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Landfill Closure – Pay Me Now or Pay Me Later

ESAA Remtech 2015

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Why Do We Cap Landfills?

- ▶ It's the law
- ▶ To minimize financial and environmental liability
- ▶ To minimize post closure costs



Why Do We Choose the Lowest Capital Cost? (Pay Me Later)



- ▶ Paying later comes out of someone else's budget
- ▶ We don't understand our financial and environmental liability
- ▶ We haven't factored in post closure costs



Alberta Final Cover Requirements (prescriptive but flexible)

“(ii) a final cover system consisting of three layers constructed in the following

order from bottom to top:

a. **0.60 metres barrier layer with a maximum hydraulic conductivity of 1×10^{-7} metres per second;**

b. subsoil; and

c. 0.20 metres of topsoil.

(iii) subsoil depth in 6.1(c)(ii)b. shall be:

a. 0.35 metres for pasture or recreational uses; or

b. 0.80 metres for cultivated land use or forestry;

(iv) vegetation establishment as per the intended land use;

(v) alternative final cover systems may be authorized by the Director.”

STANDARDS FOR LANDFILLS IN ALBERTA

February 2010

Existing British Columbia Final Cover Requirements (very flexible)

“A closure plan will specify at least the following:

- A topographic plan showing the final elevation contours of the landfill and surface water diversion and drainage controls
- **Design of the final cover including the thickness and permeability of barrier layers and drainage layers, and information on topsoil, vegetative cover and erosion prevention controls”**

Landfill Criteria

For Municipal Solid Waste

Author:



Ministry of
Environment



Proposed British Columbia Final Cover Requirements (draft only but very prescriptive)



“The minimum final cover shall consist of **a barrier layer, providing a maximum hydraulic conductivity of 1×10^{-5} cm/sec for landfill sites located in arid regions and 1×10^{-7} cm/sec for landfill sites located in non-arid regions.**

The final cover barrier layer shall have a **compacted thickness of 0.6 m** measured perpendicular to the slope with a **0.15 m topsoil** layer capable of establishment and sustained growth of the vegetative cover.”

LANDFILL CRITERIA FOR MUNICIPAL SOLID WASTE

Draft Interim Second Edition

BRITISH COLUMBIA

BC Ministry of Environment

NOVEMBER 2013

Ontario Final Cover Requirements (wisdom from Ontario?)

“A low permeability soil and vegetative cover is typically used for a natural attenuation landfill where a reduced rate of infiltration and leachate generation is normally desirable.

For an engineered site with leachate collection, an increased rate of infiltration to promote waste stabilization would normally be desirable to reduce long term maintenance and monitoring requirements, and to reduce the contaminating life span of the site.”

LANDFILL STANDARDS:

A GUIDELINE ON THE REGULATORY AND APPROVAL REQUIREMENTS FOR NEW OR EXPANDING LANDFILLING SITES

Last Revision Date:

January 2012

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PIBS 7792e

USEPA Final Cover Requirements (surprisingly sensible)

“The material must have a permeability no greater than 1×10^{-5} cm/s, **or equivalent permeability of any bottom liner** or natural subsoils present, whichever is less.

The reason for this requirement is to prevent the “bathtub effect” where liquids infiltrate through the overlying cover system but are contained by a less permeable underlying liner system. This causes the landfill to fill up with water (like a bathtub), increasing the hydraulic head on the liner system that can lead to the contaminated liquid (leachate) escaping and contaminating groundwater supplies.”



Landfill Capping Options

1. Standard Regulatory Prescription
2. Compacted Clay Barrier
3. Geosynthetic Barrier (Geomembrane and/or Geosynthetic Clay Liner)
4. Water Balance (Store and Release) Cover
5. Infiltration Cover

Regulatory Prescription / Compacted Clay Cover



2012/10/10

Standard Regulatory / Compacted Clay Cover (Pay Me Later)



Pros	Cons
Low capital cost if suitable clay soils are present on site.	Highly susceptible to wetting/drying and freeze/thaw cycles.
Permit approvals/registrations straightforward.	Several order of magnitude increase in permeability years after construction.
	Typically more permeable than bottom liner systems (i.e. landfill could accumulate water and may require leachate collection and treatment in perpetuity).
	Ongoing leachate treatment or disposal costs could be significant.

Geosynthetic Barrier Cover



Geosynthetic Barrier Cover (Pay Me Now)



Pros	Cons
Readily obtainable and can be shipped anywhere.	Capital costs are typically higher than standard covers.
Not significantly affected by wetting/drying and freeze/thaw cycles.	Thin layers that must be installed with care.
Very low infiltration rates.	Require gas control and venting if waste is gas generating.
Can significantly reduce ongoing leachate treatment and disposal costs.	Require drainage control above geomembrane in areas of high precipitation.

Water Balance Cover



Water Balance Cover (Maybe Pay Me Later)



Pros	Cons
Not significantly affected by wetting/drying and freeze/thaw cycles.	Design and regulatory process can be more costly and lengthy.
Very low infiltration rates in semi-arid and arid environments.	Need a significant volume of suitable cover soil (topsoil and subsoil).
Can significantly reduce ongoing leachate treatment and disposal costs.	Performance relies heavily on plant growth.
	Performance relies heavily on modelling, so field verification is often required.

Infiltration Cover



Infiltration Cover (Don't Pay Me)



Pros	Cons
Can promote waste stabilization.	Performance relies on either leachate collection and treatment or natural attenuation, depending on landfill design.
Very low capital cost if leachate treatment is either not required or is readily available.	Requires significant historic groundwater monitoring data if no bottom liner present.
Could significantly reduce long term liability if waste is stabilized.	Regulatory process can be more costly and lengthy.
	Ongoing leachate treatment costs could be significant.

Any Questions?

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