

Landfill Site Management Plan Guidance



Introduction

Landfill operators (“Authorised Person”) must manage their operations to minimise the risk of pollution from the activities covered by their SEPA Authorisation and must have methods in place that ensure compliance with every condition in their permit. As a minimum the authorised person must ensure that:

1. systems and procedures are in place that ensure compliance with all conditions,
2. compliance is monitored and reviewed,
3. that these systems and procedures are audited, and corrective action taken where the systems are not shown to ensure compliance.

Management Plans set out how an authorised person intends to operate their site to minimise risks to the environment and ensure compliance with their authorisation. Management Plans are developed by the authorised person and set out the risks posed by the activities carried out, and the measures put in place to mitigate those risks.

The Landfill authorisation requires the authorised person to provide and maintain management plans that cover specific risk areas, which must include but are not limited to:

1. [Landfill Gas Management Plan](#);
2. [Water Management Plan](#);
3. [Leachate Management Plan](#);
4. [Waste Acceptance Management Plan](#);
5. [Capping Management Plan](#);
6. [Nuisance Management Plan \(including odour, noise \(and vibration\), dust \(and mud\), litter, aerosols vermin and landfill cover\)](#);
7. [Closure and Aftercare Management Plan](#); and
8. [Monitoring Management Plan](#).

Plans may be created individually or combined into a single document. In addition, there is a specific authorisation condition which relates to the development and adherence to a Restoration Plan, (Restoration Management Plan). The requirements of the Restoration Plan are covered by separate SEPA guidance and documentation, namely, Landfill Restoration General Guidance, and Landfill Restoration Plan – Operator Notification Guidance. These

documents are available on SEPA's website. SEPA reserves the right to add to or delete from the list of Management Plans required in the Authorisation.

Where a Management Plan conflicts with an authorisation condition, the authorisation condition takes precedent.

This guidance is intended to set out the minimum content requirements of Management Plans required by the Landfill Authorisation.

1 Landfill Gas Management Plan

A Landfill Gas Management Plan is required for all landfills for hazardous or non-hazardous waste. The Landfill Gas Management Plan is a live document and should be based on all aspects of landfill gas management considered during an initial Landfill Gas Risk Assessment and proposed operational controls. Probabilistic models, such as GasSim should be used to estimate landfill gas production, screen out risks and inform air dispersion modelling of emissions to air. Predictive modelling will continue to inform the Management Plan as new phases and cells develop but, over time, the authorised person's approach to landfill gas management will be increasingly influenced by empirical data gathered from the site.

The Landfill Gas Management Plan should be written with consideration of the guidance laid out in Landfill Technical Guidance Note 03 as well as the 'best practice' information contained within the Landfill Gas Industry Code of Practice.

The Landfill Gas Management Plan should refer to a landfill gas management system, which means the combination of infrastructure required for landfill gas monitoring, collection, extraction, flaring and/or utilisation, and the management philosophies, techniques and practices designed and adopted to ensure optimal landfill gas recovery.

As a minimum a Landfill Gas Management Plan must:

- evaluate the risks to receptors as identified in the Landfill Gas Risk Assessment,
- identify types and volumes of waste disposed of, and rates of filling,
- estimate the nature and anticipated quantities of landfill gas that could be generated during each phase of development,
- set out performance criteria for landfill gas control measures,
- demonstrate that the control measures meet the requirements and objectives for managing landfill gas,
- set out the procedures for managing changes and reviewing the performance of the landfill gas control system, and
- set out installation criteria and Construction Quality Assurance procedures (for permanent landfill gas control measures).

The Landfill Gas Management Plan must describe how landfill gas will be controlled, including:

- details for containment (lining and capping) and phasing of landfill development and operation,
- clearly stated emission standards based on authorised emission limits and the outcome of the risk assessment,
- how landfill gas will be collected from the waste body (from initial site development through to the aftercare stage) including details of the layout of the collection system,
- how condensate will be managed from the landfill gas control system,
- how each element of the landfill gas collection and control system, utilisation and flaring plant and supplementary processing and treatment equipment will be inspected, maintained and serviced; and
- how collected landfill gas will be managed including methods such as supplementary processing, utilisation, flaring and methane oxidation.

Landfill Gas Accident and Emergency Plan

A Landfill Gas Accident and Emergency Plan must detail how potential accidents and failure scenarios that might lead to:

- migration or other uncontrolled emission of landfill gas,
- an impact on local air quality,
- release of odorants; and
- harm to human health,

will be managed.

