Appendix 3

Benchmark Techniques

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Table A3.1 identifies the benchmark techniques outlined in Appendix A of the *Environmental Guidelines: Solid Waste Landfills* (EPA, 1996) and where each is address in this document.

Table A3.1
Benchmark Techniques

Objective	Where addressed
Benchmark Technique 1 - Leachate Barrier System	
Leachate barrier system should be designed to contain leachate over the period of time that the waste poses a potential environmental risk.	Section 4.2.3.
The leachate barrier system should be designed and installed in accordance with the quality requirements specified in an approved Construction Quality Assurance Program	
The benchmark technique for a leachate barrier system for new landfills and lateral expansions of operating landfills is a liner system that forms a barrier between groundwater, soil and substrata, and the waste.	
Benchmark Technique 2 - Leachate Collection System	
All leachate in excess of the field capacity of the waste should be collected in s leachate collection system and prevented from escaping from the landfill into groundwater, surface water or subsoil.	Section 2.5.5
The leachate collection system should be designed and installed in accordance with the quality requirements specified in an approved Construction Quality Assurance Program.	Section 2.5.5
Benchmark Technique 3 - Surface Water Controls	
To avoid the generation of excessive leachate, erosion of cover material and/ or waste from the landfill, surface water controls should precent any surface water from mixing with waste, and prevent any sediment or contaminants from being carried off the landfill site.	Section 4.3.3
Benchmark Technique 4 – Groundwater Monitoring Network	
The design, number and location of wells or lysimeters in the groundwater monitoring network should be able to demonstrate that groundwater or subsoil is not contaminated, and ensure early detection of any contamination by means of regular representative samples of groundwater and water vapour from the vadose zone.	Section 4.2.3
Benchmark Technique 5 – Groundwater Monitoring Program	
The groundwater monitoring program should effectively monitor and report groundwater character, and ensure early detection and reporting of possible pollution of groundwater.	Section 4.2.3
A comprehensive hydrological investigation of the site and the surrounding groundwater regime should have been conducted before the site was established. (The technique employed should take into consideration DUAP's *EIS Practice Guideline: Landfilling* (DUAP 1996). The groundwater flow and flow pathways for all aquifers on- site should be identified with a high degree of certainty, via a groundwater monitoring program.	Sections 4.2.1, 4.2.2, Appendix 5
Benchmark Technique 6 – Groundwater Assessment Program	
If the groundwater monitoring program detects a possible failure of the leachate containment system, a groundwater assessment program should be established to determine the extent of that failure.	Section 4.2.3

Table A3.1 (Cont'd)
Benchmark Techniques

Objective	Where addressed
Benchmark Technique 6 – Groundwater Assessment Program (Cont'd)	
If the sampling of groundwater monitoring bores or lysimeters indicates levels for any chosen indicator exceeding the limits agreed to in the LEMP, the affected groundwater monitoring bores or lysimeter should be resampled as soon as possible. If the anomaly is verified in resampling, the EPA should be notified immediately by phone and in writing within 14 days of verification of the increase in the groundwater indicator contaminants. Within 28 days of the notification, the occupier should prepare a Groundwater Assessment Plan which identifies the specific contaminants and extent of the pollution to the groundwater. The Groundwater Assessment Plan should include a submission to the EPA of a list of proposed anolytes for evaluation, and a monitoring program for sampling the groundwater wells and lysimeters. The list of anolytes needs to be based on the detection of monitoring variations and the contaminant content of the leachate. The proposal would need to be supported by the justification for the selection of anolytes. Any information obtained during this assessment should be used to prepare the Groundwater Contamination Remediation Plan.	Section 4.2.3
Benchmark Technique 7 – Surface Water Monitoring Program	
The surface water monitoring program must be able to demonstrate that surface water is not polluted by the landfill.	Section 4.3.3
If the surface water monitoring program detects water pollution, the occupier should follow the procedures outlined in the Water Contamination Remediation Plan to investigate water pollution.	Section 4.3.3
Benchmark Technique 8 – Surface Water Monitoring Program	
A leachate monitoring program is recommended to assess the effect leachate may have if it is recirculated in a landfill, irrigated on the surface of a landfill, stored in a pond, or treated on- site. Any disposal method for leachate should be approved by the EPA and outlined in the LEMP. Off – site disposal of untreated leachate should be limited to discharge to an approved treatment facility.	Section 4.3.3
Initially characterisation testing is to be conducted for aromatics, volatiles, halocarbons and the base, neutral and acid – extractable organic contaminants that should be detected by Methods 8260 and 8270 (USEPA 1992). Additional quarterly or batch testing of a representative sample for all contaminants may be required as agreed in the groundwater monitoring program.	Section 4.3.3
Benchmark Technique 9 – Water Contamination Remediation Plan	
A Groundwater Contamination Remediation Plan should be developed if groundwater or subsoil contamination is confirmed via the Groundwater Assessment Plan, or identified by external monitoring.	Section 4.3.3
The landfill occupier must detail the procedures to deal with any possible surface water contamination incident in the LEMP. If surface water pollution is detected, the landfill occupier should take immediate action to contain the pollution, and prepare a report to the EPA detailing the nature and source of the contamination, any actions taken, and future actions that will be carried out to prevent recurrence, When the future action are approved by the EPA, these should be carried out immediately.	Section 4.3.3

