risk assessment stage, to ensure your approach is 'future proof' you will also need to consider the predicted effects of climate change when deciding how to remediate and develop your strategy. Techniques or designs that appear to be appropriate now might not be under predicted climate change conditions, for example:

- Changes in precipitation and temperature might alter some parameters used in design calculations or predictive modelling for the technique proposed. Examples include biological activity, redox conditions, depth to water table and groundwater flux.
- Remedial solutions could be physically damaged or fail because of increased erosion, drought or flooding conditions. Examples include caps and barriers failing and stabilised/solidified contaminants being released.

You could consider including a 'factor of safety' in your remedial design if you think that climate change could affect it during its design life.

23. Are the costs of remediation justified?

Any scheme should be proportional and balance the costs of the required remediation and the environmental benefit it achieves. This is key to delivering a sustainable solution (see question 21 on sustainable remediation). Various guidance documents on cost-benefit assessment are referred to in the ***Model Procedures*** and on our ***options appraisal guidance web page***. They include:

- ***Cost-Benefit Analysis for Remediation of Land Contamination*** (Environment Agency R&D Technical Report P316, 1999);
- ***Costs and Benefits Associated with Remediation of Contaminated Groundwater: A Framework for Assessment*** (Environment Agency R&D Technical Report P279, 2000).

Cost-benefit arguments should be properly documented where they influence a remediation strategy. It is not acceptable to merely state that the costs outweigh the benefits.

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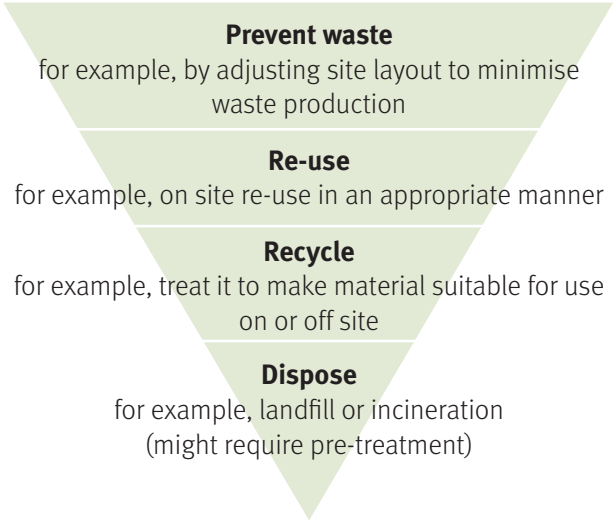
2.0 Options appraisal (continued)

24. What options are there other than 'dig and dump'?

There are often opportunities to reuse material,



after treatment if necessary. When considering the options you should take account of sustainability. The preferred order of ways to manage waste is called the waste hierarchy:

You should aim towards the top of this hierarchy and avoid disposal unless this is demonstrably the best practicable technique for a particular case.

You should ensure you consider the environment as whole when designing a remediation strategy, rather than solving one problem while causing a new one.

Appendix 1 of our ***Position Statement on the Definition of Waste: Development Industry Code of Practice*** provides more detailed guidance on this.

For example, it would **not** be acceptable for you to treat soil or groundwater by removing contaminants and simply discharging them into the atmosphere. Similarly, it would not normally be appropriate to mix clean materials with contaminated ones to simply reduce the contaminant concentration of the mass as a whole down to acceptable levels.

25. What has remediation got to do with waste management?

When materials produced during development or remediation are waste, their treatment and disposal will be subject to waste regulatory controls. The holder of the materials needs to decide whether or not they are handling waste.

The implementation section of this document provides more detailed information on waste issues and important references – see questions 27–32.

As you develop your remediation strategy you should bear in mind that it will need to provide:

- details of the use of excavated and/or imported materials in the remediation scheme;
- information about the use and production of waste;
- information on the regulatory permits and licences likely to be required.

Applying for and obtaining permits can take time, in some cases several months or longer. This should be one of many factors you consider when undertaking an options appraisal and developing your strategy.

