

REHABILITATION OF LANDFILLS EXEMPT FROM LICENSING

Publication 674

November 1999

SCOPE

This guideline applies only to those municipal landfills which have served a population of less than 5,000 people and have been identified for closure in the Regional Waste Management Plan. It is not intended to provide an exhaustive guide on the closure, rehabilitation and aftercare of landfills but rather to provide some design objectives and management criteria that should ensure that the environment is protected.

SITE PREPARATION

During the operation of the landfill, and especially after the final load of waste is deposited, all wastes must be covered by clean earth. This cover prevents wind blown litter, reduces the fire risk and helps to control the number of flies and other insects. It also provides a firm base for laying the cap. The cover material must:

- be a minimum of 30 cm of clean soil
- ensure that no wastes are exposed
- be compacted before placing the cap.

CAPPING

The landfill cap provides the primary means for protecting groundwater by preventing excessive water infiltration. The cap must also prevent access to the waste by insects, rodents and birds. The cap will commonly consist of at least two layers: one being resistant to water penetration [such as clay], and the other being the top most layer capable of supporting and sustaining vegetation.

Low permeability barrier

Clay generally provides a practical, low permeability barrier that prevents the infiltration of water into the underlying waste. The suitability of the clay should be assessed to determine, with the equipment available for use on the site, that it is capable of achieving a hydraulic conductivity of less than 1×10^{-9} metres per second. There are commercial or educational facility laboratories that, by using equipment such as a triaxial cell, can determine the density and moisture content for clay to achieve the desired hydraulic conductivity.

To achieve the design objective of the low permeability liner the clay must:

- be placed at a moisture content of about two to four per cent wet of optimum
- be placed by a series of shallow lifts not exceeding 200 mm in thickness
- be inspected to remove protruding rocks
- have several passes by a roller or some compaction equipment, and
- have a total compacted thickness of not less than 0.5 m.

Where a suitable clay is not readily available, then a clay with a higher hydraulic conductivity may be used subject to the following constraints:

- an increase in thickness of the low permeability barrier to compensate for the nature of the clay, and/or
- an assessment of the infiltration rate through the cap and its consequences.

Once this assessment has been completed, advice from the relevant office of the Environment Protection Authority should be sought on the acceptability of the rehabilitation design. On no account should a clay with a hydraulic conductivity of greater than 1×10^{-8} metres per second be used.

Construction Quality Assurance Plan

A Construction Quality Assurance Plan ensures that the cap is constructed to meet the design objectives and provides a means of demonstrating the quality of the cap.

Field measurements of the moisture content and density should be conducted on the completed low permeability barrier. These measurements should be conducted at a frequency being the greater of 1 per 2,500 m² of area or at three tests per visit. The thickness of the clay may be checked by survey, or by marker pegs, or core sampling.

The results of these measurements as well as the inspection programs and records of any moisture addition to the clay must be documented and may need to be provided to regulatory authorities.

Surface capping layer

The surface capping layer must prevent the underlying clay drying out and subsequently cracking as well as provide a medium to support vegetation. Ideally the site should be vegetated with indigenous plants so that the revegetated area blends with the surroundings. The surface layer should generally reflect the type and depth of top soils found in the local area. As this layer is also designed to protect the clay cap from desiccation, then this layer should comprise at least 30 cm of soil, with at least the top 10 cm being good quality top soil.

Trees or plants with deep roots planted on the cap may die if their roots should penetrate the cap. If large plant varieties are proposed on the cap, then expert advice should be obtained about root penetration and it may be necessary to provide raised mounds for this vegetation.

Cap profile

The two objectives of landfill rehabilitation are to ensure the environment is protected and to provide a useable landform. The landfill should therefore be shaped such that the final surface will be suitable for the intended afteruse and for ease of cap maintenance.

The completed landfill surface must not contain any water features such as dams and should be graded so that it sheds water without eroding the cap or contributing to the erosion of adjoining properties.

The design considerations of the final landform are:

- to be compatible with the final proposed end use of the land. Where no end use is proposed, then the final surface must blend in with the topography of the surrounding area.
- to adequately shed water, which requires a gradient in excess of three per cent. With shallower gradients there is increased risk of rain infiltration through the cap. To compensate for shallow grades, the thickness of the low permeability barrier will need to exceed 0.5 m.
- to minimise erosion potential which increases when the gradient exceeds 10 per cent. Avoid gradients in excess of 30 per cent.