Table A3.1 (Cont'd)
Benchmark Techniques

Objective	Where addressed
Benchmark Technique 10 – Landfill Gas Containment System	
The landfill gas generated in the landfill should be contained by other benchmark techniques, for example: 1. Leachate barrier system 28. Site capping and revegetation 33. Covering of waste. The design of these techniques must take into consideration the landfill gas containment system.	Section 2.5.6
Benchmark Technique 11 – Extraction and Disposal of Landfill Gas	
A gas extraction system should be used to extract and, where possible, combust landfill gases. This system should reduced the risk of explosion and fire, reduce the contribution to greenhouse gases (methane is 20 to 30 times more potent than carbon dioxide), and lower the level of toxic organic compounds emitted from landfills.	Section 2.5.6
Benchmark Technique 12 – Fire Prevention	
The licensed landfill occupier should prevent fires at the landfill in order to minimise emissions to the atmosphere.	Section 4.8.3
Benchmark Technique 13 – Controlled Burning	
The release of leachate and/ or pollutants into the atmosphere as a result of burning waster at the landfills should be prevented. The increases in particulate emissions and decreases in site safety arising from landfill fires outweigh any perceived benefit in waste reduction. Waste reduction strategies (e.g. composting and mulching) and materials re- use are approved methods of reducing waste.	Section 4.8.3
Benchmark Technique 14 – Site Closure	
A landfill site should be closed in a manner that reduces to a minimum the emission of landfill gases. This may involve capping and revegetation designed to have the net effect of decreasing the emission of landfill gas through the surface of the landfill. This measure will also improve the potential for containing landfill gas. Landfill occupiers should be aware that as escape through the surface becomes more difficult there is a potential for greater lateral movement of gas. Closure and capping are covered in significant detail in '28. Site capping and revegetation' below.	Sections 2.12.4, 2.12.5
Benchmark Technique 15 – Subsurface Gas Monitoring Devices	
Landfill gas monitoring devices should be capable of detecting landfill gas in sufficiently low concentrations to ensure that landfill gas is not migrating off – site and toxic air emissions are not a threat to the community.	Section 2.5.6
Monitoring wells should be installed around the perimeter of the site, at a depth equal to the minimum groundwater level, the greatest depth of refuse, or 10 metres below underground utilities or manholes within 20 meters of the landfill. These wells should be placed at intervals sufficiently small to be able to detect any potential off – site migration.	Section 2.5.6
The spacing and design of these wells should be determined based on a site investigation, and detailed in the LEMP. If distinct lithological units that could act as conduit for landfill gas were identified in the site investigation, then either multi-port wells that are able to monitor the distinct lithological units separately, or separate wells for every distinct unit should be installed.	Section 2.5.6