2.0 Options appraisal (continued)

26. Can I just let natural attenuation take its course?

Monitored Natural Attenuation (MNA) is a valid remedial option in some circumstances but is not a 'do nothing' option. Our guidance on its appropriate use is presented in R&D Publication 95 ***Guidance on the assessment and monitoring of natural attenuation of contaminants in groundwater*** (Environment Agency 2000). This guidance defines MNA as:

'Monitoring of groundwater to confirm whether natural attenuation processes are acting at a sufficient rate to ensure that the wider environment is unaffected and that remedial objectives will be achieved within a reasonable timescale; typically this will be less than one generation or 30 years.'

Only when attenuating processes are monitored to demonstrate adequate progress will monitored natural attenuation be appropriate.

3.0 Implementation of remediation

During the implementation stage you finalise your strategy, implement it and monitor its success. Key aspects are confirming what permits and licences you need, and obtaining them.

27. What other permits or licences might be needed?

You must obtain any permits required for the proposed remediation scheme prior to commencement. This might include planning permission or permits issued by other organisations, and permits issued by us.

Where remediation involves the removal and/or disposal of water, a number of permits could be required. For example:

- If you need to **abstract surface or groundwater** (more than 20m^3/day) as part of a remediation scheme, an *abstraction licence* will be required (as explained on our ***water abstraction web page***).
- If you need to **discharge water into surface waters**, a *discharge consent* will be required (as explained on our ***discharge consents web page***).
- If you plan to **dispose of listed substances into or onto land**, you may need a *groundwater authorisation* (as explained on our ***groundwater authorisations web page***).
- If you need to **re-inject treated water to groundwater**, these activities must not cause an unacceptable discharge to groundwater and must be controlled through a *discharge consent*.

Our specific requirements relating to the re-injection of groundwater are detailed in ***Remediation Position Statement No. 3A*** and ***Groundwater Protection: Policy and Practice (GP3)***. Chapter 9 of Part 4 (Legislation and Policies) covers land contamination issues specifically.

You can find general information about these and other licences on our ***Netregs web site*** and ***Do you require an Environmental Permit?*** page.

28. What waste legislation applies to remediation?

Contaminated material that is excavated, recovered or disposed of is sometimes waste. Where it is waste, its handling, transport, treatment, disposal or re-use can be subject to waste management legislation, which includes:

- ***Duty of Care Regulations 1991*** (as amended);
- ***Landfill (England and Wales) Regulations*** 2002 (as amended);
- ***Hazardous Waste (England and Wales) Regulations*** 2005 (as amended);
- ***Environmental Permitting (England and Wales) Regulations*** 2007.

Problem holders should ensure that all contaminated materials are adequately characterised, both chemically and physically, and that the permitting status of any proposed operation is clear. If in doubt, contact us for advice at an early stage to avoid any delays.

You will find lots of useful information about regulatory requirements on the ***NetRegs web site***.

3.0 Implementation of remediation (continued)

29. When is contaminated soil or other material 'waste'?

Our ***Position Statement on the Definition of Waste: Development Industry Code of Practice*** summarises our views on this.

'Waste' is defined in Article 3 of the European Waste Framework Directive (Waste FD) as ***'any substance or object which the holder discards or intends or is required to discard'***. It is the responsibility of the holder of a substance or object to decide whether or not they are handling waste. This must be considered in light of all the specific circumstances of each case. Ultimately it can be a question for the courts.

Material excavated during the development of land may be waste and subject to waste regulatory controls (see question 28). We do not consider land affected by historic contamination to be waste while it remains *in situ* and undisturbed.

We have worked with industry through CL:AIRE (Contaminated Land: Applications in Real Environments) to contribute to their preparation of a voluntary industry ***Definition of Waste: Development Industry Code of Practice (the Code of Practice)***.

This code of practice sets out good practice for the development industry to use in certain circumstances when:

- assessing whether materials are classified as waste or not; and
- determining when treated waste can cease to be waste for a particular use.

It also describes an auditable system to demonstrate that the code of practice has been adhered to on a site-by-site basis.

The code of practice should be read in conjunction with our ***Position Statement on the Definition of Waste: Development Industry Code of Practice*** and the associated ***frequently asked questions***.

30. What is a site waste management plan (SWMP)?

SWMPs became a legal requirement in England in April 2008 for any construction project costing more than £300,000. They should set out how building materials are going to be used efficiently, and how waste is going to be minimised and managed, throughout the life of a construction project. Although it is a legal requirement to write and implement a SWMP, they can also save you money and help protect the environment.