The Plan must identify failure scenarios for each component of the landfill gas management system and must assign appropriate actions for elements of the landfill gas control system at specific locations.

Failure scenarios and appropriate actions include:

- compliance criteria requirements such as emissions standards,
- assessment and action criteria – these are derived values based on compliance and emission limit criteria which form an early warning or may trigger additional monitoring or emergency procedures,
- systems failure criteria, for example failure of the landfill gas plant or accidental disconnection of landfill gas collection wells,
- timescales for replacing critical equipment,
- incident/event report criteria, such as odour reported beyond the authorised place boundary,
- emergency actions – immediate measures, for example evacuating buildings,
- changes to landfill gas management techniques and other operational control measures required to control landfill gas on-site, for example installing additional landfill gas collection wells; and
- changes to the strategy for routine monitoring to provide improved data to evaluate the event, for example increased perimeter monitoring.

A Landfill Gas Management Plan must detail what will be done when the following are encountered:

- abnormal results in monitoring data,
- operational problems or failure of the landfill gas control system during routine inspections or maintenance; and
- reported event, for example an odour complaint.

Where remedial action will be needed, expected implementation timescales should be included in the plan, e.g. start enhanced monitoring protocols within 24 hours or incorporate additional collection wells within 7 days (in the case of sacrificial pin wells).

Reviewing a Landfill Gas Management Plan

The Landfill Gas Management Plan must identify key review triggers, e.g. as predicted and measured landfill gas yields (particularly methane) rise and fall, the technology that will be used at each stage (based on the proportion of landfill gas that be successfully collected) and include a plan for recovering landfill gas at low concentrations where it may no longer be a financial incentive.

The Landfill Gas Management Plan should take account of the impact of the forthcoming ban on biodegradable municipal waste disposal at landfill and explore options of heat recovery and alternative uses of energy.

The Landfill Gas Management Plan must reference the current version of GasSim to consistently set appropriate measures for landfill gas collection efficiency assessments.

The technology used must:

- minimise surface methane emissions,
- efficiently combust recoverable gas.

The type and integrity of the capping in any risk-based assessment of passive landfill gas control by bio-attenuation, must be considered.

2 Water Management Plan

A site-specific Water Management Plan must set out how rainwater, surface water and groundwater will be managed. It must account for local weather, hydrology and hydrogeology, be part of the engineering design, and must also link to the Restoration Plan.

The surface water management system must be designed to achieve recognised industry best practice. The Environmental Services Association has published an Industry Code of Practice LGG116: Sizing of Surface Water Management Systems at Landfill Sites, which may be of assistance.

The Water Management Plan must detail, where applicable, how operations will be designed to:

- intercept rainwater running off areas outside the landfill, then channel this water away from all construction works or operational and post-closure phases;
- carry out water balance calculations based on accurate data for the site location, accounting for seasonal variations and likely changes in rainfall pattern or flood risk, if the site is near rivers or coasts, caused by climate change;
- manage rainwater that comes into contact with the waste in the landfill, or liquid leaching from the waste, as leachate (which will likely be further detailed in the Leachate Management Plan);
- manage rainwater that comes into contact with waste at Directly Associated Activities, as contaminated surface water, unless demonstrated otherwise;
- treat rainwater that does not come into contact with the waste to remove suspended solids before use or discharge;
- install a temporary cap on non-operational areas and install a permanent cap and restore completed areas (including flanks) as soon as practicable;
- confirm how surface water will be collected from capped areas;
- ensure surface water drains on the landfill accommodate settlement;
- cope with predictable storm events;
- ensure there is sufficient capacity;

- prevent the direct discharge of hazardous substances to groundwater and avoid pollution of the water environment by non-hazardous substances; and
- allow safe access for monitoring of surface water levels/flows and chemistry (features like v-notch weirs could be routinely included enabling spot measurements of flow to be undertaken readily).

The Water Management Plan must also detail how it is designed to protect and manage groundwater to:

- control groundwater and prevent it entering the engineered landfill cells;
- accommodate calculated groundwater flows, accounting for seasonal variations and the likely influence of climate change;
- manage the risk of clogging in drainage layers;
- accommodate discrete spring flows;
- accommodate anticipated settlement and overburden; and
- allow safe access for monitoring of groundwater levels/flows and chemistry.