Table A3.1 (Cont'd)
Benchmark Techniques

Objective	Where addressed
Benchmark Technique 15 – Subsurface Gas Monitoring Devices (Cont'd)	
Well construction details should be submitted to the EPA for approval prior to installation. Generally, the EPA will require individual slotted probes with bentonite seals between monitoring zones, with the monitoring zones back filled with pea gravel to facilitate movement of gas.	Section 2.5.6
Benchmark Technique 16 – Subsurface Gas Monitoring Program	
A subsurface gas monitoring program should be implemented to demonstrate that gas is not migrating off – site.	Section 2.5.6
The tabulated results of all monitoring are to be submitted as part of an annual report, unless subsurface methane is detected above 1.25% (v/v), in which case more frequent reporting will be required by the EPA.	Section 2.5.6
Benchmark Technique 17 – Surface Gas Emission Monitoring	
Surface gas migration should demonstrate that the cover material and extraction is controlling the emission of landfill gas.	Section 2.5.6
Reports on monitoring and corrective action will form part of the annual report. This monitoring is to continue until the certificate of completeness is issued or the occupier satisfies the EPA that landfill gas is n longer present in significant quantities to pose an environmental risk or inhibit revegetation.	
Benchmark Technique 18 – Gas Accumulation Monitoring	
Landfill gas must not accumulate in buildings and pose a danger of explosion. All buildings within 250 meters of deposited waste or areas in the LEMP as having potential to have methane concentrations of greater than 1.25% (v/v) in the subsurface should be tested on a monthly frequency with a tested and calibrated methane detector.	Section 2.5.6
Benchmark Technique 19 – Remediation of Uncontrolled Landfill Gas Emissions	
The EPA must be notified within 24 hours of detection of: • Methane at concentrations greater than 1.25% (v/v) in the surface, subsurface or building monitoring • a one hour average NO^2 above 320 ug/m^3 from electricity generating equipment • NMOC destruction below 98% from gas burning flare or engine. A written assessment of the emissions and management controls implemented or proposed to be implemented to prevent further emissions should be provided to the EPA within 14 days of the incident.	Section 2.5.6
Benchmark Technique 20 – Assurance of Quality	
To minimise the risk of the landfill having deleterious effects on the surround environment, the occupier should construct and operate the landfill to a appropriate quality management system.	Sections 4.2.3, 4.3.3
Benchmark Technique 21 – Screening of Wastes Received	
The landfill occupier should have in place waste acceptance and screening procedures to ensure that the site does not accept waste that are prohibited from entry.	Section 2.6.1

Table A3.1 (Cont'd)
Benchmark Techniques

Objective	Where addressed
Benchmark Technique 22 – Measurement of Quantities of Waste Received	
All landfill operations accepting in excess of 25, 000 tones per annum of waste should: • Install a weighbridge, and • Lodge a report on the total quantity of waste received every 12 months, compiled by a registered surveyor or by an alternative method approved by the EPA.	Section 1.3.6
Benchmark Technique 23 – Recording of the Quantities, types and Sources of Wastes Received	
Each month, landfill occupiers must provide data to the EPA on the amount, type and source of waste according to the National Waste Classification System. This requirement extends to all materials accepted on- site.	Section 2.5.4
The landfill occupier must have a survey of the site compiled by a registered surveyor or by an alternative method approved by the EPA on an annual basis to confirm the volume of landfill space consumed in the past 12 months.	Section 2.5.4
The landfill survey specified above will form part of the landfill's annual report to the EPA reconciling these quantities with the monthly waste acceptance reports.	Section 2.5.4
Controls should be established to prevent vehicles from entering and exiting the site without generating a permanent record.	Section 2.11.2
Benchmark Technique 24 – Compaction of Waste	
Landfill occupiers are expected to ensure that maximum compaction is achieved for the capacity of the machines used. For landfills receiving over 50, 000 tonnes of waste per annum, the waste compaction goal is 850 kg/m 3, excluding cover material. For landfills receiving less than 50,000 tonnes per annum, the waste compaction goal is 650 kg/m3, excluding cover material. An exception of this is where the landfill is being operated as a bioreactor, and the landfill is to be mined or stabilised after degradation is completed. The achieved rate (excluding cover material) will be submitted in the annual report to the EPA.	Section 2.5.4
Benchmark Technique 25 – Recycling	
The LEMP should include a plan to recover and recycle, re – use or reprocess wastes that can be recycled.	Section 2.6.2
Benchmark Technique 26 – Financial Assurance	
Financial assurance is a means of ensuring that landfill occupiers adequately plan for emergency closure, site remediation and post – closure care, by providing a specific mechanism to accumulate requisite funding during the life of the landfill. This mechanism encourages development of the necessary long - term financial planning to protect all environmental objectives.	Section 2.12
Benchmark Technique 27 – Filling Plan/Contours	
The landfill contours should be managed in a systematic manner as outlined in the LEMP. Regular filling plan surveys that document the process by which land is filled allow the licensed landfill occupier to demonstrate that site operations are under control and to estimate the volume of waste landfilled.	Section 2.5.4
Benchmark Technique 28 – Site Capping and Revegetation	
Site capping and revegetation should ensure that the final surface provides a barrier to the migration of water into the waste, controls emissions to water and atmosphere, promotes sound land management and conservation, and prevents hazards and protects amenity.	Section 2.12.5

