



**Cyfoeth
Naturiol**
Cymru
**Natural
Resources**
Wales

How to surrender your environmental permit

Additional guidance for:

Landfill and other permanent deposits of waste (5.02)

Document Owner: National Services/ Knowledge, Planning & Strategy (KSP)

Version History:

Document Version	Date Published	Summary of Changes
1.0	September 2010	Issue of 'The surrender of permits for the permanent deposit of waste'
2.0	3 rd December 2012	Redrafted to reflect current best practice
3.0	September 2014	Re-brand to NRW

Published by:

Natural Resources Wales

Cambria House

29 Newport Road

Cardiff

CF24 0TP

0300 065 3000 (Mon-Fri, 8am - 6pm)

enquiries@naturalresourceswales.gov.uk

www.naturalresourceswales.gov.uk

© Natural Resources Wales

All rights reserved. This document may be reproduced with prior permission of

Natural Resources Wales

Contents

Document Owner: National Services/ Knowledge, Planning & Strategy (KSP)	2
1.1. Purpose of this document	4
1.2. Activities covered by this guidance.....	4
2.1. Surrender criteria.....	4
2.2. Evidence requirements	6
4. Low risk surrender	7
4.1. Landfill Directive inert waste	8
4.1.2. Landfill Directive inert waste from a single source	8
4.2. Pre-Landfill Directive inert wastes	9
4.2.1. Assessment of waste deposited	9
4.2.2. Pre-Landfill Directive inert wastes - sensitivity of the site	10
4.2.3. Pre-Landfill Directive inert wastes - monitoring	14
4.2.4. Sampling of the deposited waste mass	15
4.2.5. Restoration and slope stability	16
5. Standard surrender	16
5.1. Aftercare monitoring.....	17
5.2. Leachate completion criteria	18
5.2.1. Leachate monitoring	20
5.2.2. Groundwater monitoring	20
5.3.1. Landfill gas monitoring requirements	21
5.3.2. Continuous monitoring	22
5.3.3. Scenario 1 completion criteria	22
5.3.4. Site characteristic hazardous gas flow	23
5.3.5. Scenario 2 and 3 completion criteria	24
5.3.6. Other gases	25
5.4. Hazardous wastes	25
5.5. Settlement completion criteria and slope stability	26
8. References	32

1. Introduction

1.1. Purpose of this document

This document gives guidance on what evidence we expect to be included in the surrender report supporting an application for the surrender of a permit for the permanent deposit of waste. It outlines the acceptable types of information for the different types of site, based on the risk posed to the environment.

Our policy on the surrender of environmental permits is set out in our **Regulatory Guidance Note 9**, 'Showing that land and groundwater are protected at:

- installations
- waste facilities
- mining waste operations
- non-nuclear radioactive substances facilities and mobile apparatus'

Guidance on how to gather relevant evidence throughout the lifetime of the site, how to close your site and the aftercare management is described in relevant sector guidance notes for your activity. There are sector guidance notes for mining waste facilities and landfills for inert, hazardous and non-hazardous waste. You should use the guidance appropriate for your sector.

Where you have activities at your site covered by permit conditions that do not include the permanent deposit of waste you may also need to keep site condition records. Guidance on how you comply with this requirement is provided in '**How to comply with your environmental permit**', and **H5 'Environmental Permitting Regulations, Site Condition Report Guidance and Templates'**.

1.2. Activities covered by this guidance

This guidance may be used for all types of permanent deposits of waste permitted under the Environmental Permitting Regulations (England and Wales) 2010 and subsequent amendments. These include:

- landfills
- mining waste operations
- deposits of waste for recovery

These include activities that have a bespoke environmental permit and lower risk activities that have been operating under a standard rules permit.

2. General approach

2.1. Surrender criteria

The aim of an environmental permit is to set the standards you must achieve to ensure that you manage operations at your site to prevent or minimise pollution. You will have set out how you will achieve this in a number of documents approved under the permit (or previously approved under a waste disposal or management licence). Central to this is your understanding, set out in the conceptual model, of how the site can impact the surrounding environment. You will have included information on the setting of the site, the wastes that you have deposited and the pollution control

measures that you employed. As your site has developed, the monitoring data that you have collected will have updated and refined your conceptual model.

To accept an application to surrender an environmental permit for a site involving the permanent deposit of waste, we must be satisfied that:

- the site has ceased accepting waste
- relevant closure procedures have been complied with
- an appropriate period of aftercare has passed to allow the waste to stabilise and to gather evidence to demonstrate that the pollution control measures are no longer necessary
- the deposits of waste are in a satisfactory state that, if left undisturbed, will not cause pollution of the environment

'Pollution control measures' can include both:

- Active pollution control measures, which require your intervention or maintenance, for example using a pumping system to maintain leachate levels below that of the surrounding groundwater level or maintaining water levels in a settlement pond.
- Passive pollution control measures, which degrade and whose performance is anticipated to deteriorate over time, for example a flexible membrane liner that over time will develop holes.

Active pollution control measures are likely to be required at higher risk sites. You will need to provide evidence that they will no longer be necessary because the waste has degraded to a point that the quality and quantity of the pollutants such as effluent, leachate or landfill gas will not pose a risk to people or the environment through an uncontrolled release.

Your surrender report must identify any impact on the surrounding environment, taking into account the use of the land. You must consider any receptors that are present and any specific land use approved by the planning authority.

