



Guidance Note on Daily and Intermediate Cover at Landfills



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Environmental Protection Agency

The Environmental Protection Agency (EPA) is a statutory body responsible for protecting the environment in Ireland. We regulate and police activities that might otherwise cause pollution. We ensure there is solid information on environmental trends so that necessary actions are taken. Our priorities are protecting the Irish environment and ensuring that development is sustainable.

The EPA is an independent public body established in July 1993 under the Environmental Protection Agency Act, 1992. Its sponsor in Government is the Department of the Environment, Heritage and Local Government.

OUR RESPONSIBILITIES

LICENSING

We license the following to ensure that their emissions do not endanger human health or harm the environment:

- Waste facilities (e.g., landfills, incinerators, waste transfer stations);
- Large scale industrial activities (e.g., pharmaceutical manufacturing, cement manufacturing, power plants);
- Intensive agriculture;
- The contained use and controlled release of Genetically Modified Organisms (GMOs);
- Large petrol storage facilities.
- Waste water discharges

NATIONAL ENVIRONMENTAL ENFORCEMENT

- Conducting over 2,000 audits and inspections of EPA licensed facilities every year.
- Overseeing local authorities' environmental protection responsibilities in the areas of - air, noise, waste, waste-water and water quality.
- Working with local authorities and the Gardaí to stamp out illegal waste activity by co-ordinating a national enforcement network, targeting offenders, conducting investigations and overseeing remediation.
- Prosecuting those who flout environmental law and damage the environment as a result of their actions.

MONITORING, ANALYSING AND REPORTING ON THE ENVIRONMENT

- Monitoring air quality and the quality of rivers, lakes, tidal waters and ground waters; measuring water levels and river flows.
- Independent reporting to inform decision making by national and local government.

REGULATING IRELAND'S GREENHOUSE GAS EMISSIONS

- Quantifying Ireland's emissions of greenhouse gases in the context of our Kyoto commitments.
- Implementing the Emissions Trading Directive, involving over 100 companies who are major generators of carbon dioxide in Ireland.

ENVIRONMENTAL RESEARCH AND DEVELOPMENT

- Co-ordinating research on environmental issues (including air and water quality, climate change, biodiversity, environmental technologies).

STRATEGIC ENVIRONMENTAL ASSESSMENT

- Assessing the impact of plans and programmes on the Irish environment (such as waste management and development plans).

ENVIRONMENTAL PLANNING, EDUCATION AND GUIDANCE

- Providing guidance to the public and to industry on various environmental topics (including licence applications, waste prevention and environmental regulations).
- Generating greater environmental awareness (through environmental television programmes and primary and secondary schools' resource packs).

PROACTIVE WASTE MANAGEMENT

- Promoting waste prevention and minimisation projects through the co-ordination of the National Waste Prevention Programme, including input into the implementation of Producer Responsibility Initiatives.
- Enforcing Regulations such as Waste Electrical and Electronic Equipment (WEEE) and Restriction of Hazardous Substances (RoHS) and substances that deplete the ozone layer.
- Developing a National Hazardous Waste Management Plan to prevent and manage hazardous waste.

MANAGEMENT AND STRUCTURE OF THE EPA

The organisation is managed by a full time Board, consisting of a Director General and four Directors.

The work of the EPA is carried out across four offices:

- Office of Climate, Licensing and Resource Use
- Office of Environmental Enforcement
- Office of Environmental Assessment
- Office of Communications and Corporate Services

The EPA is assisted by an Advisory Committee of twelve members who meet several times a year to discuss issues of concern and offer advice to the Board.

An Gníomhaireacht um Chaomhnú Comhshaoil

Is í an Gníomhaireacht um Chaomhnú Comhshaoil (EPA) comhlachta reachtúil a chosnaíonn an comhshaoil do mhuintir na tíre go léir. Rialaímid agus déanaimid maoirsiú ar gníomhaíochtaí a d'fhéadfadh truailliú a chruthú murach sin. Cinntímid go bhfuil eolas cruinn ann ar threochtaí comhshaoil ionas go nglactar aon chéim is gá. Is iad na príomh-nithe a bhfuilimid gníomhach leo ná comhshaoil na hÉireann a chosaint agus cinntiú go bhfuil forbairt inbhuanaithe.

Is comhlacht poiblí neamhspleách í an Gníomhaireacht um Chaomhnú Comhshaoil (EPA) a bunaíodh i mí Iúil 1993 faoin Acht fán nGníomhaireacht um Chaomhnú Comhshaoil 1992. Ó thaobh an Rialtais, is í an Roinn Comhshaoil, Pobal agus Rialtais Áitiúil.

ÁR bhFREAGRACHTAÍ

CEADÚNÚ

Bíonn ceadúnais á n-eisiúint againn i gcomhair na nithe seo a leanas chun a chinntiú nach mbíonn astuithe uathu ag cur sláinte an phobail ná an comhshaoil i mbaol:

- áiseanna dramhaíola (m.sh., líonadh talún, loisceoirí, stáisiúin aistrithe dramhaíola);
- gníomhaíochtaí tionsclaíocha ar scála mór (m.sh., déantúsaíocht cógaisíochta, déantúsaíocht stroighne, stáisiúin chumhachta);
- diantalmhaíocht;
- úsáid faoi shrian agus scaoileadh smachtaithe Orgánach Géinathraithe (GMO);
- mór-áiseanna stórais peitreal.
- scardadh dramhuisce
- dumpáil mara

FEIDHMIÚ COMHSHAOIL NÁISIÚNTA

- Stiúradh os cionn 2,000 iniúchadh agus cigireacht de áiseanna a fuair ceadúnas ón nGníomhaireacht gach bliain.
- Maoirsiú freagrachtaí cosanta comhshaoil údarás áitiúla thar sé earnáil - aer, fuaim, dramhaíl, dramhuisce agus caighdeán uisce.
- Obair le húdarás áitiúla agus leis na Gardaí chun stop a chur le gníomhaíocht mhídhleathach dramhaíola trí comhordú a dhéanamh ar líonra forfheidhmíthe náisiúnta, díriú isteach ar chiontóirí, stiúradh fiosrúcháin agus maoirsiú leigheas na bhfadhbanna.
- An dlí a chur orthu siúd a bhriseann dlí comhshaoil agus a dhéanann dochar.
- don chomhshaoil mar thoradh ar a gníomhaíochtaí.

MONATÓIREACHT, ANILÍS AGUS TUAIRISCIÚ AR AN GCOMHSHAOIL

- Monatóireacht ar chaighdeán aeir agus caighdeán aibhneacha, locha, uiscí taoide agus uiscí talaimh; leibhéil agus sruth aibhneacha a thomhas.
- Tuairisciú neamhspleách chun cabhrú le rialtais náisiúnta agus áitiúla cinntiú a dhéanamh.

RIALÚ ASTUITHE GÁIS CEAPTHA TEASA NA HÉIREANN

- Cainníochtú astuithe gáis ceaptha teasa na hÉireann i gcomhthéacs ár dtiomantas Kyoto.
- Cur i bhfeidhm na Treorach um Thrádáil Astuithe, a bhfuil baint aige le hos cionn 100 cuideachta atá ina mór-ghineadóirí dé-ocsaíd charbóin in Éirinn.

TAIGHDE AGUS FORBAIRT COMHSHAOIL

- Taighde ar shaincheisteanna comhshaoil a chomhordú (cosúil le caighdeán aeir agus uisce, athrú aeráide, bithéagsúlacht, teicneolaíochtaí comhshaoil).

MEASÚNÚ STRAITÉISEACH COMHSHAOIL

- Ag déanamh measúnú ar thionchar phleananna agus chláracha ar chomhshaoil na hÉireann (cosúil le pleannanna bainistíochta dramhaíola agus forbartha).