The risk of erosion can be reduced by:

- using mulch mixed with the topsoil to resist erosion until vegetation is established.
- construction of swales to control stormwater run-off.
- constructed drains and holding dams to dissipate the energy in run-off water.

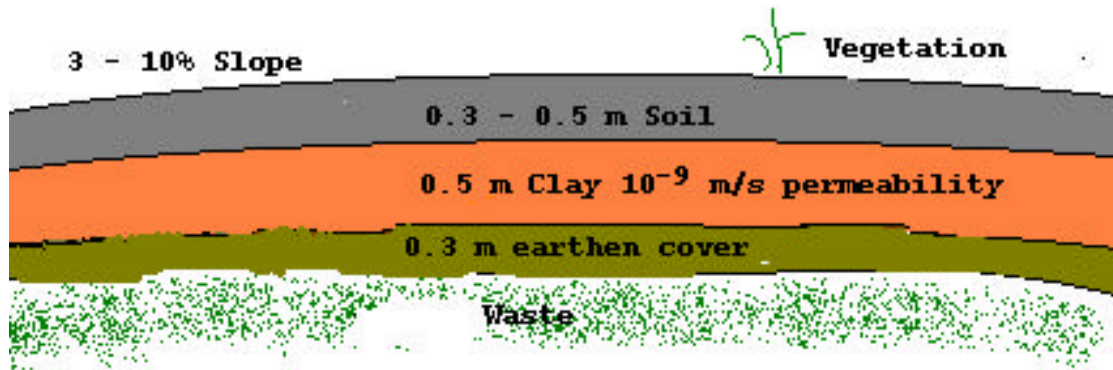


Figure 1: Indicative Landfill Cap Design

AFTERCARE MANAGEMENT

Aftercare management entails the maintenance of the landfill cap and, depending on the location and type of landfill, conducting an environmental monitoring program. This management program ensures the long term protection of the landfill cap and, if necessary, provides a monitoring program checking the environmental performance of the landfill.

Cap maintenance

As the cap provides the primary protection measure for the environment, it is essential that it be maintained in good condition. During the first year after the cap placement, it must be inspected at least on a quarterly basis. A walk over the site will reveal what actions may be required:

- filling of depressions resulting from differential settlement.
- preventing erosion of the cap and subsequent exposure of the clay barrier.
- planting and/or watering to revegetate the site.
- controlling any leachate springs that may break out through the cap.

The frequency of inspection may be reduced to half yearly in subsequent years and to annually after five years provided no problems have been observed or reported at the site. A record should be retained of these inspections and any follow-up actions.

Environmental monitoring program

A monitoring program may be required where the landfill is located in a sensitive environment such that a groundwater resource is potentially at risk (for example, groundwater extracted within 500 m of the site) or there is a perennial creek or river within 100 m of the site. In these cases, advice should be sought from the local EPA office as to whether a monitoring program should be undertaken.

RECORD KEEPING

The Construction Quality Assurance Plan must provide a record trail to demonstrate that the landfill has been rehabilitated according to the rehabilitation plan. The Regional Waste Management Group and EPA may audit the plans. In addition, management systems must be able to demonstrate that the site has an appropriate active aftercare management program.

FURTHER INFORMATION

EPA Information Centre
40 City Road, Southbank 3006
Tel: (03) 9695 2722 Fax: (03) 9695 2780

EPA Regional Offices

Gippsland

7 Church Street, Traralgon 3844
Tel: (03) 5176 1744 Fax: (03) 5174 7851

North-East

24 Ely Street, Wangaratta 3677
Tel: (03) 5721 7277 Fax: (03) 5721 2121

North-West

43 Williamson Street, Bendigo 3550
Tel: (03) 5442 4393 Fax: (03) 5443 6555

South Metro

45 Princes Highway, Dandenong 3175
Tel: (03) 9794 0677 Fax: (03) 9794 5188

South-West

Cnr Lt Malop & Fenwick Streets, Geelong 3220
Tel: (03) 5226 4825 Fax: (03) 5226 4632

EPA internet site

www.epa.vic.gov.au