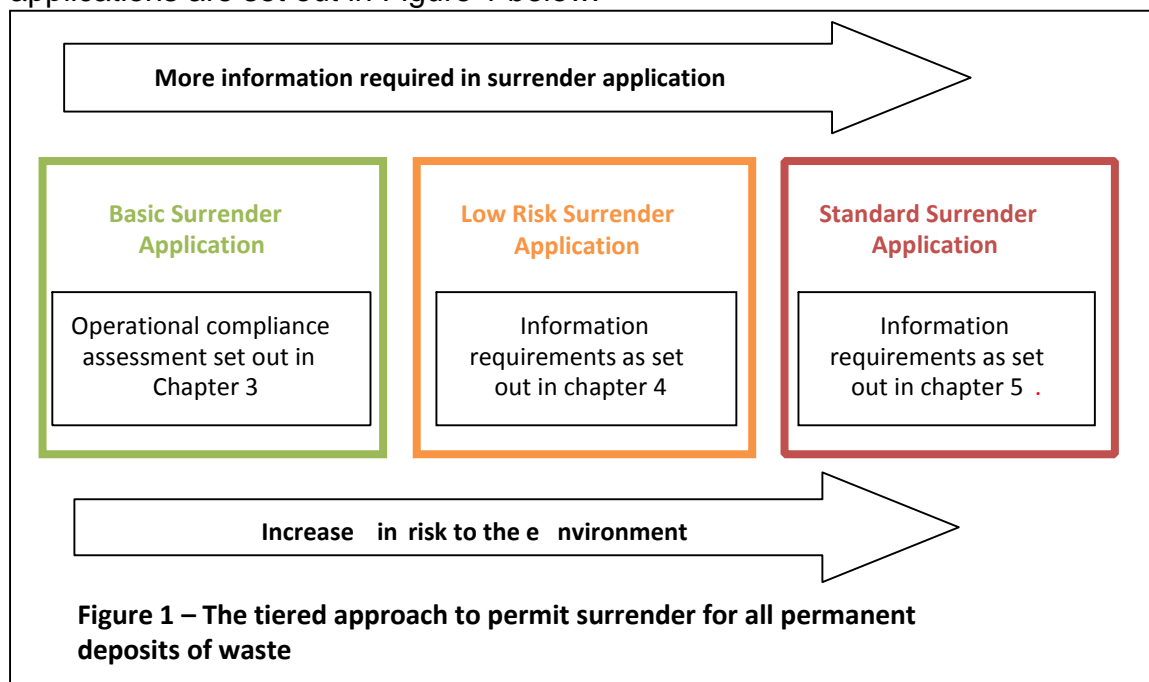
Site infrastructure such as leachate extraction wells, monitoring boreholes and associated site infrastructure must be decommissioned to make them safe before we will accept an application to surrender your permit.

2.2. Evidence requirements

There are three types of surrender application that we accept for environmental permits. These are: basic, low risk and standard surrender applications. The amount of information that you are required to provide with the application will increase with the complexity of site. In determining the appropriate type of surrender application we will take into account:

- the types of waste deposited
- the controls that you have employed to protect the environment
- the sensitivity of the location

The different types of information that we require for the different surrender applications are set out in Figure 1 below.



It is important that you discuss the evidence to support the application to surrender with us when:

- you enter the formal closure procedures (this does not apply to recovery deposits)
- you breach a condition of the permit
- you are preparing your surrender application

Where you supply environmental monitoring data with your application, you will need to provide evidence that you obtained this data from monitoring infrastructure that is fit for purpose. For relevant monitoring points, this should include construction details and evidence that the condition has been regularly checked and repaired where necessary.

The monitoring we agreed when you ceased accepting waste for disposal at your site may not be sufficient to demonstrate that the waste mass is stable for the purposes of permit surrender. At the point of closure, monitoring is for emissions from the site to demonstrate compliance with limits in the permit. Additional data may be necessary to demonstrate

surrender and you should contact us about this as part of your surrender pre-application discussions.

3. Basic surrender

For some deposit activities, we have adopted a lighter regulatory approach to permitting and compliance as they present a low risk to the environment. If we are satisfied that you have complied with your permit and there is no evidence to the contrary you will not normally be required to provide a surrender report with your application. These sites include:

- The management of inert wastes and unpolluted soil resulting from the prospecting, extraction, treatment and storage of mineral resources and the working of quarries, at mines and quarries (either under standard rules permit SR2009 No 8 or under a bespoke permit where the facility is not category A).
- Treatment of land for reclamation, restoration or improvement of land, up to 100,000 tonnes of waste (under standard rules permit SR2010 No 9 and 10).

Use of waste in construction, up to 100,000 tonnes of waste (under standard rules permit SR2010 No 7 and 8).

4. Low risk surrender

This chapter provides guidance on how to establish whether an activity is in the low risk category and how we will assess the surrender application.

Operators of sites that accepted hazardous and non-hazardous biodegradable waste, or where active pollution control measures have been employed, will not be able to apply to surrender their permit using this approach.

The low risk surrender approach is based on a review of records collected during the operational phase that should include evidence of the waste you accepted.

For sites (or parts of sites) where the waste has been deposited in accordance with Landfill Directive requirements, the records you collect as part of your waste acceptance procedures will provide this evidence. In the case of a mining waste operation, the waste accepted will be reviewed against the site's waste management plan. In the case of a recovery deposit, this will consist of a review of the permit documents and waste acceptance procedures.

For sites (or parts of sites) where wastes were deposited to Pre-Landfill Directive standards you should review the information that you have on that waste to determine whether the site is in a suitable condition for a surrender application to be made. You will need to:

- assess the waste deposited
- assess the sensitivity of the site and its surrounding location

4.1. Landfill Directive inert waste

If you have been operating a landfill for inert waste, permitted in accordance with the requirements of the Landfill Directive, you have protected the environment through a combination of the geological barrier and controls on waste acceptance. You should be able to demonstrate, through waste records, that the waste accepted is genuinely inert. Guidance on the collection of these records is provided below.

During the operational phase of your landfill, we will have inspected the site, reviewed your records and carried out audits of your waste acceptance controls and procedures. These will have included reviews of the checks that you have taken together with an assessment of the results of any waste analysis. Where we have identified that you are not complying with your waste acceptance procedures, we will notify you at that time. If you improve your waste acceptance controls and remove unacceptable waste you should include evidence of this when characterising the waste in your landfill.

We will accept the landfill is in a condition for its permit to be surrendered where, based on the review of the waste acceptance controls, you can demonstrate that the Landfill Directive waste acceptance controls have been complied with during the life of the site.

We will accept that you have protected the environment based on:

- a construction quality assurance report to demonstrate that a geological barrier was constructed or a site investigation in the permit application to demonstrate that the natural geology provides the geological barrier
- a review of relevant environmental monitoring

4.1.2. Landfill Directive inert waste from a single source

Where the waste within your site is from a single large excavation (for example a mine, quarry, road cutting or tunnelling operation) you should be able to demonstrate, from the results of a comprehensive source report, that the waste accepted is inert and thus unlikely to cause pollution.

To benefit from this approach, you must obtain from the producer of the waste the relevant site investigation report(s) that will include a characterisation of the waste. You will need to confirm that the waste is not likely to be contaminated. You must check that any investigation was carried out in accordance with the appropriate British Standards (for example, BS5930:1999 and BS10175:2011).

We will inspect the waste records and carry out audits on your waste acceptance controls and procedures. This will include reviewing any site investigation reports, to ensure that the waste accepted was that identified within the report(s). Where non-inert or contaminated waste is identified, your records must demonstrate how this waste was managed.