The Water Management Plan must clearly link to the Hydrological Risk Assessment(s) (HRAs) undertaken for the site. The Hydrological Risk Assessment (and potentially Water Management Plan) should be reviewed and submitted to SEPA:

- if any changes to design or operation of site are proposed, for example, in support of authorisation variation;
- ahead of closure, to justify that the aftercare regime is adequate;
- ahead of surrender;
- if there is a significant water pollution incident at the site; and
- if routine monitoring results show the landfill is behaving significantly differently to what was predicted by the original HRA.

Surface Water Discharges

For any discharge from the landfill to the Water Environment there must be a risk assessment undertaken and referenced in the Water Management Plan. SEPA will include limits on the quality/quantity of the discharge in the Landfill Authorisation. The authorised person must ensure that it is adequately monitored and there should be a clear link between the Water Management Plan and the Monitoring Management Plan.

3 Leachate Management Plan

A Leachate Management Plan for landfills accepting hazardous or non-hazardous waste must be developed. The plan must show how leachate will be collected, treated, disposed of, and monitored, from initial site development through to surrender.

It is important to note that from a Hydrological Risk Assessment perspective the key concern is leachate head above the liner. Where there are retro drilled leachate wells that do not penetrate the full depth of the waste mass then leachate heads (above the cell base) will need to be calculated and recorded accordingly.

For cells with a steep base, hydraulic modelling may be necessary to demonstrate how leachate heads at the monitoring point reflect leachate heads above the cell base.

The leachate management system must be continuously reviewed, and changes reflected in an updated Leachate Management Plan. The leachate extraction and monitoring infrastructure and procedures must remain fit for purpose.

The Leachate Management Plan must include:

- site-specific action levels, which are below the specified compliance limit;
- an appropriate water balance calculation to predict the volume of leachate produced over time;
- demonstration of adequate capacity within the leachate management system to extract, store, treat and dispose of leachate volumes expected, based on water balance calculations;
- procedures and responsibilities to install, operate, maintain and monitor the leachate control measures;
- procedures to inspect, maintain and service each element of the leachate collection, control and discharge system, including supplementary processing and treatment equipment;
- installation criteria and Construction Quality Assurance (CQA) procedures;
- measures to minimise potential emissions of landfill gas and odour;

- procedures for extreme weather events – such as high rainfall and freezing temperatures; and
- how the impact of climate change will be considered, for example the potential for wetter winters and drier summers.

The Leachate Management Plan must also identify the response to:

- abnormal results in monitoring data;
- operational problems or a failure in the leachate control system during routine inspections or the maintenance programme; and
- leaks or spills of leachate.

It is desirable to have separate leachate monitoring wells rather than relying on leachate level monitoring in extraction wells. If leachate levels can only be monitored in extraction wells, then this must be accounted for that in monitoring protocols and referenced in the Leachate Management Plan. We encourage authorised persons to periodically undertake hydraulic tests (for example, a rising head test or similar) on the leachate extraction wells to better characterise the relationship between pumped and rest leachate levels.

4 Waste Acceptance Management Plan

The Waste Acceptance Management Plan (WAMP) must detail how the authorised person will comply with their authorisation, the Criteria and Procedures for the Acceptance of Waste at Landfills (Scotland) Direction 2005 (as amended), the Duty of Care: Code of Practice for Managing Controlled Waste, and where relevant, the Special Waste Regulations 1996 (As Amended).

All types of landfill site must have a Waste Acceptance Management Plan.

The complexity of demonstrating compliance, and therefore the Waste Acceptance Management Plan, is directly linked to the types of waste accepted. Where landfill activity is limited to the acceptance of non-hazardous waste, without the creation of any separate cells for Stable Non-Reactive Hazardous Waste (SNRHW) or Gypsum/High Sulphate, then Paragraph 13 of the WAC Direction(s) is the primary consideration.

Waste Acceptance

The following must be detailed in the Waste Acceptance Management Plan:

- the type of waste the landfill site is authorised to accept and specifically excluded from accepting,
- the landfill classification (hazardous, non-hazardous or inert),
- the types of waste authorised, by EWC Code, and
- the waste acceptance criteria for the landfill classification, as specified in the 2005 direction(s) and originally sourced from EU Council Decision 2003/33/EC, which includes leaching limit values for;
 - ❖ inert waste (Tables 1, 2 and 3)
 - ❖ hazardous waste (Tables 6, 7 and 8), and
 - ❖ stable non-reactive hazardous waste and non-hazardous waste that can be accepted in cells for stable non-reactive hazardous waste (Tables 4, 5, 5A and 5B).