PLEANÁIL, OIDEACHAS AGUS TREOIR CHOMHSHAOIL

- Treoir a thabhairt don phobal agus do thionscal ar cheisteanna comhshaoil éagsúla (m.sh., iarratais ar cheadúnais, seachaint dramhaíola agus rialacháin chomhshaoil).
- Eolas níos fearr ar an gcomhshaoil a scaipeadh (trí cláracha teilifíse comhshaoil agus pacáistí acmhainne do bhunscoileanna agus do mheánscoileanna).

BAINISTÍOCHT DRAMHAÍOLA FHOGRHNÍOMHACH

- Cur chun cinn seachaint agus laghdú dramhaíola trí chomhordú An Chláir Náisiúnta um Chosc Dramhaíola, lena n-áirítear cur i bhfeidhm na dTionscnamh Freagrachta Táirgeoirí.
- Cur i bhfeidhm Rialachán ar nós na treoracha maidir le Trealamh Leictreach agus Leictreonach Cainte agus le Srianadh Substaintí Guaiseacha agus substaintí a dhéanann ídiú ar an gcrios ózón.
- Plean Náisiúnta Bainistíochta um Dramhaíl Ghuaiseach a fhorbairt chun dramhaíl ghuaiseach a sheachaint agus a bhainistiú.

STRUCHTÚR NA GNÍOMHAIREACHTA

Bunaíodh an Gníomhaireacht i 1993 chun comhshaoil na hÉireann a chosaint. Tá an eagraíocht á bhainistiú ag Bord Iánaimeartha, ar a bhfuil Príomhstíúrthóir agus ceithre Stíúrthóir.

Tá obair na Gníomhaireachta ar siúl trí ceithre Oifig:

- An Oifig Aeráide, Ceadúnaithe, Taighde agus Úsáide Acmhainní
- An Oifig um Fhorfheidhmíochán Comhshaoil
- An Oifig um Measúnacht Comhshaoil
- An Oifig Cumarsáide agus Seirbhísí Corparáide

Tá Coiste Comhairleach ag an nGníomhaireacht le cabhrú léi. Tá dáréag ball air agus tagann siad le chéile cúpla uair in aghaidh na bliana le plé a dhéanamh ar cheisteanna ar ábhar inní iad agus le comhairle a thabhairt don Bhord.

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- Greenstar
- Enrich Environmental Ltd.
- Fehily, Timoney & Co.
- Bord na Móna
- South Dublin County Council
- CIWM (The Chartered Institution of Wastes Management, Republic of Ireland Centre)

LIST OF TERMS

Note: The list of terms below is intended to assist understanding of this report and does not purport to be a legal interpretation of said terms.

Biodegradable Waste

Means waste that is capable of undergoing anaerobic or aerobic decomposition, such as food and garden waste, paper and cardboard.

Biodegradable Municipal Waste (BMW)

Means the biodegradable component of municipal waste, not including bio-stabilised residual waste. Biodegradable municipal waste is typically composed of food and garden waste, wood, paper, cardboard and textiles.

BMW Factor

Means the proportion of waste that is biodegradable. For example, paper has a BMW factor of 1.0, which means it is considered 100% biodegradable.

Biological Treatment

Means composting, anaerobic digestion, mechanical-biological treatment or any other biological treatment process for stabilising and sanitising biodegradable waste, including pre-treatment processes.

Bio-stabilised Residual Waste

Means residual biodegradable municipal waste that has been treated to achieve an EPA-approved biodegradability stability standard prior to landfilling or alternative use agreed.

Characterisation of Waste

Is the sampling and analysis of waste to determine, among other things, its nature and composition, including the proportions of biodegradable, recyclable and other materials in the waste.

Commercial Waste

Is a term used to describe the non-household fraction of municipal waste, which is produced by commercial premises such as shops, offices and restaurants, as well as municipal premises such as schools and hospitals. It also includes non-process industrial waste arising from factory canteens, offices, etc. Commercial waste is broadly similar in composition to household waste, consisting of a mixture of paper and cardboard, plastics, organics, metal and glass.

Cover Management Plan

Is a documented plan used by landfill operators to describe the specific materials and management practices to be used for landfill cover. The cover management plan should form part of the site's overall Landfill Environmental Management Programme, and should include details of how the effectiveness of cover management practices is regularly reviewed on-site.

Construction and Demolition Waste

Is all waste that arises from construction, renovation and demolition activities and all wastes mentioned in Chapter 17 of the European Waste Catalogue (EWC).

Daily Cover

(in the context of landfilling) is the term used to describe material (about 150 mm if soil cover is used) spread over deposited waste at the end of each working day. Appropriate synthetic materials may also be used.

Final Capping

Refers to the provision of a permanent capping system across the top of deposited waste to act as a barrier and restoration layer between the waste body and the external environment. The design details of any final capping system should be in accordance with published EPA Guidance and any specific requirements outlined in an EPA licence.

Fines

Refers to the small-sized fraction of waste that is mechanically separated from a mixed-sized waste stream by means of passing it through a screen (such as a trommel) during a waste processing activity. Fines are typically segregated from a mixed waste stream after an initial shredding, agitation or crushing pre-step. There is no set or uniform screen size used by all operators to generate fines. Depending on the origin or nature of the waste from which the fines are generated, they may be specifically described by the operator as organic fines, C&D fines, inert fines or by some other name.

Household Waste

Is defined as waste produced within the curtilage of a building or self-contained part of a building used for the purposes of living accommodation.

Intermediate Cover

Refers to the placement of suitable, adequate and stable material (minimum 300 mm if soil is used) over deposited waste for a period of time prior to temporary capping or prior to further disposal of waste. (Note: The term "intermediate cover" is sometimes used interchangeably with the term "temporary cover" within the waste sector.)

Mechanical-Biological Treatment (MBT)

Means the treatment of residual municipal waste through a combination of manual and mechanical processing and biological stabilisation, in order to stabilise and reduce the volume of waste that requires disposal.

Municipal Solid Waste (MSW)

Means household waste as well as commercial and other waste which, because of its nature or composition, is similar to household waste. It excludes municipal sludges and effluents.

Putrescible Waste

Or waste that is putrescible in character, is waste that is organic in nature and will readily rot or biodegrade, e.g. food waste, garden waste.

Residual Waste

Means the fraction of collected waste remaining after a treatment or diversion step, which generally requires further treatment or disposal.

Stabilisation

(in the case of bio-stabilised residual waste) means the reduction of the decomposition properties of the waste to such an extent that offensive odours are minimised and that the respiration activity after four days (AT_4) is $<10 \text{ mg O}_2/\text{g DM}$ until 1-1-2016, and $<7 \text{ mg O}_2/\text{g DM}$ thereafter. Waste that has been stabilised to this standard is assigned a BMW factor of zero.

Temporary Capping

Refers to the provision of a temporary capping system, at least 0.5 m thick and including a gas barrier membrane, to allow for settlement prior to the installation of the final capping system. A sacrificial gas barrier membrane should also be laid on the interfaces between the cell being capped and future cells. (The application of the sub-soil/top soil layers to such interfaces is not considered necessary by the EPA.)

Treatment/Pre-treatment

Includes, in relation to waste, any manual, thermal, physical, chemical or biological processes that change the characteristics of waste in order to reduce its volume or its hazardous nature, or facilitate its handling, disposal or recovery.

Working Face

Is the area of the landfill site in which waste, other than cover material or material for the purposes of the construction of specified engineering works, is being deposited.

1. INTRODUCTION & SCOPE

This document provides guidance on what is required of landfill operators by the EPA in relation to the use of daily and intermediate cover at licensed municipal solid waste (MSW) landfills.