4.2. Pre-Landfill Directive inert wastes

This section should be applied to sites that were operational before 16th July 2001 and contain wastes that pose a lower risk to the environment which were historically called “inert wastes”. Definitions of inert have changed across different regulatory regimes (particularly with the introduction of the Landfill Directive) and permits have a varied description of the permitted wastes. The low risk surrender assessment is applicable at sites where it is unlikely that significant quantities of leachate or landfill gas have been or will ever be generated. We use the terms low leaching potential and low gassing potential to describe these wastes.

4.2.1. Assessment of waste deposited

To determine whether you can apply the low risk surrender approach you should consider whether the wastes in your site have a low leaching or low gassing potential. Table 1 below sets out two categories of such wastes - Type A or Type B.

Table 1 - Description of low leaching and low gassing potential waste

Type A	Type B
<p>General description Well characterised waste. Strong evidence that the waste types in the site are inert.</p>	<p>General description Waste is poorly characterised as it has come from various sources over a long period of time. Less information from site records of the waste types in the site. No wastes which have a biodegradable or leachable content, have entered the site in significant quantities.</p>
<p>Types of waste which fit into this category are:</p> <ul style="list-style-type: none"> • inert uncontaminated soils. • clean minerals. • single source waste with known low biodegradable or leachable content. 	<p>Types of waste which fit into this category are:</p> <ul style="list-style-type: none"> • multi-source ‘inert’ waste types (before the Landfill Directive defined what is inert) • construction, demolition and excavation waste
<p>Types of evidence which may be used are:</p> <ul style="list-style-type: none"> • Details of permitted and excluded waste types. • Waste input records – Records of the source and characteristics of the waste accepted at the site. • Compliance history – Compliance assessment records for the site showing there has been good compliance with waste acceptance conditions. • Waste characterisation records – The result from any site investigation involving the direct examination of the nature of the waste. • Landfill gas records – The results from any ad-hoc or routine landfill gas monitoring to indicate presence of biodegradable waste. 	

You should examine the evidence that you have about your site and determine whether it fits within either of the categories. If there are records of non-compliance against your permit conditions (relating to the waste types accepted) that were not resolved at the time, we will not normally accept that the waste falls into either Type A or Type B. However we may accept that the waste falls into Type B based on the findings of a site investigation. If you consider your landfill to contain Type A waste, you must have a high level of confidence that the waste has low leaching and gassing potential. If monitoring suggests methane concentrations above 1.5% and carbon dioxide above 5%, you should class the waste as Type B, or undertake a further assessment to justify why the site should be Type A. You can identify waste types, for example, by examining waste acceptance records or examining the results of the analysis of waste samples. Where you have kept good quality records that give an accurate description of the wastes you accepted, we will accept these provided that you also have a good compliance history.

Developing good records of waste received is best achieved during the operational phase of the site. We will check the accuracy of the records through auditing your procedures for waste acceptance and testing of the deposited waste. You must include evidence that you rejected or removed waste that was not permitted.

4.2.2. Pre-Landfill Directive inert wastes - sensitivity of the site

When considering the sensitivity of the site and its surroundings, you must consider how isolated the waste is from a receptor. The nature of the risk posed to a receptor is different when considering the leaching and gassing potential of the waste. Isolated sites are those where it is unlikely that any of the emissions from the site will ever reach a receptor in sufficient quantity to cause pollution.

Isolation can be due to the surrounding geology, topography or by distance between the site and a receptor. For example, where the site is situated in or over strata where pollutants from the site could not reach sensitive water courses or other sensitive receptors, we would accept that the site is isolated. You should have established the relevant source – pathway – receptor relationships for your site when you developed the conceptual model, either as part of your permit application or when you reviewed the pollution control measures at the site. To determine what information you need to provide to us within the surrender application, you must consider the sensitivity of the site setting. The matrix in Table 2 below sets out what information should be included in the surrender report, based on the type of waste accepted and the sensitivity of and distance to a receptor. The types of information required for the leaching and gassing potential may be different at the same site. The type of surrender application you need to make will be based on the highest risk identified.

For example, where you have identified the gassing potential can be assessed using the low risk approach (category 1, 2 and 3 of Table 2) but the leaching potential has to be assessed using the standard approach (category 4 of Table 2) your surrender application will be considered to be a standard surrender application.

Small sites with a deposit of less than 25,000 tonnes may have a lower potential to cause pollution. The operators of such sites falling into categories 2a, 2b and 3 on Table 2 (below) should contact us to discuss the monitoring requirements for the site.

In some cases, the information you hold may be insufficient. You will therefore need to improve your aftercare monitoring programme to start to collect information to show the potential impact of your site. Chapter 5 sets out the type of information that you must collect.

Leaching potential of waste	Lower leaching potential Type A	1	1	2a	2a	2b	1
	Lower leaching potential Type B	1	2b*	2b	3	3	3
	Higher leaching potential	4	4	4	4	4	4
		Non – Productive	Secondary B	Secondary A	Principal not in Source Protection Zone (SPZ)	Principal in SPZ	Surface water course <100 m
Aquifer type							

Gassing potential of waste	Lower gassing potential Type A	1	2a
	Lower gassing potential Type B	2b	3
	Higher gassing potential	4	4
		>250m	<250m
Proximity of receptor			

Table 2 - Risk matrix for assessing whether a site will meet the criteria for a low risk surrender application

Information required for surrender assessment (See chapter 4.2 for

more detail) 1 Your application can be based on review of waste acceptance records.

2a Your waste is low risk, so you can base your application on a review of waste acceptance records. However, given the location of your site in relation to a sensitive receptor you must consider the leaching and/ or gassing potential of the waste. If gas concentrations on site are above 5% for carbon dioxide and/ or above 1.5% for methane, you must either class the waste in your site as Type B or provide a justification as to why it is Type A

2b You must base your application either on a direct assessment of the leaching or gassing potential of the waste, or through a risk assessment that shows that there is a suitable barrier to prevent pollution.

- To assess the risk to water, the results of a site investigation or routine monitoring must demonstrate that groundwater or surface water receptors are not being impacted by the leachate.

- To assess the risk from landfill gas you must either demonstrate that the concentration of gas within the waste is:

- similar to background soil gas concentrations (either natural sources or as a result of non-landfill activities); or
- below 5% for carbon dioxide and below 1.5% for methane; or

- between 5% and 10% carbon dioxide and between 1.5 % and 5% methane, where the maximum hazardous gas flow rates (Qhgs as defined by BS 8485:2007) is 0.7 litres/hour. The maximum gas flow rate in any borehole must be less than 70 litres/hour.

- Above 10% carbon dioxide and/or above 5% methane, you should monitor in accordance with Chapter 5 and submit a standard surrender application. * A desk study may be sufficient at sites in Secondary B locations. This should be clarified in pre-application discussions.