Where a non-hazardous landfill is also authorised to accept stable non-reactive hazardous waste and/or gypsum and other high sulphate bearing materials, the following details are also required in the Waste Acceptance Management Plan.

- demonstration that these waste types will be deposited in a separate cell designed for the purpose, where no biodegradable waste is accepted, and
- demonstration that any waste accepted in a separate cell will still meet the relevant WAC and leaching limit values.

Waste Acceptance Procedures

A Waste Acceptance Management Plan must include waste acceptance procedures, including details of:

- visual inspection of every waste load received,
- checks on documentation accompanying waste loads, including Duty of Care paperwork to ensure it includes,
- a written description of the waste – see Section 6 & 10 of the Duty of Care code of practice,
- the basic characterisation; and
- the results of any basic characterisation or compliance testing.
- checks on the credentials of the waste carrier.

A Waste Acceptance Management Plan must also include details of procedures to be followed in the event of a waste load being rejected.

NOTE: - Landfill Waste Acceptance Criteria (WAC) analysis (specifically leachate test results) must not be used for waste classification and hazardous waste assessment purposes. WAC analysis is only applicable for landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

5 Capping Management Plan

Capping is fundamental to the control of landfill gas emissions and odour as well as to the minimisation of infiltration of rainwater into the waste mass. The absence of capping or presence of poor-quality capping can lead to increased production of leachate, inefficient landfill gas collection, landfill fires, odour nuisance, erosion, instability and difficulty in accessing areas of the site. For that reason, Landfill Authorisations require progressive capping of the landfill.

SEPA expects that when a new cell is opened, the previous cell will be permanently capped if it has reached final levels and temporarily capped if waste operations in that cell are to cease for a period longer than 3 months. The level/specification of temporary capping will depend on the length of time over which the temporary capping will be expected to provide control over landfill gas escape, leachate production, odour etc. Site specific discussions will be required with SEPA Officers.

A Capping Management Plan is required for all landfill sites.

A Capping Management Plan and, in addition, a relevant drawing, must be provided to identify:

- all areas of the site which have been permanently capped, temporarily capped or remain uncapped and subject to ongoing landfill,
- timescales for capping any area not permanently capped, and
- A drawing showing the cell footprints in addition to the areas that have been /are due to be capped.

6 Nuisance Management Plan

A Nuisance Management Plan (NMP) is required to identify all the nuisance impacts landfill can have on its local community and identify:

- the measures to be taken to **prevent those** impacts, or
- only where prevention is not practicable, to **minimise** them.
- what the authorised person will do if nuisance is caused.

This guidance considers the key potential nuisances specifically referenced in Schedule 9 of the Landfill Authorisation, but there may be other site-specific nuisances to be considered and documented in the Nuisance Management Plan.

Odour

The Nuisance Management Plan must include an odour risk assessment which identifies potential sources generated at the landfill site, the likely effect on sensitive receptors and different mitigation options for each potential source.

The assessment must include consideration of sources including, but not limited to:

- point sources, such as flares, inadequately sealed leachate and/or gas wells,
- linear or area sources, such as tipping faces and cracks in the cap,
- the operational cell,
- temporary situations, such as landfill gas well installation or landfill gas control maintenance and downtime,
- insufficient and/or unsuitable daily cover, intermediate cover, temporary and permanent capping,
- receipt, handling and disposal of specific odorous wastes including high sulphate waste, agricultural waste and sludges,
- activities at Directly Associated Activities,
- disturbance of previously deposited waste,
- leachate weeps, leachate ponding, and
- the potential for odours during waste excavation or removal of cover/temporary caps

Once each source is identified, the Nuisance Management Plan must be used to identify actions and procedures to **prevent** odour from these sources.

Prevention measures could include, for example, a documented decision not to accept high odour risk wastes at the site, or specific treatment prior to acceptance at site.