Further guidance on SWMPs is available from:

- ***Defra's non-statutory guidance for site waste management plans***;
- our ***web page on Site Waste Management Plans***. This page includes links to other guidance, a simple guide and a SWMP checklist.

31. How do I know what type of waste I have?

The type of waste you hold can influence what you can do with it, particularly when you want to dispose of it. The following web pages include guidance on classifying materials you have decided are waste and intend to dispose of to landfill sites, as well as specific advice on hazardous and oily wastes (including contaminated soils):

- ***Guidance on landfilling wastes***;
- ***Guidance on hazardous waste***;
- ***What is hazardous waste?***, including ***WM2***, our Guidance on the Interpretation of the definition and classification of hazardous waste;
- ***Assessing specific waste types***.

The last of these web pages includes guidance on how to classify waste oils and waste that contain oil, along with other specific waste types.

3.0 Implementation of remediation (continued)

Where on-site or off-site treatment is proposed rather than disposal, these activities are still often licensable as waste treatment or recovery operations.

32. How are remedial treatment activities regulated?

We have developed a system of licensing mobile plant used for the remediation of contaminated land. Mobile treatment permits are now a type of standard rules Environmental Permit.

Further guidance is contained in our series of 15 ***Remediation Position Statements***:

1. Cover systems
2. Containment barriers
3. Excavation and disposal
4. Monitored natural attenuation
5. Ex-site bioremediation
6. In-situ bioremediation
7. Bioventing
8. Soil flushing
9. Solvent extraction
10. Transformation by chemical treatment
11. Soil vapour extraction
12. Soil washing
13. Permeable reactive barriers
14. Solidification/stabilisation
15. Thermal desorption

Each statement describes the technique in question, what contaminants it typically treats and our regulatory position on its use. This latter section covers other permits that might be required, how the treated material can be used and waste disposal issues.

There are circumstances where activities that require licensing can proceed without a licence, providing certain criteria are met. Details of these activities and the qualifying criteria are contained in our ***Licensing/ Permitting Position Statements***.

Our position on our approach to the enforcement of the activities described in these position statements is in our ***Enforcement and Prosecution Policy*** and associated ***Guidance for the Enforcement and Prosecution Policy***. (In particular see section 4.1.2.)

Our web pages addressing the ***mobile treatment permitting system*** and ***mobile plant for the treatment of waste soils and contaminated material, substances or products*** contain all these documents, further information and the permit application details.

33. How do I show that remediation has been successful?

The need to verify that the objectives of remediation have been met should be an integral part of a scheme, and should have been documented in a **verification plan** at the design stage. It is good practice to implement this plan and produce a verification report to demonstrate the success of the project. Guidance on verification is contained in our document ***Verification of Remediation of Land Contamination***.

The fundamental purpose of verification is to demonstrate that identified risks are successfully managed over pre-defined timescales. Our verification guidance document provides a generic framework you can adopt to verify that a remediation strategy has achieved its objectives.

In some cases we may indicate that you do not need to submit verification reports to us, or we have no plans to review them.

> You should produce and retain verification reports for your own records and in case other interested parties wish to see them. These might include other authorities (for example, planning), prospective purchasers or adjacent landowners.
>
> It is also possible that we might ask for them at a later date, for example if water pollution is subsequently discovered.

3.0 Implementation of remediation (continued)

34. How long should I continue monitoring?

In some cases verification might involve longer-term monitoring, or maintenance of elements of the remedial scheme might be necessary. This is discussed in our guidance ***Verification of Remediation of Land Contamination***.

How long this should carry on will depend on the scenario in question (for example, contaminant properties and hydrogeological conditions) and the type of remediation undertaken. It could range from a number of weeks to several decades.

Monitoring or maintenance should continue until you can demonstrate that the remediation objectives have been met; that is, the pollutant linkages have been permanently broken and any harm or pollution caused has been mitigated.

Like verification reports, you should retain monitoring or maintenance reports for your own records and in case other interested parties wish to see them. It is also possible that we might ask for them at a later date.

Would you like to find out more about us, or about your environment?

Then call us on

08708 506 506* (Mon–Fri 8–6)

email

enquiries@environment-agency.gov.uk

or visit our website

www.environment-agency.gov.uk

incident hotline 0800 80 70 60 (24hrs)
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