3 You must base your application on an assessment of monitoring data to confirm that the site is having no impact on the surrounding environment:

- To assess the risk to water you must monitor the groundwater and any surface waters near the site both up gradient and down gradient of the site.
- To assess the risk from landfill gas, you must undertake monitoring for landfill gas within the waste as for 2b above and where gas is present above 5% carbon dioxide and/ or 1.5% methane, you should consider monitoring for landfill gas outside the site between the site and the closest receptor.

4 Not a low risk site, you must make a standard surrender application in all cases – See Chapter 5

4.2.3. Pre-Landfill Directive inert wastes - monitoring

If your site has accepted waste with a low leaching and gassing potential, but based on your assessment you decide that you need more monitoring data to determine whether the waste has achieved the completion criteria, you must monitor for a reasonable minimum period:

- For sites in Table 2 categories 2a and 2b, we recommend that you carry out monitoring to assess the impact from leachate quarterly, for a minimum of two consecutive years. To assess the impact from landfill gas the monitoring should be a minimum of monthly for 6 months.
- For sites falling in category 3, you should monitor landfill gas for a minimum of two consecutive years with at least two occasions when the atmospheric pressure is below 1000mb and falling.
- For sites falling into category 4, you will need to make a 'standard surrender' see chapter 5.

We will consider shorter monitoring periods where you can satisfy us that the monitoring is representative. For the requirements for continuous monitoring, see 5.22.

If your site falls within categories 2a, 2b or 3 of Table 2, you will have to undertake some monitoring for landfill gas to confirm that little or no biodegradable waste was accepted at the site when it was operational. Gas monitoring must represent the full depth of the waste that has a potential to produce gas. Landfill gas monitoring should be undertaken from permanent monitoring points installed within the waste at a frequency of no less than two boreholes per hectare, with a minimum of four boreholes per site.

Where a significant proportion of the waste mass is saturated, for example at high water table sites, you will need to design a site specific monitoring strategy to gather the necessary evidence. This monitoring strategy may include monitoring of water receptors, analysis of wastes and shallow gas monitoring.

For the majority of sites, we do not consider that spike (or searcher bar) monitoring is adequate to confirm whether biodegradable waste has been deposited, or to provide the evidence to demonstrate low gassing potential in support of a permit surrender application. We expect the use of spike testing to be rare.

Where a site has taken entirely inert waste as defined by the Landfill Directive or 'Type A' waste as defined in Table 1, you may use data from spike monitoring where the waste is less than four metres deep. For example, where a site falls within category 2a of Table 2 and where the waste has a maximum thickness of less than four metres, you can consider the use of spike testing to gather data in support of a surrender application.

However, you must recognise the limitations of spike testing. Should concentrations greater than 1.5% methane be detected, you will need to gather further evidence to support the surrender application. This will most likely include permanent gas

monitoring points within the waste, though other site investigation techniques such as soil sampling and trial pitting may also provide relevant information. You will also have to consider the thickness of any capping or restoration layer placed above the waste, as a thickness significantly greater than one metre is likely to prevent a spike test bar from penetrating the waste mass.

As a guide, where spike testing is used, sampling should be undertaken using 25m grid spacing.

If you are able to demonstrate that your site has accepted a single waste type with a known negligible gassing potential such as Pulverised Fuel Ash (PFA) waste, you should be able to rely on analysis of the waste to demonstrate that there is no significant organic content. In these cases you should not need to undertake landfill gas monitoring of the waste mass. Where the site sensitivity requires that groundwater is monitored you should typically do this using a minimum of one up gradient and two down gradient monitoring points.

4.2.4. Sampling of the deposited waste mass

If following a review of the existing waste records, you are not satisfied that the waste has a low leaching or gassing potential, you can take samples of the waste from the site for analysis to demonstrate that it has a low leaching or low gassing potential. You must take a representative number of samples of the waste from different parts of the site.

Your sampling must extend throughout the site, both across its full area and through the entire depth of the waste. The number and the extent of samples must be collected, according to a programme designed to ensure that the samples are representative of the contents of the site. Guidance on designing a sampling programme is available in British Standards BS5930:1999 and BS10175:2011. Where you are sampling waste within a landfill with a lining system, you should ensure that the risk to that lining system is minimised. Where we have informed you during the operational phase of the site that your waste acceptance controls have not been effective, you must increase the frequency of sampling in the area that we had concerns about. For closed sites where the waste was accepted under a previous regime, (e.g. waste management licensing) and the review of waste records and site inspection reports demonstrate that you had a poor compliance record, we expect a higher frequency of waste samples to be collected.

To characterise the deposited waste you must use a combination of:

- a visual inspection of the waste
- an assessment of the odour of the waste, to check for the presence of organic pollutants
- a chemical analysis for the concentration of the common pollutants within soils including metals, salts, and organic substances

We will accept the components listed in Table 3 below as a basis for the assessment. You should also investigate for the presence of landfill gas. Where you confirm that all of the waste is of low leaching/low gassing potential, you may use the results of the site investigation to show that the landfill meets the requirements for low risk surrender.

Table 3 – List of potential pollutants within soils

Metals ¹	Others ¹	Organic (indicators) ²
Antimony (Sb) Arsenic (As) Barium (Ba) Cadmium (Cd) Chromium (Cr) Copper (Cu) Lead (Pb) Mercury (Hg) Molybdenum (Mo) Nickel (Ni) Selenium (Se) Zinc (Zn)	Chloride (Cl) Fluoride (F) Sulphate (SO ₄) Total dissolved solids (TDS) Dissolved organic carbon (DOC) Phenol index	Total Organic Carbon (TOC) BTEX (Benzene, toluene, Ethylbenzene and Xylenes) Polychlorinated biphenyls (PCB's) Mineral Oil (C10 to C40) Polycyclic aromatic hydrocarbons (PAH's)
<p>From the Council Decision 2002/33/EC, Annex, paragraph 2.1.2</p> <p>¹ Leaching limit values BS EN 12457:2002</p> <p>² Total concentration</p>		

4.2.5. Restoration and slope stability

You must have restored your site in accordance with your closure plan and or permit requirements before making an application to surrender your permit.

You must review the length and gradient of slopes at the site and determine the likelihood of failure using an appropriate stability assessment for the level of risk posed by the slope. A slope specific analysis is not required for shallow slopes. We will not accept an application to surrender your permit where any waste slope or retaining structure is in an unstable condition.