Where a risk assessment concludes that the odour risk cannot be removed completely, the Nuisance Management Plan must outline the procedures and actions proposed to **minimise** odour. These could include examples like:

- deposit of odorous wastes in specific areas and application of immediate cover,
- adaptation of activities to deal with specific weather conditions, for example wind direction towards sensitive receptors,
- designing tipping areas to be as small as possible,
- applying cover in a timely manner,
- capping waste with a temporary or permanent cap as soon as possible,
- robustly designed and maintained landfill gas control systems,
- timely installation of active landfill gas extraction to minimise uncontrolled emissions,
- enclosed leachate storage and treatment systems,
- leachate sumps, wells and side wall risers, are sealed to restrict fugitive odours but not to restrict access for monitoring and maintenance.

The odour risk assessment and Nuisance Management Plan must be regularly reviewed. To effectively do this the authorised person must have clear procedures to illustrate how odour will be monitored proactively, and how they will respond to on- and off-site odour notifications.

Odour complaints must be investigated by authorised persons in a timely manner. SEPA recommends that these investigations are conducted and documented in the format outlined in SEPA's odour guidance.

Further information and guidance on preparing an Odour Management Plan and investigation of complaints is available in the SEPA Odour Guidance – 2010, and any subsequent amendments, available on SEPA's website.

Noise and Vibration

The Nuisance Management Plan must identify all potential noise and/or vibration sources on site and outline measures to prevent or minimise them.

The Nuisance Management Plan must outline how on- and off-site noise complaints will be investigated and recorded.

The following guidance is available on the SEPA website: [Guidance – Noise and Vibration Management: Environmental Permits](#), and [Environmental Best Practice Guidance Note – Noise Emissions from Vehicle Reversing Alarms](#).

Mud and Dust

Particulate matter can cause nuisance in different forms. At landfills that is typically mud in wet conditions and dust when it is dry.

A dust plan should use a risk assessment approach to identify all potential dust sources, receptors and how impact can be prevented, and if not preventable, minimised using mitigation measures.

Common landfill dust sources which should be considered include

- waste deposit locations,
- traffic on site roads during dry weather,
- site preparation and restoration activities,
- wind-blown surface emissions; and
- carriage of dust onto the highway.

Examples of minimisation methods include:

- keeping unrestored areas to a minimum by capping cells or phases as soon as possible after the end of waste disposal,
- extend surfaced site roads as far as possible to the tipping face and keep them available for as long as possible,

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- maintain surfaced site roads and keep them clean,
- control site traffic, including restrictions on routes and speeds, and
- suppress dust using bowsers and water.

The dust plan must also consider:

- how long particles may remain airborne,
- how far particles may travel,
- deposition rates; and
- human health impacts.

The Nuisance Management Plan must show consideration of mud management. Methods and procedures should be employed to prevent, and where that is not possible minimise, mud production. Where minimisation techniques are used, they should prevent mud leaving the site.

Methods and procedures to prevent mud emissions must be included in the Nuisance Management Plan and must detail the following:

- effective wheel and body cleaners to remove mud and debris from vehicles before they leave site,
- regular maintenance of wheel wash equipment, for example water changes for wet systems,
- supervising wheel washing to make sure the equipment is used correctly,
- keeping site roads free of mud and in good condition; and
- having a sufficient distance of surfaced site roads between haul roads and wheel wash facilities.

The mud plan must identify how the efficacy of procedures and methods will be monitored and reviewed. Good practice includes clear records and photographic evidence.

The Nuisance Management Plan must detail the response when self-identification of off-site mud or dust has been made, and the response to on and off-site complaints are made.

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Litter

Litter management must be included in the Nuisance Management Plan for all hazardous and non-hazardous landfills. Litter is any wind-blown material other than particulate matter, which is considered under dust and mud above.

Measures and procedures should be used to prevent wind-blown litter being produced and should include long-term planning, e.g. maintaining a clear, phased cell development and tipping plan - looking to be depositing waste within sheltered areas when winter wind and weather may be at its most extreme.

The litter plan should also document regular litter minimisation activity such as:

- keep incoming waste covered or contained before it is deposited,
- have an emergency tipping area to allow lightweight waste to be discharged in a secure enclosure during windy weather,
- compact waste when it is deposited,
- cover waste immediately after it is deposited,
- minimise the size of the active tipping area or enclose the tipping face within a netted area,
- make sure vehicles fully discharge at the tip face, to prevent any waste staying in the vehicle and being released later,
- close the site to specific or all waste types during windy weather,
- installing permanent and mobile litter fences around the active tipping area,
- installing temporary bunds immediately next to the tipping area,
- carrying out regular inspections around the site boundary and beyond – specifically ditches, haul roads and watercourses; and
- employ extra temporary staff to collect litter if inspections and monitoring show this is needed.