The use of cover material is an essential element of landfilling operations and performs a number of important functions to minimise the impact on the environment of the landfill. The type, quantity and method of application of the cover material used at each landfill must be appropriate to achieve the overall objective of controlling potential nuisances that may arise.

Operational landfills represent a very dynamic and changing work environment that must be managed on a continuous basis to achieve good overall environmental control over a prolonged period. Following on from the first deposition of waste within a cell, cover materials are applied to that waste at the end of the working day prior to the emplacement of further lifts of waste, with further daily cover then applied to those lifts.

Where waste deposits are left for longer than a week or so, a thicker covering of material is usually applied, referred to as intermediate cover. Where further waste deposition in a cell has ceased completely, or is not due to take place again for a considerable period of time (e.g. months), landfill operators may wish to strengthen their cover material by the provision of temporary capping, prior to the ultimate installation of final capping.

The typical progression of cover/capping systems employed within a landfill cell can be summarised in the manner outlined in Figure 1 (although different cover/capping systems may be in use in different areas simultaneously).

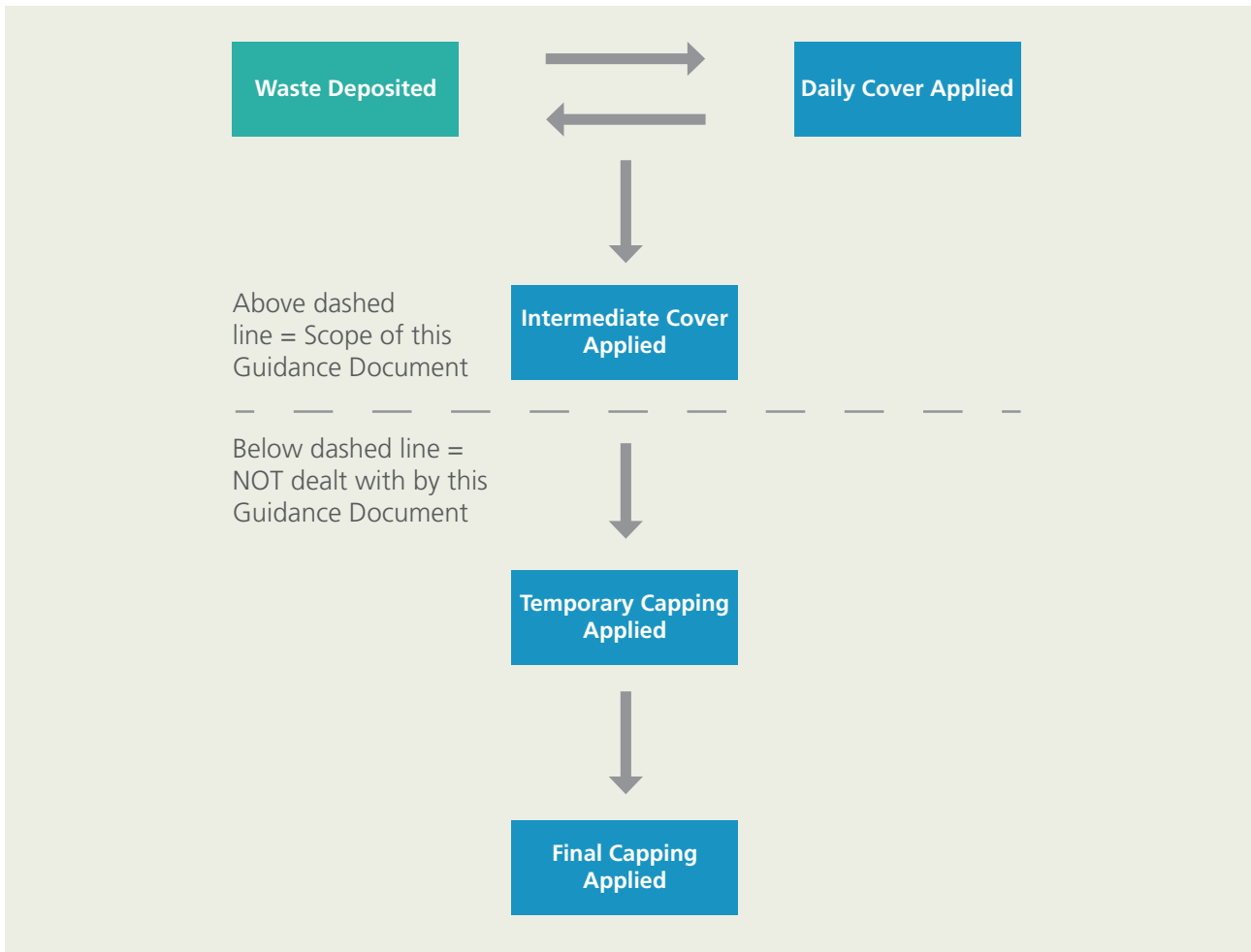


Figure 1 Typical Progression Of Cover And Capping Systems At A Landfill

The EPA requirements for temporary and final capping at MSW landfills are not addressed in this document. Temporary and final capping requirements are specified in the landfill operator's licence and in other EPA guidance issued, such as the Landfill Site Design manual (EPA, 2000).

This guidance does not address the health and safety aspects of using different types of cover materials at a landfill. The waste operator must address all aspects of work practices in accordance with health and safety legislation.

While this document sets out what the EPA considers to be best practice for landfill operators to follow in relation to the use of cover material, it does not override any specific requirements in this regard that may be specified in any individual EPA licence or that have been agreed by the EPA.

2. DAILY COVER

Daily cover is the term used to describe material (about 150 mm if soil cover is used) spread over deposited waste at the end of each working day. Appropriate synthetic materials may also be used.

The main objectives of daily cover at a landfill include:

- Prevention of wind-blown litter;
- Deterrence of scavenging by birds or other animals;
- Prevention of fly infestations;
- Reduction of odour and landfill gas emissions;
- Reduction of dust nuisance;
- Deterrence of vermin such as rats;
- Reduction of the risk of fire; and
- Improvement of the visual appearance.

Daily cover should not:

- Be itself a source of odour;
- Encourage or give rise to nuisances such as flies, dust, scavenging birds or litter;
- Cause pollution;
- Breach licence requirements in terms of what waste types are acceptable at the landfill;
- Impede the proper functioning of site infrastructure;
- Be a feedstock for future landfill gas production or conflict with BMW diversion targets;
- Cause ponding or perched leachate build-up within a landfill – this can occur if the cover used is not free-draining or has a high clay content;
- Interfere with the functioning of the landfill gas collection and extraction system;
- Degrade over time causing secondary problems such as those listed above.

In the past, materials such as soil, subsoil, stone, rock, and construction and demolition wastes like bricks and crushed concrete have been used as daily cover. However, many of these materials are a valuable resource and their availability is dependent on the level of local building/construction activity. The trend is now for operators to generally use other types of cover materials, at least for some portion of the landfill's cover requirements.

Cover materials should only be used when an assessment of their appropriateness for use at that specific landfill has been undertaken by the landfill operator and their use has been agreed in advance by the EPA.

It is advised that a landfill should always maintain a back-up supply of inert cover materials for use in case of emergencies such as a fire.

3. INTERMEDIATE COVER

Intermediate cover refers to the placement of suitable, adequate and stable material (minimum 300 mm if soil is used) over deposited waste for a period of time prior to temporary capping or prior to further disposal of waste in that area. Daily cover should generally be replaced by intermediate cover in any area of an active cell where a new covering lift of waste is not planned within the next seven days, although the precise timeframe may vary according to prevailing conditions.