5. Standard surrender

This chapter provides guidance for sites in the higher risk categories (Table 2, category 4) where the surrender assessment involves some form of intrusive investigation. This can involve:

- the monitoring of the pollutants generated within the waste

- the impact on the surrounding environment

For sites where active pollution control measures were required and for sites that took hazardous or non-hazardous waste, you must monitor for the presence of pollutants before submitting a surrender application.

5.1. Aftercare monitoring

Degradation of the waste within your site will be affected by a number of different factors. The degradation of waste within different parts of the site may occur at different rates. It is essential that you collect data about the generation of pollutants across the whole of the site during its entire life.

You must continue to monitor the generation of pollutants within the site and the condition of the landform during the aftercare phase, until you can show that the waste is unlikely to present a hazard to the environment. You must not consider applying to surrender your permit until the concentration of the pollutants within the site and the condition of the waste meet this requirement (the completion criteria). You must also continue to monitor the surrounding environment (groundwater, surface water and soil gasses) until you can show that there are no unacceptable releases from the site. A number of factors will govern the duration of aftercare monitoring, including:

- The stabilisation of conditions, including gas volume/pressure and leachate strength/level, within the site following the removal of any active control measures.
- The degradation of passive control measures.
- The travel time between the waste mass and the external monitoring infrastructure. We will not accept an application to surrender an environmental permit while active control measures are required at the site. Once those control measures have stopped, it can take a number of years for the conditions at the site to stabilise. You must set out the methodology, monitoring provisions and contingency measures for removing active controls within the closure and aftercare plan.

You must monitor the conditions at the site to show when the control measures are no longer necessary. The types of monitoring will be different for the various types of control measures employed. Table 4 below gives some examples of measures that can be employed at a site, what steps or monitoring is required to show that the controls are no longer necessary and the timeframe for the conditions to stabilise.

You should consider how the various components of the landfill lining system may deteriorate over time. We will not accept surrender until you can demonstrate that further degradation of the lining system will not result in an unacceptable discharge.

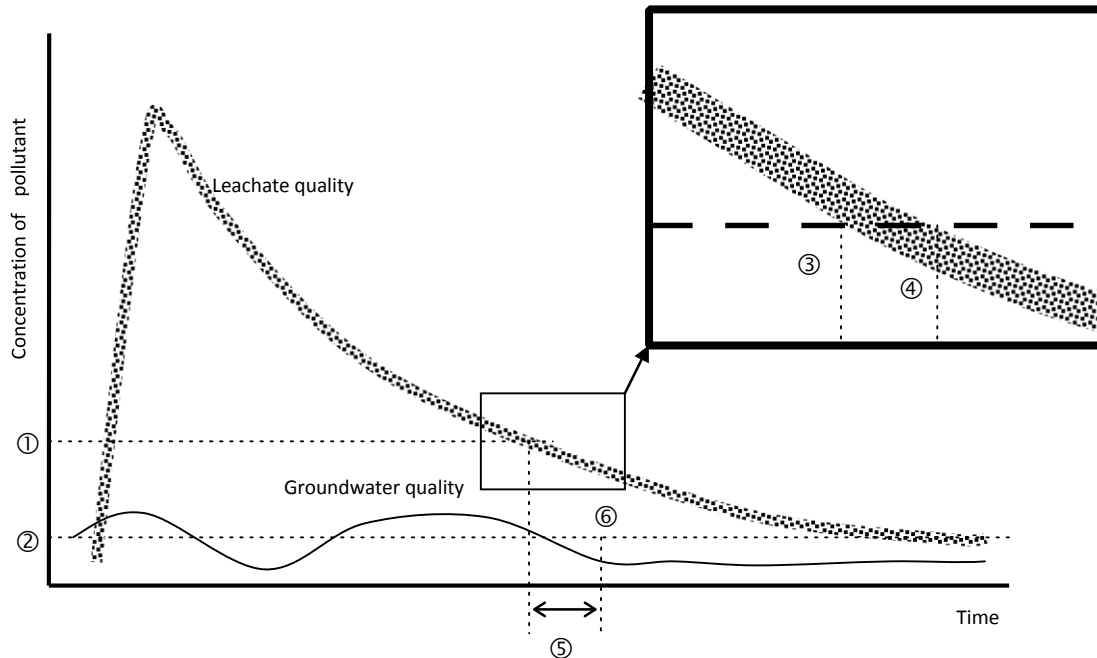
Table 4 – Stabilisation of the site following the removal of pollution control measures

Control measure	Action	Stabilisation monitoring
Control of groundwater levels	Cessation of pumping of groundwater from around the site	Monitoring of the levels until they have returned to a level consistent with the local water table
Control of leachate levels	Cessation of leachate extraction from the waste	Monitoring of the rise of leachate levels until they reach a consistent level
Extraction of landfill gas	Cessation of gas extraction from the waste mass	Monitoring of landfill gas concentration, extent and pressure until the generation rate of gas remain constant
Control of infiltration of water into landfill	Installation and maintenance of a low permeability cap	Monitoring of the settlement of the cap including; visual assessment for cracks or depressions, gas emissions rates through the cap to identify failures and monitoring of changes in leachate level through a water balance assessment
Collection and discharge of surface water	Removal of the discharge	None, once the discharge has been removed there is no impact to monitor

5.2. Leachate completion criteria

Where a contaminated leachate is generated within your site and you have used some form of active control measure to protect groundwater and surface waters, you must develop site specific completion criteria for your leachate. You will need to develop completion criteria for each priority pollutant identified within the leachate. You should set these leachate completion criteria at the concentrations for each substance that has been shown within the validated hydrogeological risk assessment, will not result in an unacceptable impact on groundwater or surface water.

Figure 2: Review of leachate quality data to determine when a permit can be surrendered



1. Leachate completion criteria as determined through hydrogeological risk assessment.
2. Environmental quality standard or site specific concentration for groundwater.
3. Leachate concentration at points in the site meeting the completion criteria.
4. Leachate concentration consistently meeting the completion criteria.
5. Travel time from the waste to the monitoring point.
6. Point at which the permit can be surrendered on the basis of the leachate criteria.

In setting the individual completion criteria you should take into account the permeability, retardation and attenuation characteristic of the lining system for the appropriate period and the likely leakage rate through that liner. You should set the criteria at a level that demonstrates that the requirements of the Groundwater Daughter Directive are complied with and no Environmental Quality Standards in any sensitive water courses are breached. General guidance on the assessment of risk to groundwater and surface waters is provided within our guidance **H1 – Environmental Risk Assessment**. Specific advice on the risk assessment of impacts to the groundwater environment from landfills is provided within **Annex J3** to H1, Hydrogeological risk assessments for landfills and the derivation of groundwater control levels and compliance limits.