The litter plan must identify the means by which the authorised person will monitor litter arising in and outside the site, review their prevention and control measures and adapt them in response.

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Aerosols

Aerosols must be considered for all landfill sites.

The plan must detail how the biological activity of finer particles can be reduced. Some particulate matter (solid or liquid droplets) from landfills are biologically active. Biological aerosols (also called bioaerosols) may consist of biological organisms suspended in air. These aerosols can affect organisms by infection, allergy, toxicity, pharmacological and other processes. Degrading waste is most likely to form bioaerosols when it is disturbed.

Vermin

The Nuisance Management Plan must outline the methods and procedures intended to prevent vermin, including rodents, birds, flies, and foxes, from

- being attracted to the landfill – for example as a source of food, shelter or heat, and
- transferring impact from the landfill elsewhere – for example birds taking waste from site as food and depositing it on neighbouring land.

The predominant attraction for vermin is access to the waste mass as this provides a food source and, for some vermin, somewhere to live. The plan should detail how daily operations are undertaken to prevent access to the waste mass as a whole e.g. through timely and effective application of daily cover, minimisation of the working area and waste compaction. The plan should also consider waste storage times and spillages of waste on route to the working faces from transfer station areas.

The Nuisance Management Plan should also show consideration of on-site preventative measures away from waste management activity – for example consideration of bunds, banks and culverts as rodent nesting sites.

The Nuisance Management Plan should also reflect on off-site factors which may attract vermin. For example, large areas of warehouse roofing can be attractive roosting locations for birds, therefore the primary attraction may not be the landfill, but there may be a greater bird population which needs to be managed.

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Supply chain prevention may include fly-spraying at transfer stations and minimising delay between waste production and disposal.

Where prevention is not possible the plan must detail minimisation methods which could include:

- effective daily management – examples might include prompt deposit, compaction and cover of waste in well-defined cells, and intermediate capping of completed areas,
- not disturbing, exposing or move previously deposited waste,
- arrange regular visits by pest control contractors or fully trained staff; and
- inspect and treat areas where rats live, for example sewers, culverts and drains.

Birds pose a wider nuisance risk due to their ability to travel further. The plan must show consideration of:

- bird-strike damage to aircraft,
- pathogens being introduced to nearby waterbodies, crops and animals,
- alien species being introduced to sensitive local habitats; and
- bird scaring techniques, including flying birds of prey over the site, bird kites, flare, bangers, gas cannons, species-specific bird distress calls, electronic sounds imitating calls of distress and bird corpses or dummies.

A record of the techniques, and combinations of techniques, used to comply with the authorisation must be detailed.

Landfill cover

Landfill cover is a fundamental control measure in preventing many of the nuisances discussed in this guidance and is therefore specifically conditioned in the landfill Authorisation (in Schedule 9). Consequently, the Nuisance Management Plan must clearly identify the materials, procedures and methods employed to ensure adequate daily cover is applied, how it is maintained, and how that contributes to nuisance prevention, and where that is not possible, minimisation.

The use of cover material should be documented and regularly reviewed for efficacy.

7 Closure and Aftercare Management Plan

A Closure and Aftercare Management Plan (CAMP) must be provided and maintained for all landfill sites.

Closure is the period between the end of waste disposal and 'Definite Closure'. Definite Closure is when the Landfill Authorisation is varied to confirm that the site has entered the aftercare phase. After Definite Closure, the site will no longer be authorised to receive waste for disposal.

The Closure and Aftercare Management Plan must demonstrate how the site will be managed into and through this phase whilst preventing or mitigating environmental impact.

The Closure and Aftercare Management Plan should support the authorised person by ensuring that they can demonstrate:

- waste disposal, capping and restoration has been completed in a compliant manner,
- all necessary environmental protection infrastructure, especially that relating to leachate and landfill gas, is provided and maintained,
- compliant leachate, groundwater and landfill gas monitoring boreholes have been installed and maintained at appropriate locations,
- adequate and compliant monitoring is undertaken,
- monitoring result reporting is undertaken at the relevant frequency; and
- the results of monitoring indicate compliance with authorised limits.