Intermediate cover has the same objectives as daily cover, i.e. to control nuisances such as litter, odour and vermin, but in addition, intermediate cover should reduce the infiltration of rainfall, help prevent the escape of leachate and landfill gas, and be functional over a prolonged period of time (e.g. weeks or months).

Not all materials used as daily cover may be suitable for use as intermediate cover. Intermediate cover needs to be robust and to provide greater long-term protection to the landfill surface until such time as capping takes place or waste placement in that area recommences.

Subsoils that are not free-draining are more suitable for use as intermediate cover than daily cover, because they will help prevent the ingress of rain and lessen fugitive landfill gas emissions and leachate break-outs.

Areas with intermediate cover should be regularly inspected by site staff, and any eroded cover materials should be replenished.

If the area subject to intermediate cover is to be used for the further tipping of waste, then the cover should be extensively scraped off or punctured immediately prior to waste placement in order to prevent leachate perching within the waste body in the future. The cover that is to be scraped off should be checked for contamination by unsuitable waste and may be put to one side for re-use if feasible. While there are practical limitations on the extent to which all the cover material can be removed, the removal process should ensure that any remaining intermediate cover does not significantly impede the flow of landfill gas and leachate.

If the area subject to intermediate cover is never to be used again for further tipping, or if it is likely to be left undisturbed without any further waste placement for a long time (e.g. greater than 6 months), then a more robust temporary capping system may need to be put in place. The details of this temporary capping should be agreed in advance by the EPA.

4. ENFORCEMENT ISSUES AT LANDFILLS

Inspections and audits of landfills conducted by the EPA in recent years have found recurring problems in relation to the use of cover. These problems include, but are not limited to:

- Inadequate coverage or inadequate depth of cover material applied, which leads to waste being visible;
- Erosion of previously deposited cover material from wind and rainfall leading to exposed waste (see Figure 2);
- Use of unsuitable materials for odour control and sometimes odour coming from the cover itself;
- Poor coverage of waste on side slopes (see Figure 3);
- Waste slopes too steep to allow the application of cover material by mechanical plant;
- Poor characterisation and consistency of cover materials;
- Inappropriate cover material used for prolonged periods;
- Absence of appropriate cover material underneath haul roads to minimise fugitive landfill gas emissions;
- Damage to cover materials arising from vehicle movements;
- Poor maintenance following rainfall and heavy surface water run-off resulting in etching and channeling within the cover material;
- Fly infestation on or under the cover material (see Figure 4);
- Inappropriate/unapproved use of waste material as cover.

The proper use and application of cover materials will continue to be a key enforcement issue for the EPA during inspections and audits of landfills.



Figure 2 Eroded Cover At Landfill



Figure 3 Inappropriate Covering Of Side Slopes



Figure 4 Fly Infestation On Hessian Cover

4.1 RECOVERY VERSUS DISPOSAL

The use of waste that has been agreed by the EPA as cover material at a landfill is considered to be a waste recovery activity rather than a waste disposal activity. Under Irish waste management regulations, a landfill levy is payable by the landfill operator on all waste disposed of at the landfill.

The use of inappropriate waste, or excessive quantities of waste over what is normally required as landfill cover, is considered by the EPA to be a “sham recovery” activity. This “sham recovery” cannot be used as a legitimate way to avoid payment of the landfill levy or to circumvent policy initiatives such as the diversion of biodegradable municipal waste from landfill. Landfill operators must take appropriate measures, including the implementation of proper waste acceptance and verification procedures, to ensure that sham recovery is not being practised at their landfill. An example of an inappropriate waste type used as landfill cover would be the unstabilised mechanically separated “fines” fraction generated from the processing of MSW.

Enforcement action in relation to the non-payment of landfill levies may be taken by the relevant competent authority where there is non-compliance with the legislation in this matter.

The landfill operator must ensure that the amount of cover used is sufficient to control nuisances and to perform properly as a cover material, but that the quantities are not so great that cover might be potentially considered as a disposal activity in its own right. The operator needs to be able to justify by calculation the amount of each type of cover material used at the landfill.

Volume to weight conversion factors for different waste types are listed in the Landfill Levy Regulations.

4.2 BIODEGRADABLE WASTE MATERIALS

Materials that contain putrescible waste or unstabilised biodegradable municipal waste should not be used as landfill cover or mixed with other materials for use as landfill cover.

The use as landfill cover of “fines” material (arising from waste processing operations) has increased in recent years. This material is often described by the waste licensee as being from construction and demolition (C&D) sources and hence assumed to be inert. Given the widespread practice in the industry of co-processing C&D skip wastes and other wastes of municipal/commercial origin (i.e. mixed skip waste), there is the potential for C&D fines to contain significant amounts of biodegradable wastes. As a consequence, any landfill operator wishing to use this type of fines material as cover must have the material tested for respiration activity (AT_4), and must be able to demonstrate that the source of the cover material is such that it is of predominantly C&D origin and that it is fit for purpose. EPA agreement to use fines material as cover will likely have a number of caveats attached, requiring ongoing verification to be carried out to ensure that only suitable material is used as cover.

In relation to the use as cover of biodegradable waste that has undergone biological treatment, the landfill operator must be able to demonstrate that the material has been adequately stabilised to be considered as bio-stabilised residual waste.

In the case of bio-stabilised residual waste, stabilisation means the reduction of the decomposition properties of the waste to such an extent that offensive odours are minimised and that the respiration

activity after four days (AT_4) is $<10 \text{ mg O}_2/\text{g}$ dry matter until 1 January 2016 and $<7 \text{ mg O}_2/\text{g}$ DM thereafter.

Bio-stabilised residual waste that meets the above EPA standard may be used as landfill cover where it:

- Has been stabilised in accordance with the landfill licence;
- Complies with any requirements of the Department of Agriculture, Food and the Marine relating to the management of animal by-products;
- Is fit for purpose;
- Has been agreed in advance by the EPA as cover for the landfill in question.

Landfill operators must pay close attention to the quality of any bio-stabilised residual waste to be used as landfill cover, to ensure that it remains fit for purpose and is in accordance with this guidance document on an ongoing basis. Where such material is accepted for use as landfill cover, landfill operators should record it as an incoming waste in accordance with their licence, and should generally use EWC code: 19 05 99 wastes not otherwise specified.

The website of the Department of Agriculture, Food and the Marine contains useful information in relation to the management of animal by-products.

See: <http://www.agriculture.gov.ie/agri-foodindustry/animalbyproducts/>.

4.3 AUTOSHREDDER RESIDUE (ASR)

Autoshredder residue, also referred to as fragmentised waste, frag or fluff, was used occasionally as landfill cover in Ireland in the past. The waste is generated from the shredding of end-of-life vehicles (ELVs) after the removal of hazardous and certain recyclable materials. The shredder residue is now not considered to be suitable as daily or intermediate cover at landfills. It has the potential to contain high levels of contaminants such as heavy metals, oils, and persistent organic pollutants (POPs) including certain brominated flame retardants and polychlorinated biphenyls (PCBs). It also presents a fire hazard, can be visually unattractive and can cause dust and litter concerns, depending on the composition of the material. Full testing and characterisation of the ASR waste is required prior to it going to landfill for disposal.

Action is needed by Ireland to increase re-use/recovery/recycling of ELV materials in order to meet the diversion/recovery targets under EU and Irish legislation. Large-scale landfilling of this waste is not considered sustainable in the long term. More information may be found in the EPA's National Waste Report series.

5. CRITERIA FOR SELECTION OF COVER MATERIAL

Table 1 summarises the issues that need to be addressed when considering what type of daily or intermediate cover material to use at a landfill.