5.2.1. Leachate monitoring

During the development of the site and early in its operational phase, you will only be able to develop indicative completion criteria. These will be in the form of wide concentration ranges for the priority pollutants you expect the waste to generate. You should use these ranges within the site risk assessment to ensure that you provide appropriate pollution control measures at the site. As the site develops and you get a better understanding of leachate quality through monitoring, you will be able to refine your model to reduce the size of the uncertainty in these concentration ranges.

Where there is the potential for leachate breakout to occur, by the overtopping of leachate containment systems, you should consider the impact from direct contact with people, water, flora and fauna. The leachate at its completion criteria must not contain any substances at a concentration that could cause harm to human health or the environment through direct toxicity.

Some older landfills (or parts of landfills) were designed without a low permeability lining system and may not have the infrastructure to collect samples of leachate. Without this ability, it will be difficult for you to assess the leachate completion criteria directly. You must therefore adopt an alternative scheme to assess leachate completion. For example it may be possible to obtain samples of leachate from perched levels within the site or by extracting pore water from solid samples by centrifugation. However these samples are likely to be limited in providing an indication of the characterisation of the whole site. In such circumstances you may use a combination of:

- monitoring of the impact on groundwater from the landfill
- monitoring of the landfill gas generation rate

5.2.2. Groundwater monitoring

Once you have reached the completion criteria for a particular substance in the leachate, you must continue to monitor the surrounding environment for a suitable period of time to demonstrate that no unacceptable discharge or impact on the environment has occurred. You should base the length of this monitoring period on the travel time from the waste to the monitoring point. You should monitor groundwater using a minimum of one up hydraulic gradient and two down hydraulic gradient boreholes per groundwater system with the down gradient boreholes to be spaced a maximum of 100m apart.

For sites where the leachate completion criteria are being assessed based on groundwater quality, we will consider the site to have met them where you can show that the emissions from the site are not causing a breach of a compliance limit set within the permit. Where a priority pollutant has been identified within the leachate and there is no compliance limit within the

permit, you must demonstrate that there is no significant increase over background quality for that substance.

In using such a strategy, there is a risk of assessing the results of such a monitoring exercise too soon in the aftercare phase of the site. For this reason, the approach suggested in above should only be adopted once you are satisfied that sufficient data has been collected to show that a reasonable time has elapsed and suitable conditions have been reached to allow for the substantial degradation of the wastes. You may be able to use gas generation records from the site to support this.

5.3. Landfill gas completion criteria

Where your site contains biodegradable waste, landfill gas will be generated. Where you identify gas generation, you must not consider making a surrender application until you can demonstrate through monitoring that the gas is no longer being generated at a significant rate (see below). You will have to consider this rate on a site specific basis and consider the likelihood of the gas escaping from the site, causing an unacceptable impact at a receptor. This can include human receptors, sensitive flora and fauna and emissions to the atmosphere.

We will not accept a surrender application where gas concentrations measured in boreholes outside the waste show gas migration and a breach of compliance limits.

We will not accept a surrender application where gas is causing harm to flora on or around the site. Where there is visual evidence of impact from gas on the surrounding environment, and this is a result of a previous escape of gas you must provide evidence to demonstrate that that pollution is no longer occurring. For example, you could provide monitoring data of the concentration of the gas within the ground between the waste and the affected plant life.

5.3.1. Landfill gas monitoring requirements

You must monitor and record the following determinants in each monitoring round:

- methane (%v/v)
- carbon dioxide (%v/v)
- oxygen (%v/v)
- atmospheric pressure (mbar)
- differential pressure (mbar)
- flow (l/hr)

You must carry out landfill gas monitoring over a minimum period of two years with a minimum of 12 readings being taken during that period, including:

- when the site surface may be sealed, for example following periods of heavy rain when the ground is saturated or when the ground is frozen

- when atmospheric pressure is less than 1000mbar and falling
- during or immediately following a rapid fall in atmospheric pressure (as a guide this would be a drop of at least 6mbar within a three hour period)

Landfill gas monitoring must represent the full depth of the waste that has a potential to produce gas. Monitoring must be undertaken from permanent monitoring points installed within the waste at a frequency of no less than two boreholes per hectare, with a minimum of four boreholes per site.

5.3.2. Continuous monitoring

We may accept a shorter period of more intensive monitoring to demonstrate that stable conditions exist. This intensive monitoring must take the form of continuous monitoring of concentrations of gases, differential and atmospheric pressure and should include the meteorological events outlined above. You must also undertake periodic flow measurements. Where continuous monitoring shows variation in differential pressure under different climatic conditions or gas concentrations such that scenario 2 or 3 below would apply, you must undertake additional flow monitoring.

You must place the continuous monitoring instruments in representative monitoring boreholes within the waste. You will need to justify the location of these boreholes based on initial monitoring results. You must consider short term or seasonal variations in the water table where these might affect the results of monitoring. We advise that you discuss your proposed continuous monitoring plan with us as part of your pre-application discussions.

5.3.3. Scenario 1 completion criteria

We will accept that the completion criteria to have been met when you can show that the site has achieved the conditions set out in scenario 1 below.

Scenario 1 Completion criteria

Gas concentration

Maximum methane concentration is less than 1.5%v/v

Maximum carbon dioxide concentration is less than 5%v/v

Standard of evidence

A minimum of 12 datasets over two consecutive years.

Note: You must ensure that these limits have been met throughout the entire waste body and that the gas concentrations have not been exceeded at any time during the two year period. Alternatively, if you can show that the concentration of methane and carbon dioxide within the waste is similar to background concentrations (either natural sources or because of non-landfill activities) in the surrounding environment we will accept that the gas completion criteria have been met.

5.3.4. Site characteristic hazardous gas flow

We accept that relying on a simple concentration of gas within the site means that it may be several decades before you can apply to surrender your permit and that the concentration of gas alone does not reflect the true risk associated with the gas. We also recognise that there may be high concentrations of gas within the site that are essentially static.

Where the concentrations of gas within the waste are greater than the criteria limits in Scenario 1, you can still demonstrate that the site meets the completion criteria. You can determine the gas generation rate by considering the concentration and flow rate of the gases in the monitoring boreholes. We will accept that the site meets its completion criteria when the following conditions apply:

- Concentration of gas and the site characteristic hazardous gas flow rates (Qhgs as defined by BS 8485:2007) measured in on-site monitoring boreholes is less than 0.7l/h.
- The maximum flow rate recorded in any individual borehole is less than 70l/h¹. This Qhgs is for the whole site so you will need to assess individual borehole readings (s6.2 BS 8485:2007).