SEPA Guidance, providing further details of the requirements of a Closure and Aftercare Management Plan and the closure process, is available on SEPA's website entitled:

Landfill Restoration General Guidance, and Guidance on Closed Landfills Regulated under Pollution Prevention and Control.

8 Monitoring Management Plan

A Monitoring Management Plan (MMP) must be developed which:

- illustrates the monitoring which will be undertaken in relation to compliance limits set in the Landfill Authorisation,
- fulfils any additional monitoring requirements of the relevant legislation, for example, The Landfill (Scotland) Regulations 2003 (as amended) and the Criteria and Procedures for the Acceptance of Waste at Landfills (Scotland) Direction 2005, and
- demonstrates the performance of environmentally critical equipment and the landfill itself, including
 - the landfill gas management / extraction system;
 - the leachate collection/extraction system; and
 - any monitoring required for Directly Associated Activities.

Landfill Gas Monitoring

Within the Monitoring Management Plan, there must be a landfill gas monitoring and sampling plan that includes:

- a schedule for specific data collection and frequency of monitoring at all stages of operation of the site;
- a layout drawing showing the construction and location of monitoring points in relation to the site, surrounding area, geology and phasing of operation;
- perimeter borehole details including the locations, depth and response zone details, spacing / distance between boreholes, the borehole unique identifier and the planned maintenance regime;
- a description of measurement techniques and sampling strategy;
- an analysis and testing schedule;
- a method for data storage, retrieval and presentation;
- the background, action, trigger and compliance values against which collected data will be evaluated;

- how data will be interpreted, reviewed and reported;
- how results of monitoring and interpretation will be communicated to SEPA;
- a brief overview of how relevant guidance, such as the Management of Landfill Gas: Landfill Technical Guidance Note 03, has been considered regarding the design, construction, location and number of perimeter boreholes; and
- a brief overview of how monitoring for each phase of the landfill will be undertaken to ensure the correct functioning of the landfill gas management system.

The Monitoring Management Plan must capture:

- the suite of landfill gas constituents that are to be monitored for perimeter boreholes to ensure compliance with the authorised compliance limits,
- the suite of landfill gas constituents that are to be monitored for each section of the landfill to ensure the correct functioning of the landfill gas management system,
- a brief justification why the selected landfill gas constituents are suitable and representative,
- the frequency at which landfill gas monitoring will be undertaken.
- a brief justification why the selected frequencies for landfill gas monitoring is suitable and representative, and
- a summary of how the authorised person intends to collect, handle and analyse landfill gas samples in accordance with Landfill Technical Guidance Note 03 – Guidance on the Management of Landfill Gas.

Leachate and Groundwater

As a minimum, monitoring of leachate and groundwater must be undertaken to monitor the generation and migration of leachate and to confirm that the water environment is not adversely impacted. The monitoring plan must reflect the conceptual site model, assumptions, uncertainties, and predictions of the Hydrological Risk Assessment.

The Monitoring Management Plan must include the following monitoring point details:

- a plan indicating the locations of all leachate and groundwater monitoring points at the site.
- borehole details, including National Grid Reference, surveyed reference point (mAOD), elevation of borehole base as constructed (mAOD), response zone elevation (both base and top) (mAOD) and the borehole unique identifier.
- the planned borehole maintenance regime, including the steps to be implemented to ensure the monitoring points remains fit for purpose and accessible.
- a brief overview of how relevant standards and guidance regarding the design, construction, location and number of monitoring points will be met.
- the suite of leachate and groundwater parameters that are to be monitored at the landfill which shall, as a minimum, represent the requirements of the Authorisation.
- a brief justification why the selected leachate and groundwater parameters are suitable and representative.
- the frequency at which monitoring will be undertaken in accordance with the Authorisation.
- a brief justification why the selected frequencies for leachate and groundwater monitoring are suitable and representative.
- a summary of how leachate and groundwater samples will be collected, handled and analysed in accordance with BS EN ISO 5667 – Water Quality Sampling and 21413 - Manual methods for the measurement of a groundwater level in a well, and
- a summary of how leachate and groundwater monitoring data will be tracked and assessed, including the use of control charts for key parameters, to identify and interpret any spatial or temporal trends.

Authorised Treated Leachate Discharge

Where applicable, the Monitoring Management Plan must demonstrate adequate monitoring of the authorised treated leachate discharge to the Water Environment.