Table 1 Criteria For Selection Of Cover Material

<p>Performance</p> <ul style="list-style-type: none"> ➤ Will the cover material control nuisances such as odour, flies, litter and dust? ➤ Will the cover material itself cause other problems such as litter and dust?
<p>Availability, Consistency And Quality Of Supply</p> <ul style="list-style-type: none"> ➤ Is there a source nearby? ➤ Does the availability vary from time to time? ➤ Is the quality consistent?
<p>Ease Of Application/Removal</p> <ul style="list-style-type: none"> ➤ Is it easily applied to the working face? ➤ Does special equipment/machinery have to be purchased to apply the material? ➤ Is the cover to be removed each day before placement of waste?
<p>Permeability</p> <ul style="list-style-type: none"> ➤ Is it free draining so that perched leachate does not become a problem (e.g. on areas that will be subject to further waste filling)?
<p>Combustibility</p> <ul style="list-style-type: none"> ➤ Is the material easily combustible and thereby presenting a fire risk?
<p>Chemical Contamination</p> <ul style="list-style-type: none"> ➤ Is the material derived from a contaminated site or from contaminated material? ➤ Does it contain elevated levels of certain contaminants? ➤ Is it potentially a hazardous material? ➤ Is there the potential for the release of contaminants that could be harmful to the environment or to human health?
<p>Potential Loss Of Revenue</p> <ul style="list-style-type: none"> ➤ Does the material take up a lot of void space in the landfill?
<p>Exposure Of Site</p> <ul style="list-style-type: none"> ➤ Are high winds a regular problem? ➤ Is the site in a visually sensitive area?

Traction Needs Of Vehicles

- Does the material provide adequate support and traction for vehicles?

Distance To And Sensitivity Of Nearest Receptor(s)

- Are complaints regularly received in relation to nuisances?
- What are the predominant nuisance issues with the site?
- Is there potential nuisance or pollution from the cover itself, e.g. dust, odour, visual?

Limitations

- Does the cover material require any special storage or handling?
- Is the suitability of the material compromised under certain weather conditions, e.g. high winds?
- Is the suitability of the material restricted to specific areas/purposes (e.g. only suitable for application on horizontal working face areas and not suitable for side slopes)?
- Will the material require blending prior to use and, if so, is a suitable area available to facilitate this?

BMW Diversion

- Is the material derived from a municipal waste origin and does it potentially contain biodegradable waste?
- Has the material been stabilised in accordance with the landfill licence?

Sustainability

- Does the use of the material as landfill cover constitute an appropriate use of a specific waste stream or a valuable resource that could otherwise be re-used, recycled or recovered for a higher-value purpose?

Note: Topsoil is a valuable natural resource and should normally be used for purposes other than landfill cover. Where soils are used for daily cover, it is recommended that they be removed at the start of the next working day and subsequently re-used as much as possible in order to conserve this valuable resource.

Physical Stability

- Will the material change its physical properties when placed into the landfill environment to such an extent that it will cause further difficulties on-site (e.g. dried materials becoming re-wetted on the landfill surface and then behaving in a liquid- or slurry-like manner, which could compromise traction needs of vehicles and stability of the landfill body)?

Cost

- Is it expensive to buy (where relevant) and to transport to the site?

Compliance With Legislation

- Does use of the proposed cover material comply with all relevant legislation?

Appendix A provides a summary of materials that have been used as landfill cover in Ireland in the past, are currently in use or may potentially be in use in the future, along with some advantages and disadvantages of each type. The list is not exhaustive and should not be considered as a definitive list of specific wastes/cover materials to which the EPA will agree at specific sites. This list is provided to assist operators in the assessment of the suitability of particular cover materials for use at Irish landfills.

Other novel materials may be considered as cover by the EPA, but first the landfill operator will have to undertake an assessment of the material by addressing the issues outlined in Table 1, to justify its appropriateness for use as cover material at a specific landfill. In general, the landfill operator needs to agree with the EPA the type of materials proposed to be used as daily and intermediate cover.

6. COVER MANAGEMENT PLAN

The implementation of robust landfill cover practices is one of the major control measures available to operators to manage the impact of the landfill on the surrounding environment. The techniques and materials that operators use are likely to change over the lifetime of the facility, and it is important that operators be aware of the adequacy of their cover management strategy at any given time.

It is therefore recommended best practice by the EPA for landfill operators to have a documented cover management plan in place, which will ensure that the appropriate cover materials and practices are used at the landfill having regard to the guidance outlined in this document and the site-specific issues that pertain to each individual facility. This cover management plan should document all details and procedures relating to cover at the landfill, and should form part of the Landfill Environmental Management Programme (LEMP), which is a requirement of most EPA waste licences. Issues to be addressed in the Cover Management Plan are outlined in Table 2.

Table 2 ISSUES TO BE ADDRESSED IN THE COVER MANAGEMENT PLAN

Description Of The Materials

- Details of the primary and back-up types of cover materials proposed to be used and reasons for choosing each;
- A description of each type of cover material (including where relevant, the waste materials or origin from which the cover material has been derived) and any relevant quality criteria (e.g. only clean soils derived from known sources);
- In the case of manufactured products, details of the suppliers of materials and material safety data sheet (MSDS);
- Relevant EWC codes, if waste material is being used;
- Major limitations/issues to consider with regard to the use of certain materials – this assessment needs to be site-specific (see Appendix A also).

Stockpile Management

- Size of stockpiles required and storage requirements for the stockpiles – a procedure for the regular review of stockpiles to ensure that sufficient quantities are held on-site;
- An appropriate area designated for cover material storage – e.g. within the footprint of lined cells where the surface water run-off from the cover material may itself be a source of contaminants; ensure that adequate separation of cover stockpile from lining system is in place to protect integrity of lined cell;
- Measures to control fire risk (e.g. location and size of cover material stockpiles, and measures to minimise self-combustion);
- Provision of an on-site stockpile of inert materials at all times for use in the event of a fire outbreak (1 month stockpile recommended for back-up and emergency purposes);

Cover Material Characterisation And Quality Assessment

- Programme for regular quality assessment and characterisation of the cover material;
- Chemical composition testing of the cover material where necessary, e.g. potentially contaminated soils, ash;
- Visual assessment – e.g. presence of contamination or foreign objects;
- Stability testing of stabilised biowaste;
- Permeability testing, if necessary.

Cover Application Techniques

- Procedures in relation to cover application techniques;
- Minimising the size of the working face to aid the covering of waste;
- Ensuring all exposed areas including the side slopes/flanks are covered;
- The use of special cover techniques for particular parts of the landfill - e.g. pre-construction of clay berms along flank areas;
- How the weather may influence the type of cover material used and ensuring waste remains covered if conditions change (e.g. high winds procedure);
- Details of the target thickness of cover application to be used;
- Avoiding tracking of vehicles over previously covered areas, causing damage;
- Replacement of any cover at any location within the facility that is eroded, washed off or otherwise removed by the end of the working day;
- Design details for special circumstances - e.g. around well heads, under haul roads;
- Recording of quantities used each day.

Reviews Of Cover Management Practices

- Programme for regular reviews of effectiveness of cover management practices;
- Review of the number and types of complaints received. Ensure cover practices are not causing nuisance, e.g. dust, litter, odours;
- Review of any surface volatile organic compound (VOC) emission survey results, and comparison/interpretation with the surface VOC trigger levels specified in the operator's waste licence or the EPA's Air Guidance Note 6 (AG6) Surface VOC Emissions Monitoring on Landfill Facilities - <http://www.epa.ie/downloads/advice/air/emissions/AG6.pdf>
- Visual assessment of performance, e.g. check regularly for effectiveness of the cover material at controlling nuisances and the erosion of cover on the waste and replace as necessary. Any issues with regard to the adequacy of landfill cover materials or techniques should be assessed and recorded in the weekly nuisance inspections at the facility;
- Periodically assess the impact of any infrastructure protrusions through the intermediate cover system (e.g. vertical wells, internal haul roads), to ensure that the integrity of the cover system is not compromised so as to cause any localised but significant fugitive emissions to the environment;
- Quarterly assessment of the adequacy of the overall cover management plan.