The site characteristic hazardous gas flow rate defined in BS 8485:2007 is a method used to assess the risk associated with developing buildings on contaminated land. We will accept this method to assess whether your site is in an acceptable state for you to apply to surrender your permit. The gas completion criteria reflect the characteristic gas situation 2

¹ The maximum concentrations and flow rates may have been measured in different boreholes.

in BS 8485:2007, Table 1. This does not guarantee that the site is suitable for development without further site investigation or assessment.

5.3.5. Scenario 2 and 3 completion criteria

Where concentrations of gas in the site are greater than the criteria limits in Scenario 1 above, you must demonstrate that you have based the derived Qhgs on sufficient monitoring.

We will accept either of the following two scenarios:

- Scenario 2 is where the observed methane concentration is less than 5%v/v (the lower explosive limit) and there is therefore little risk that gas migration off site could present an explosion hazard.
- Scenario 3 covers situations where the methane concentration is greater than the lower explosive limit. We will require a higher standard of evidence to allow us to accept surrender of permits for sites that fall into Scenario 3 and you will need to demonstrate, by extended monitoring, that the derived Qhgs includes the worst case scenarios for landfill gas migration.

Scenario 2 Completion criteria

Gas concentration

Maximum methane concentration is less than 5%v/v and

Maximum carbon dioxide concentration is less than 10%v/v Flow rate

Qhgs is less than 0.7l/h

Maximum flow in any borehole is less than 70l/hr

Standard of evidence

A minimum of 12 datasets over two consecutive years.

This must include gas concentrations in external boreholes between the site and nearby receptors if this is not already required by your permit.

Where continuous monitoring is used this must be for a minimum of 2 months.

Scenario 3 Completion criteria

Measured gas concentration

Maximum methane concentration is greater than 5%v/v or

Maximum carbon dioxide concentration is greater than 10%v/v

Flow rate

Qhgs is less than 0.7l/h

Maximum flow in any borehole is less than 70l/hr

Standard of evidence

A minimum of 24 datasets over two consecutive years.

This must include gas concentrations in external boreholes around the site perimeter if this is not already required by your permit.

Where continuous monitoring is used this must be for a minimum period of six months

5.3.6. Other gases

If your site has accepted waste types that have the potential to produce significant quantities of gases other than methane and carbon dioxide, for example hydrogen sulphide or hydrogen, you will need to demonstrate that production of these gases is no longer significant and that there are no unacceptable risks associated with any residual gases within the waste mass.

5.4. Hazardous wastes

Where you have accepted hazardous or special wastes within your site, you must ensure that the technical measures that you have employed to isolate that waste from the surrounding environment will remain in place if the site is left undisturbed. You must include within your surrender assessment a description of the wastes that you have accepted and a review of those technical measures. The presence of hazardous waste should not prevent us accepting a surrender application.

For landfills that closed under the Landfill Directive and mining waste facilities for hazardous wastes you would have completed this assessment prior to the closure of the site, cell or phase, and documented it within your closure report. For all other sites you must include the results of your assessment within the next review of your closure and aftercare plan or when you are assessing the site's completion criteria.

You must base the description of the wastes on waste acceptance and deposit records collected during the operational phase of the site. Where

these records are not available (e.g. because the hazardous waste was deposited before 1996) or where we have questioned the reliability of these records, you must consider whether to treat the whole phase or site as if it contains the hazardous waste permitted or to undertake a suitable site investigation:

- For landfills classified as hazardous under the Landfill Directive you must provide a summary of the different waste types and their hazards within each phase or cell.
- For landfills classified as non-hazardous under the Landfill Directive you must provide details of the location of any cell used for the deposit of asbestos or stable nonreactive hazardous waste, and a summary of the wastes accepted and their associated hazards.
- For landfills that closed before the Landfill Directive, you must provide details of the phases and cells that contain co-disposed hazardous and non-hazardous waste, their location within the site and their associated hazards.
- For mining waste facilities with deposits of hazardous wastes, you must provide a summary of the waste management plan, characteristics of the waste and their associated hazards.

You must make sure that any hazardous waste is isolated from direct contact by a suitable thickness of soil or robust capping layer. As the hazard from some hazardous wastes will not diminish over time, the degree of robustness of the separation layer or cap should be designed based on the potential harm that the waste can cause. In order to accept the surrender of your permit, we will need to be confident that your technical measures will not be compromised and that the wastes will not be disturbed. Potential issues that we might need to take into consideration include:

- potential damage to technical measures caused by animal burrowing
- a change in the course of a stream or river causing erosion of these measures
- damage due to coastal erosion

5.5. Settlement completion criteria and slope stability

We will not accept an application to surrender your permit where:

- there is evidence that waste settlement is still taking place
- any waste slope or retaining structure is in an unstable condition, for example where there is a risk in the short medium or long term that a slope failure is likely We may not accept an application to surrender your permit where:

- there is a potential for slope instability following active erosion, for example coastal erosion or erosion due to changes in the course of streams and rivers

For sites that closed under the Landfill Directive, you must carry out an annual topographical survey of your entire site during the aftercare phase. This is also best practice at sites that closed before July 2001. You should determine the rate of settlement of the waste by comparing the levels with the levels found during the previous survey. We will accept that settlement is complete when there is no significant difference between two successive annual topographical level surveys. If you have only accepted a granular mineral waste, we will accept a review of the compaction characteristics of the waste.

Where you have provided a cap or separation to protect the environment, either through isolating the waste or controlling the rate of emissions, you must ensure that it remains effective for that purpose. Following the completion of settlement you must review the integrity of that cap or separation layer. We will not accept an application to surrender the permit where settlement has rendered the integrity of the barrier ineffective. You should use a combination of visual inspection of the barrier, with monitoring emissions from the site (e.g. landfill gas) and monitoring of conditions within the site (e.g. leachate level).

Where you have provided a stability risk assessment within your permit application or closure report, you must demonstrate that the final landform (through the provision of a topographical survey) is consistent with a 'stable profile' in the assessment. You must also provide evidence in the surrender application that there is no movement of the waste slopes, for example from a site walkover. Where such movement has been identified you must tell us how you have stabilised that slope.

Where you have not provided a stability risk assessment either with the permit application or the closure report, you must review the stability of the final landform. You must review the length and gradient of slopes at the site and determine the likelihood of failure using an appropriate stability assessment for the level of risk posed by the slope. A slope specific analysis is not required for shallow slopes.