The Monitoring Management Plan must capture the following:

- a plan indicating the locations of all treated leachate effluent discharge points and sampling points at the site.
- discharge and sampling point details, including the receiving watercourse, Discharge and Sampling locations with National Grid References, and the planned maintenance regime.
- a brief overview of how the authorised person will ensure representative samples of treated leachate effluent can be obtained.
- effluent discharge rates and volumes.
- the suite of treated leachate effluent parameters that are to be monitored at the landfill.
- a brief justification why the selected treated leachate effluent parameters are suitable and representative.
- the frequency at which monitoring will be undertaken.
- a brief justification why the selected frequencies for treated leachate effluent monitoring is suitable and representative, and
- a summary of how the site intends to collect, handle and analyse treated leachate effluent samples in accordance with BS EN ISO 5667.

Surface Water

Where a surface water feature flows through a landfill site, or receives baseflow from groundwater that is overlain by a landfill site, wider monitoring of the surface water is required to ensure:

- the correct functioning of the leachate collection and treatment system;
- that there are no 'breakouts' or 'run-off' from the landfill from unknown discharge points that are impacting surface water; and
- migration via a groundwater pathway is not adversely impacting surface water.

As a minimum, surface water monitoring is required upstream and downstream of the landfill influence. At larger or more complex sites, midstream monitoring may also be required.

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Monitoring of basic indicator parameters (e.g., pH, electrical conductivity, BOD, COD, Chloride, Suspended Solids, Ammoniacal Nitrogen.) must be undertaken to identify any potential impact. Furthermore, monitoring for additional parameters (e.g., major ions, metals and hazardous substances) should be undertaken based on the site-specific risks, characteristics of the leachate, groundwater and treated leachate effluent discharge (if applicable).

The Monitoring Management Plan must capture the following:

- a plan indicating the locations of all surface water monitoring points at the site,
- the suite of surface water parameters that are to be monitored at the landfill,
- a brief justification why the selected surface water parameters are suitable and representative,
- the frequency at which surface water monitoring will be undertaken,
- a brief justification why the selected frequency of surface water monitoring is suitable and representative, and
- a summary of how surface water samples will be collected, handled and analysed in accordance with BS EN ISO 5667.

Topography and settlement

Monitoring of landfill topography and settling behaviour must be undertaken on an annual basis throughout the operational phase of the landfill, including the structure and composition of the landfill. The Monitoring Management Plan must detail the following:

- the surface area occupied by waste;
- the volume and composition of waste;
- the methods of depositing waste;
- the time and duration of depositing waste; and
- a calculation of the remaining capacity still available at the landfill.

Accreditation

In order to ensure validity of results, the analysis of all samples must be undertaken by ISO/IEC 17025 or UKAS accredited laboratories. The details of laboratories undertaking analysis should be recorded along with the accreditation for each type of analysis conducted.

General Information

Restoration Management Plan

The authorised person is required to produce and maintain a Restoration Management Plan. Details of the requirements of a Restoration Plan, and the relevant pro-forma, Landfill Restoration Plan – Operator Notification Form, which should be completed and submitted to SEPA, are available on SEPA's website.

Additional PPC Schedule 1 Activities and Directly Associated Activities

If the Landfill Authorisation contains requirements associated with other PPC Schedule 1 activities and/or Directly Associated Activities (DAA's), Management Plans associated with those activities must also be maintained. Examples of such activities include in-vessel composting, open air windrow composting, Material Recycling Facilities (MRFs), Aggregate Recycling Facilities (ARFs) and other waste storage and treatment facilities.

Relevant Drawings

Any drawings must be to recognised scales, must have a label or key to include:

- title of drawing;
- name of the Authorised Place;
- name and address of the authorised person;
- date the drawing was made and version of the drawing;
- drawing identification number; and
- scale of the drawing.

Document Control

Management Plans will require frequent review by the authorised person. Where any change is needed to a management plan specified in the authorisation, the authorised person will need to apply to SEPA to vary the authorisation before that change can be implemented.

A Document Control Record should be included at the front of the Management Plan, detailing the version number, date of the document and a summary of the amendments made.

NOTE – the amended Plan does not take effect unless the application to vary the authorisation, to incorporate it, has been granted by SEPA.

Version	Amendment (Section number and summary)	Date issued

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