7. MISCELLANEOUS ISSUES

7.1 SIDE SLOPES

The side slopes or flank areas of deposited waste are typically one of the most difficult areas of the active cell to manage from a daily/intermediate cover perspective. Due to their relatively steep gradient and exposure to the elements over a prolonged period, cover materials placed on side slopes can become washed off or eroded over time, and further top-ups or additions of cover material are difficult to apply with machinery retrospectively.

Coupled with this, the potential environmental impact of poor landfill cover in these areas is high, due to their proximity to the edge of the lined containment area, the boundary of the site (e.g. closer proximity to neighbouring lands and property), and their increased susceptibility to wind/rain exposure.

The EPA has regularly encountered problems at landfills on side slopes such as the deposition of waste beyond the lined cell footprint, the escape of leachate break-outs from the lined area, litter nuisance, the infiltration of atmospheric oxygen into landfill gas collection systems contained within the waste body, and the fugitive escape to atmosphere of landfill gas and nuisance odours. Landfill operators need to give careful consideration to the landfill cover materials and practices that they employ on side slope areas to ensure that they maintain adequate environmental control in these areas throughout the lifetime of the operational phase of each cell.

Regardless of whether the waste side slopes are located on the external facing perimeter of a cell or on the internal face adjacent to another unused cell (e.g. interface running parallel to an intercell bund), these side slopes will be left undisturbed (without any further waste placement for disposal) for a considerable length of time. This effectively means that daily cover is not an appropriate control measure in these areas, and intermediate cover should be used instead. In this context, it is generally of more importance on side slopes to use relatively low permeability cover materials such as sub-soils or a geomembrane such as LLDPE.

Where a long-term side slope will be created along a cell perimeter, landfill operators should give consideration to the potential use of pre-constructed clay berms (before the next lift of waste is about to be placed) as a means of providing intermediate cover, and then depositing the waste up against the inside face of the berm, rather than trying to apply loose cover materials down the slope after the waste has been deposited. Subsequent lifts of waste would then involve the construction of additional clay berms on top of the previous one (but stepped in from the previous one, possibly in a bench manner) and then the process would be repeated. In the case of interface side slopes, the clay berms could largely be stripped back as necessary (and re-used) when waste placement was due to commence in the adjacent cell.

The use of clay berms in the manner described here can provide a very suitable long-term intermediate cover on side slopes, and has certain advantages such as:

- Reduce the potential for leachate breakouts from the waste body;
- Reduce the potential for litter generation on side slopes;
- Reduce the potential for rainwater and oxygen infiltration into the waste body;
- Reduce the potential for fugitive emissions of landfill gas and odours from side slopes;
- Reduce the need for machinery to traverse side slopes to apply additional landfill cover;
- Improve the visual appearance of the landfill;
- Provide a backstop for compactors and other machinery to place waste up against.

Some landfills also supplement this approach, or use an alternative one of installing a gas barrier geomembrane along the outside flank, thereby dramatically reducing the potential for fugitive landfill gas emissions. Further information on the use of pre-constructed clay berms can be found in the presentation entitled "Cover at Landfills", which is available at <http://www.epa-pictaural.com/nav/sWaste09.php>

Whatever specific cover materials and methodologies landfill operators employ on side slope/flank areas, they must provide for adequate control of potential nuisances and emissions to the environment in accordance with EPA licence requirements over a prolonged period of time.

7.2 LANDFILL GAS GENERATION

Some potential landfill cover materials, e.g. woodchip, compost, may themselves be biodegradable and therefore have the potential to generate decomposition gases in the long term. Landfill operators should be aware of the potential impact of the types and quantities of landfill cover materials that they use on landfill gas generation at the site and factor this into their landfill gas generation prediction modelling and the need for additional (e.g. up-front) gas management infrastructure.

7.3 FIRE RISK ASSOCIATED WITH SELF-COMBUSTION

Some landfill cover materials comprise almost entirely combustible matter, e.g. shredded wood or compost. Under particular conditions, large stockpiles of such material can start to self-combust, which initially at least is typically exhibited as smouldering. While this can give rise to smoke, nuisance and potential impacts on local air quality, there is also a danger that any fire could spread into the general waste body itself, where the stockpile is located on top of or adjacent to the waste (see Figure 5). Landfill operators should be aware of such a risk and take appropriate measures to minimise it, e.g. reduce the size of stockpiles, control moisture levels within the stockpile, reduce air infiltration through the stockpile, monitor the temperature within certain stockpiles. In addition to any risk reduction measures adopted, landfill operators should always maintain a stockpile of inert cover materials on-site for use in case of a fire commencing at the landfill.



Figure 5 Fire On Landfill

7.4 MIXING/BLENDING OF COVER MATERIALS

Where the properties of a specific material are proposed to be augmented with another material to improve its performance or suitability as landfill cover, this may need to be done by mixing or blending the materials either pre-application or at the landfill working face itself. An example of this may be the mixing of treated sludge with soil to improve traction for vehicles.

Landfill operators must ensure that where the mixing or blending of waste materials is proposed in the context of using the output as landfill cover, the following is adhered to:

- ▶ The mixing/blending of waste with other materials (which may or not be a waste in their own right) is an activity that is allowed for under the relevant licence;
- ▶ The mixing/blending activity is undertaken in a manner that will not cause nuisance or environmental pollution, and is done in compliance with the specific requirements of the operator's licence;
- ▶ The mixing/blending activity, and also the storage of the initial feedstock materials pre-blending, is undertaken in suitable designated areas within the landfill protected against spillage – e.g. within the footprint of a lined cell with leachate collection;

- ▶ The mixing/blending activity shall not be used as a means to change the physical characteristics of that waste material so as to meet a relevant quality criterion (e.g. levels of heavy metal contamination, bio-stability, hazardousness) that would otherwise render the waste material unsuitable for use as landfill cover;
- ▶ Any proposed mixing/blending of waste materials to be used as landfill cover has been agreed in advance by the EPA and is documented in the Cover Management Plan.

REFERENCES & ADDITIONAL INFORMATION SOURCES

Environment Agency (undated): LFE6 – Guidance on Using Landfill Cover Materials.

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APPENDIX A COVER MATERIALS - ADVANTAGES & DISADVANTAGES

Table 3 provides a summary of materials that have been used as landfill cover in Ireland in the past, are currently in use, or may potentially be in use in the future, along with some advantages and disadvantages of each. The list is not exhaustive and should not be considered as a definitive list of specific wastes/cover materials to which the EPA will agree at specific sites. This list is provided to assist operators in the assessment of the suitability of particular cover materials for use at Irish landfills.

Other novel materials may be considered as cover by the EPA, but first the landfill operator will have to undertake an assessment of the material to justify its appropriateness for use at a specific landfill.

The comments in Table 3 under the headings of “Advantages” and “Disadvantages” are intended to be of assistance in a general sense and may be subject to a particular context. For example, a cover material that is relatively free draining may be considered desirable and advantageous for use as daily cover, but this characteristic may be a disadvantage if the same material is proposed to be used as intermediate cover on side slopes. Similarly, where a cover material is identified as “may have ...”, or “may be ...” In relation to a particular characteristic (either an advantage or disadvantage), this should not be interpreted as indicating that it always has this characteristic, and the landfill operator must consider the context of the specific origin of the material and how it is proposed to be used.