6. Surrender report

You must base your surrender assessment for any permanent waste deposit site on information collected and assessed during the entire life of the site. You must ensure that at each critical stage of the life of the site, such as closure or switching off active control measures, the progress of the site towards the final completion criteria is reviewed. In addition we expect you to include an assessment of the progress against the completion criteria in the reviews of your risk assessments and permit conditions. As a result you should be confident that your site will meet the completion criteria before you apply to surrender your permit.

You must provide us with a surrender report to support your surrender application, except where you are using the basic approach. We will not duly make an application for surrender where you do not include a surrender report. Your report must bring together all the relevant information and decisions made during the life of the site so that we can determine whether to grant the application. You will not need to re-submit monitoring data and reports that you have previously supplied under the permit. However, you must summarise the findings of any relevant reports and trends in the monitoring data within the surrender report. You must clearly reference all supporting evidence including title, date and author as a minimum within the surrender report.

The amount of information that you will need to provide within the surrender report will depend on the type of surrender application you are making. Table 5 below sets out the type of information that we would expect to be included in your application.

Table 5 – Information to be provided within the surrender report

Key: Required
 ~ May be required
 Not Required

Information within the surrender report	Landfill Directive inert or Low Risk 1	Low Risk a/2b &	Standard
A review of the history of the permit including: <ul style="list-style-type: none"> • a summary of the conceptual model for the facility • key dates in the development of the permit (changes between different regimes, key variations, transfers, partial surrenders) • location and sensitivity of environmental receptors • aquifer status • proximity and sensitivity of surface water courses • proximity of housing and human receptors • Natura 2000 sites and SSSI's 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<ul style="list-style-type: none"> pollution control measures installed at the site 			
Information within the surrender report	Landfill Directive inert or Low Risk 1	Low Risk a/2b &	Standard
Confirmation of completion in accordance with permit conditions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Characterisation of waste deposited at the site, including details of: <ul style="list-style-type: none"> the description of the waste the quantities of each waste type the waste acceptance procedures employed the audits/inspections of waste acceptance procedures (including frequency and outcomes) any site investigations of deposited waste (including extent of the investigation, date of the investigation and findings) 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Details of any acceptance of non-compliant waste, including <ul style="list-style-type: none"> characterisation of the waste accepted location and extent of the non-compliant waste methodology for removal of waste (including on-site checks and disposal route) evidence confirming removal of waste from site 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The completion criteria for each pollutant generated within the site, together with a description of how they were established, including reference to any detailed risk assessment used to derive the criteria.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<p>Details of the construction of any pollution control measure employed at the site, including details of geological barrier beneath the site, including:</p> <ul style="list-style-type: none"> the design of the measure the construction quality assurance of the measure the effective lifespan of the measure; including dates they were turned off or no longer required any accident/incident that has affected the effectiveness /integrity of the measure 	<input type="checkbox"/>	~	<input type="checkbox"/>
A review of any changes to the performance of the pollution control measures during the life of the site.	<input type="checkbox"/>	~	<input type="checkbox"/>
Details of the make up and generation rate of any leachate and how it has changed over the life of the site.	<input type="checkbox"/>	~	<input type="checkbox"/>
Details of the make up and generation rate of the landfill gas and how it has changed over the life of the site.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Topographical surveys of the final landform. Stability and settlement assessment of the waste (required at low risk sites with significant slopes).	~	~	<input type="checkbox"/>

Information within the surrender report	Landfill Directive inert or Low Risk 1	Low Risk a/2b &	Standard
<p>Details of monitoring infrastructure:</p> <ul style="list-style-type: none"> Borehole Logs, response zones and construction details of monitoring points Record of regular inspection of the condition of monitoring points and remediation carried out 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p>A review of the monitoring results demonstrating no impact at any sensitive receptor including:</p> <ul style="list-style-type: none"> leachate quality groundwater surface water landfill gas (within the waste and surrounding the site) 	<input type="checkbox"/>	~	<input type="checkbox"/>

7. Glossary of terms

Aftercare	The period after [definite] closure of the site but prior to surrender during which maintenance and monitoring work is needed to ensure the restored landfill does not cause pollution of the environment.
Closure	<p>A distinct stage within the regulatory 'life-cycle' of a landfill or mining waste facility which occurs after the site has ceased accepting waste, but before it is definitely closed and can enter the aftercare phase. During this stage we ensure that the operator puts in place all the required infrastructure and procedures to manage the site in the aftercare phase.</p> <p>Mining Waste Facilities are required to close under Article 12 of the Mining Waste Directive. Guidance on these procedures can be found in government guidance.</p> <p>Landfills are required to close under Article 13 of the Landfill Directive (this did not apply to landfills that ceased accepting waste prior to 16th July 2001).</p> <p>Recovery deposits are not subject to any statutory closure procedures set out in legislation. Site specific closure requirements may be identified within the environmental permit (e.g. provision of a capping layer).</p>
Closure and aftercare plan	<p>A document that sets out how you will close your site and manage it in the aftercare phase. It will include:</p> <ul style="list-style-type: none">• how you will close the landfill following the cessation of waste acceptance• under what conditions you will cease the active management of the landfill• under what conditions you will consider the landfill to be in a condition to surrender the permit
Completion criteria	The concentration of pollutants within the waste and the condition of the site under which the waste is unlikely to present a hazard to the environment.
Conceptual model	A simplified representation or working description of how the real system is believed to behave based on analysis of field data.
Surrender report	A report produced by the operator to be submitted with an application to surrender an environmental permit that sets out how the site meets the relevant completion criteria.

Glossary of terms

8. References

Natural Resources Wales guidance

- **Regulatory Guidance Note 9** 'Showing that land and groundwater are protected at:
 - Installations;
 - Waste facilities;
 - Mining waste operations;
 - Non-nuclear radioactive substances facilities and mobile apparatus.
- **How to comply with your environmental permit Additional guidance for: Landfill (EPR 5.02).**
- **Environmental Permitting Regulations: Inert Waste Guidance Standards and Measures for the Deposit of Inert Waste on Land**'.
- **How to comply with your environmental permit. Additional guidance for mining waste operations**
- **H1 Environmental risk assessment for permits, annex J. Hydrogeological risk assessments for landfills and the derivation of groundwater control and trigger levels.**

Defra and Welsh Assembly Government guidance

- Environmental Permitting Guidance: The Mining Waste Directive

Other references

- British Standard BS 5930:1999 Code of practice for site investigations.
- British Standard BS 10175:2001 Investigation of potentially contaminated sites – Code of practice.
- British Standard BS 8485:2007 Code of practice for the characterization and remediation from ground gas in affected developments.
- British Standard BS EN 12457:2002 Characterisation of waste. Leaching. Compliance test for leaching of granular waste materials and sludges.