Table A3.1 (Cont'd)
Benchmark Techniques

Objective	Where addressed
Benchmark Technique 29 – Landfill Closure and Post-closure Monitoring and Maintenance	
That within three months of the completion of a landfill's waste receipt operations, the last licensee must submit for approval to the EPA a written Closure Plan. To ensure that the landfill continues to be non-polluting and does not cause environmental harm after site closure, the Closure Plan will include putting into place a post-closure monitoring and maintenance program which ensures the long-term integrity of the landfill. As with many other activities, post-closure monitoring and maintenance will control multiple environmental objectives, including emissions to water, emissions to the atmosphere, and protection of land use and local amenity. This monitoring and maintenance must be provided until the landfill does not pose a threat to the environment.	Section 2.12
Benchmark Technique 30 – Security of Site	
Unauthorised entry to landfills can lead to waste dumping, fires and vandalism of pollution control devices, as well as loss of amenity.	Section 2.11.2
Benchmark Technique 31 – Litter Control	
Local amenity should not be degraded by litter. Wind-blown litter is a nuisance to the community in the vicinity of landfill sites.	Section 4.5.3
Benchmark Technique 32 – Cleaning of Vehicles	
To minimise effects on both local amenity and quality of stormwater run-off, all mud and waste materials on vehicles that leave the site should generally be removed. Vehicles using landfill sites will inadvertently collect mud and litter on their wheels as they proceed to and return from the active face.	Not applicable due to the rural nature of the area.
Benchmark Technique 33 – Covering of Waste	
Use of cover material helps to protect the full range of environmental management objectives by limiting run-on and infiltration of water, controlling and minimising risk of fire, minimising emission of landfill gas, suppressing site odour, reducing fly propagation and rodent attraction, and decreasing litter generation. Cover material is classified as daily, intermediate or final, depending on operation phase and function. Intermediate cover is used to close off a cell that will not receive additional lifts of refuse or final cover for some time. Final cover forms a low permeability barrier to control water entering the site and gas emissions, and promote revegetation. Landfill occupiers are free to specify any alternative cover material (foams, mulch, etc.) provided they can demonstrate compliance with the performance goals. To ensure that there will always be sufficient cover material available to meet the performance requirement, landfill occupiers will be expected to maintain a stockpile or an area where cover can be won on-site in all weather condition, adequate to meet the cover requirements of the landfill for two weeks.	Sections 2.5.2.5, 2.5.4
Benchmark Technique 34 – Dust Controls	
Dust controls should minimise pollutants leaving the site as airborne dust, reduce stormwater sediment load, and protect local amenity. The generally expected maximum level for dust deposition is 4g/m^2 per month as an annual mean for total solids, but the limit could be lower for landfills adjacent to sensitive areas. This deposition rate from the landfill should not be exceeded outside the site boundary.	Section 4.7.3
Benchmark Technique 35 – Pest, Vermin and Noxious Weed Controls	
Pests, vermin and noxious weeds should not be present at the site in sufficient numbers to pose an environmental hazard or loss of amenity in the areas neighbouring the site.	Section 4.4.4

Table A3.1 (Cont'd)
Benchmark Techniques

Objective	Where addressed
Benchmark Technique 36 – Odour Controls	
Landfills must have no odour impacts, in accordance with the Clean Air Act. Acceptance of wastes that are highly biodegradable and improper gas management can lead to odour problems. Applicants are encouraged to consider at the planning stage the use of a separation distance/buffer zone as a technique for controlling the off-site movement of landfill odours. The use of sufficient distance between the landfill and sensitive receptors (i.e. residential zones) will minimise the requirement for other stringent odour controls.	Section 4.7.3
Benchmark Technique 37 – Noise Control	
Unless specified under an existing Noise Control Act licence, the noise generated during the operation of the landfill facility should be managed so that the following objectives can be met: • Noise from any single source does not intrude generally above the prevailing background noise level; and • The background noise level does not exceed the level appropriate for the particular locality and land-use.	Section 4.6.3
Benchmark Technique 38 – Fire-fighting Capacity	
Occupiers should have the ability to adequately fight fires at any part of the landfill site. Landfill occupiers shall demonstrate sufficient fire-fighting capacity through development of a site-specific fire management plan to minimise the incidence and impact of fire.	Section 2.10.1.3
Benchmark Technique 39 – Staffing and Training Requirements	
The level and nature of staffing and training should be adequate for environmentally responsible and safe management of the landfill. Staffing requirements will vary as a function of size, type of wastes, diversity and complexity of site operations.	Section 2.9

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