Table 3 Cover Materials – Advantages and Disadvantages

Type of Cover	Use As Daily Cover	Use As Intermediate Cover	Advantages	Disadvantages
<p>Uncontaminated waste soils & subsoils (preferably free draining¹ and of a low clay content).</p> <p>Note: Topsoil is a valuable natural resource and should normally be used for purposes other than for landfill cover.</p>	Generally suitable, about 150 mm depth.	Generally suitable, about 300 mm depth.	<p>Good visual appearance.</p> <p>Low combustion risk.</p> <p>May have methane and odour oxidative properties.</p> <p>Relatively easy application.</p> <p>Low odour.</p> <p>Can be temporarily seeded if used as intermediate cover.</p>	<p>Low-permeability soils such as clay are not suitable daily cover unless mixed with other materials or when used on flank areas.</p> <p>Possibly dusty during prolonged dry periods, especially if sandy.</p> <p>Traction may be poor in wet conditions.</p> <p>May contain large or irregular stones which can present a puncture risk to geomembrane liners.</p> <p>Use of a valuable resource.</p>

¹ "Free draining" implies that it does not cause perching of liquid for a prolonged period (and generally has a hydraulic conductivity of greater than 5×10^{-6} m/s).

Type of Cover	Use As Daily Cover	Use As Intermediate Cover	Advantages	Disadvantages
<p>Contaminated soils, subsoils (preferably free draining and of a low clay content).</p> <p>Note: Contaminated soils & subsoils can only be used as cover in non-hazardous landfills provided that:</p> <p>A full characterisation in terms of the chemical composition has been undertaken,</p> <p>The waste is non-hazardous,</p> <p>Appropriate site-specific controls are available to sufficiently control any environmental risk.</p>	<p>Assessment required, about 150 mm depth</p>	<p>Assessment required, about 300 mm depth.</p>	<p>Utilises a waste stream.</p> <p>Low combustion risk.</p> <p>May have methane and odour oxidative properties.</p> <p>Relatively easy application.</p> <p>Can be temporarily seeded if used as intermediate cover.</p>	<p>Requires full characterisation in terms of its chemical composition.</p> <p>Low-permeability soils such as clay are not suitable unless mixed with other materials or when used on flank areas.</p> <p>Possibly dusty during prolonged dry periods, especially if sandy.</p> <p>Traction may be poor in wet conditions.</p> <p>May contain large or irregular stones which can present a puncture risk to geomembrane liners.</p> <p>Will require appropriate dedicated storage area.</p> <p>Possibly odorous depending on nature of contamination.</p> <p>Possible health risks depending on nature of contamination, e.g. dust exposure.</p>

Type of Cover	Use As Daily Cover	Use As Intermediate Cover	Advantages	Disadvantages
<p>Uncontaminated construction & demolition wastes (e.g. bricks, crushed concrete, tarmac, stone, rock).</p> <p>Note: This waste stream is generally more appropriate and suitable for use as engineering material (e.g. haul road construction).</p>	Generally suitable, about 150 mm depth.	Generally suitable, about 300 mm depth.	<p>Utilises a waste stream.</p> <p>Good traction for vehicles.</p> <p>Relatively easy application.</p> <p>Low odour.</p>	<p>Availability dependent on development works.</p> <p>May contain large angular solids, glass or sharp fragments which can puncture adjacent geomembranes.</p> <p>May contain gypsum (calcium sulphate, CaSO_4) – gypsum should be less than 5% of the waste stream.</p>
<p>Peat.</p> <p>Note: Peat is a limited natural resource. It should only be considered for use as cover material where it arises from authorised activities.</p>	Assessment required.	Assessment required.	<p>Low odour.</p> <p>Good visual appearance.</p> <p>May have methane and odour oxidative properties.</p> <p>Can be temporarily seeded if used as intermediate cover</p>	<p>Permeability assessment required.</p> <p>Traction assessment required.</p> <p>May be an inappropriate use of a valuable natural resource.</p> <p>Possibly dusty during prolonged dry periods. Susceptible to wind and water erosion if allowed to dry out.</p> <p>Possible blockage to local drainage systems due to run-off of high levels of suspended solids.</p>

Type of Cover	Use As Daily Cover	Use As Intermediate Cover	Advantages	Disadvantages
<p>Construction & demolition fines (produced from trommelling/ screening of C&D wastes only).</p> <p>Note: The C&D fines material should not contain putrescible or unstabilised biodegradable waste.</p>	Assessment required.	Assessment required.	<p>Relatively easy application.</p> <p>Utilises a waste stream.</p> <p>Low odour.</p>	<p>May contain gypsum (calcium sulphate, CaSO₄) – gypsum should be less than 5% of the waste stream (gypsum mixed with biodegradable waste can lead to odorous H₂S (hydrogen sulphide) emissions).</p> <p>Dust may be an issue.</p> <p>Permeability assessment required.</p> <p>May contain non-inert or biodegradable waste.</p> <p>May contain glass or sharp fragments which can puncture adjacent geomembranes.</p> <p>Traction may be difficult when wet.</p>
Quarry sand and dust.	Assessment required.	Assessment required.	<p>Low odour.</p> <p>Potentially utilises a waste stream.</p> <p>Relatively easy application.</p>	<p>Permeability assessment required.</p> <p>Traction assessment required.</p> <p>Dust may be an issue.</p>

Type of Cover	Use As Daily Cover	Use As Intermediate Cover	Advantages	Disadvantages
Hessian and highly permeable geosynthetic textile-like materials.	Assessment required	Not suitable.	<p>Relatively easy application.</p> <p>Permeable to gas and water.</p> <p>Biodegradable (in the case of hessian).</p> <p>Useful for daily covering of side slopes/flanked areas (i.e. not intermediate cover).</p> <p>Saves void space.</p> <p>Good visual appearance.</p>	<p>Cannot be used on its own as daily cover and must be used with other cover materials such as soils, stones or other suitable materials.²</p> <p>Can only be used once and must not be scraped/pulled back and re-used.</p> <p>High winds can dislodge hessian and other sheet-based materials if not weighed down.</p> <p>Fly infestation is potentially an issue.</p> <p>Not suitable for areas used by vehicles.</p> <p>Allows vermin access to the waste.</p>

² In the case of hessian and highly permeable geosynthetic textile-like materials, it is recommended that use as daily cover be augmented by the use of other suitable soil-like materials to ensure the adequate control of odours and flies in particular. The permeable materials should be fully covered over by the soil-like cover material at a frequency of at least once per week, such that the permeable cover material is not the sole cover material in place for any longer than a few days. For weekend cover, soils or similar should be used instead of the permeable daily cover.

Type of Cover	Use As Daily Cover	Use As Intermediate Cover	Advantages	Disadvantages
<p>Compost (from source segregated, separately collected biodegradable materials including biodegradable municipal waste).</p> <p>Note: Must be stabilised to an acceptable OUR (oxygen uptake rate) (e.g. <13 mmol O₂/kg organic solids/hr) or respiration activity (e.g. AT₄ value of <10 mg O₂/g DM until 1 January 2016 and <7 mg O₂/g DM thereafter). Must meet requirements of Department of Agriculture, Food and the Marine relating to the management of animal by-products.</p>	Assessment required.	Assessment required.	<p>Good visual appearance.</p> <p>Compost mixed with poor-quality soils useful for intermediate cover as promotes vegetation growth.</p> <p>May have methane and odour oxidative properties.</p>	<p>Daily cover is not a good use of high-quality compost.</p> <p>Permeability assessment required.</p> <p>Traction assessment required.</p> <p>Dusty if prolonged dry periods.</p> <p>May be odorous.</p> <p>Needs regular assessment/characterisation of quality and biostability.</p>

Type of Cover	Use As Daily Cover	Use As Intermediate Cover	Advantages	Disadvantages
Treated drinking water sludge	Assessment required.	Assessment required.	Utilises a waste stream	<p>Must be treated appropriately prior to use in order to be de-watered sufficiently (e.g. minimum dry solids content of 20%).</p> <p>Excessive use of sludges could lead to instability in the waste body.</p> <p>Susceptible to being washed off.</p> <p>Permeability assessment required.</p> <p>Traction assessment required.</p> <p>Will require blending with soil at ratio of approximately 1:1.³</p>

3 The requirement for blending with soil may not be needed if the solids content of the sludge is >50%

Type of Cover	Use As Daily Cover	Use As Intermediate Cover	Advantages	Disadvantages
<p>Treated non-hazardous sewage sludge/wastewater sludge</p> <p>Note: "Treatment" in this context should include a biological stabilisation process to reduce the sludge's biodegradability sufficiently, i.e. acceptable oxygen uptake rate (e.g. <math><13 \text{ mmol O}_2/\text{kg organic solids/hr}</math>) or respiration activity (e.g. AT_4 value of <math><10 \text{ mg O}_2/\text{g DM}</math>).</p>	<p>Generally not suitable, assessment required.</p>	<p>Generally not suitable, assessment required.</p>	<p>Utilises a waste stream.</p> <p>Treated sludges mixed with poor-quality soils useful for intermediate cover as promote vegetation growth.</p> <p>May have methane and odour oxidative properties.</p>	<p>Daily cover is not a good use of high-quality treated organic sludge where alternative outlets such as landspreading are available.</p> <p>Must be treated appropriately prior to use in order to reduce odours, kill pathogens and be de-watered sufficiently.</p> <p>Needs to be dewatered – should have a minimum dry solids content of 20% where it is proposed to be mixed with soil prior to use (at approximate ratio of 1:1), otherwise should have a minimum dry solids content of 50%.</p> <p>Excessive use of sludges could lead to instability in the waste body.</p> <p>May contain high levels of contaminants (e.g. heavy metals).</p> <p>May be odorous.</p> <p>Permeability assessment required.</p> <p>Traction assessment required.</p> <p>Needs regular assessment/characterisation of quality and biostability.</p>

Type of Cover	Use As Daily Cover	Use As Intermediate Cover	Advantages	Disadvantages
<p>Bio-stabilised residual waste and bio-stabilised off-specification compost. Must meet AT₄ respiration activity stability standard (i.e. <10mg O₂/g DM until 1 January 2016 and <7mg O₂/g DM thereafter).⁴ Must meet requirements of Department of Agriculture, Food and the Marine relating to the management of animal by-products.</p> <p>Note: Unstabilised or partially stabilised composted material or fines residue from the trommelling or screening of MSW bin or skip waste cannot be used as cover material and must be disposed of within the body of waste. "Off-specification compost" is considered here to mean biologically treated material that has failed one or more of its compost quality criteria other than for stability. It must still meet the relevant biostability/ respiration activity requirements when being used as cover.</p>	Assessment required.	Assessment required.	<p>Utilises a waste stream.</p> <p>If waste is tested and meets the AT₄ respiration activity stability standard after four days then the waste can count as zero BMW when reporting quantities of BMW landfilled.</p> <p>Low odour if stabilised properly.</p> <p>May have good visual appearance if glass, plastics and paper are screened out before use.</p> <p>May have methane and odour oxidative properties.</p>	<p>Permeability must be assessed.</p> <p>May be odorous (particularly if not properly stabilised).</p> <p>Dust may be an issue.</p> <p>Possible presence of paper or plastics may lead to litter problems, or attract birds.</p> <p>Needs regular assessment/ characterisation of quality and stability.</p> <p>May contain high levels of plastic, glass or other fractions which should otherwise be recovered further up the waste management hierarchy (e.g. recycling).</p> <p>Traction may be an issue.</p>

⁴ In the case of "off-specification compost" material derived from the composting of sewage sludge or source segregated biowaste, an alternative respiration-based stability test specified in the operator's waste authorisation may be used to indicate an appropriate level of bio-stabilisation. An example of this would be material achieving an oxygen uptake rate of <13 mmol O₂/kg organic solids/hr. Non-respiration-based compost stability indicators (e.g. carbon-nitrogen ratio) cannot be used to demonstrate biological stability.

Type of Cover	Use As Daily Cover	Use As Intermediate Cover	Advantages	Disadvantages
Woodchip/ shredded timber	Generally suitable, about 150 mm depth.	Assessment required.	<p>Utilises a waste stream.</p> <p>Usually free draining to leachate and gas.</p> <p>Good visual appearance.</p> <p>Reasonable traction in all weathers.</p> <p>May have methane and odour oxidative properties.</p>	<p>Dust may be an issue.</p> <p>May contain high levels of contaminants.</p> <p>Increased fire risk.</p> <p>Loose material susceptible to movement/erosion on side slopes.</p> <p>Biodegradable in long term and so may contribute to landfill gas generation.</p>

Type of Cover	Use As Daily Cover	Use As Intermediate Cover	Advantages	Disadvantages
<p>Low-permeability geosynthetic materials (e.g. geotextiles, LLDPE, PE, GCL, PVC).</p> <p>Note: For information on highly permeable geotextiles, refer to the section above entitled "Hessian and highly permeable geosynthetic textile-like materials".</p>	<p>Assessment required.</p>	<p>Assessment required.</p>	<p>Particularly useful on side slopes and flank areas.</p> <p>Depending on type of material used, can be rapidly deployed and relocated in dry weather.</p> <p>Re-usable.</p> <p>Can be good for reducing emissions of landfill gas and surface water infiltration.</p> <p>Saves void space.</p>	<p>Susceptible to damage/dislodgement in high winds if not weighted down.</p> <p>Not suitable for heavy traffic movements.</p> <p>Low permeability of some products may not be desirable if incorporated into the body of the waste.</p> <p>Relocation can be a problem during wet periods due to the extra weight of absorbed water.</p> <p>Potential fly and odour problems, especially when moved.</p> <p>Low-permeability geosynthetics that have welded or similarly very low permeability bonded joints (e.g. GCL) are suitable.</p> <p>May degrade prior to use if storage is not adequate.</p> <p>Potential for landfill gas escape at edges.</p> <p>Can be costly.</p>

Type of Cover	Use As Daily Cover	Use As Intermediate Cover	Advantages	Disadvantages
Foams and sprays	Assessment required	Not suitable	<p>Adheres to waste surface, allowing its use on vertical or near-vertical waste surfaces, e.g. on baled waste.</p> <p>Saves void space.</p> <p>Low combustion risk.</p>	<p>Permeability, odour, visual appearance depends on product used.</p> <p>Potentially costly.</p> <p>Specialised application equipment needed.</p> <p>Easily damaged by traffic movements across it.</p> <p>Water supply may be an issue in sub-zero temperatures.</p> <p>Careful attention to application/use procedures necessary to ensure the cover material is sufficiently broken up between lifts of waste to allow movement of gas and leachate within the waste body.</p> <p>Difficult to apply in windy weather.</p>
Ash from boilers and other combustion processes etc.	Assessment required.	Generally not suitable, assessment required.	Utilises an existing waste stream.	<p>Requires full characterisation in terms of its chemical composition.</p> <p>May give rise to high-/low-pH run-off initially.</p> <p>Dust may be an issue.</p> <p>Permeability assessment required.</p> <p>Traction assessment required.</p> <p>Can be odorous.</p> <p>Fire hazard if not cooled sufficiently.</p>



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