



Latest developments and best practice in landfill lining and capping

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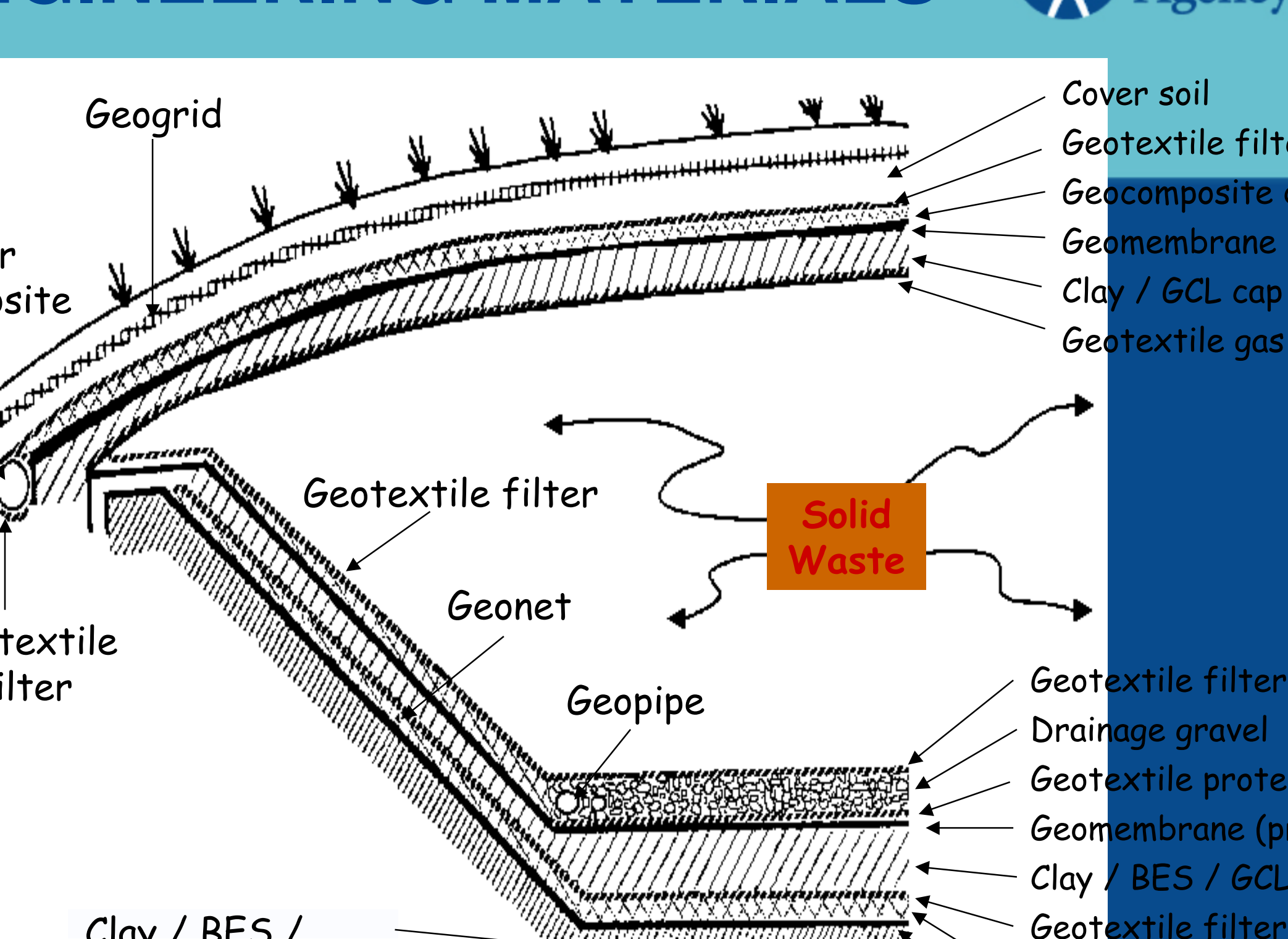
atest developments.....



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- In reality not that much has changed recently landfill engineering!



Design Considerations

The (impossible) ideal of an environmentally secure landfill (total containment) versus an “environmentally safe” landfill (controlled release)

Thus **LANDFILL BY DESIGN** *within* a framework of **RISK ASSESSMENT**

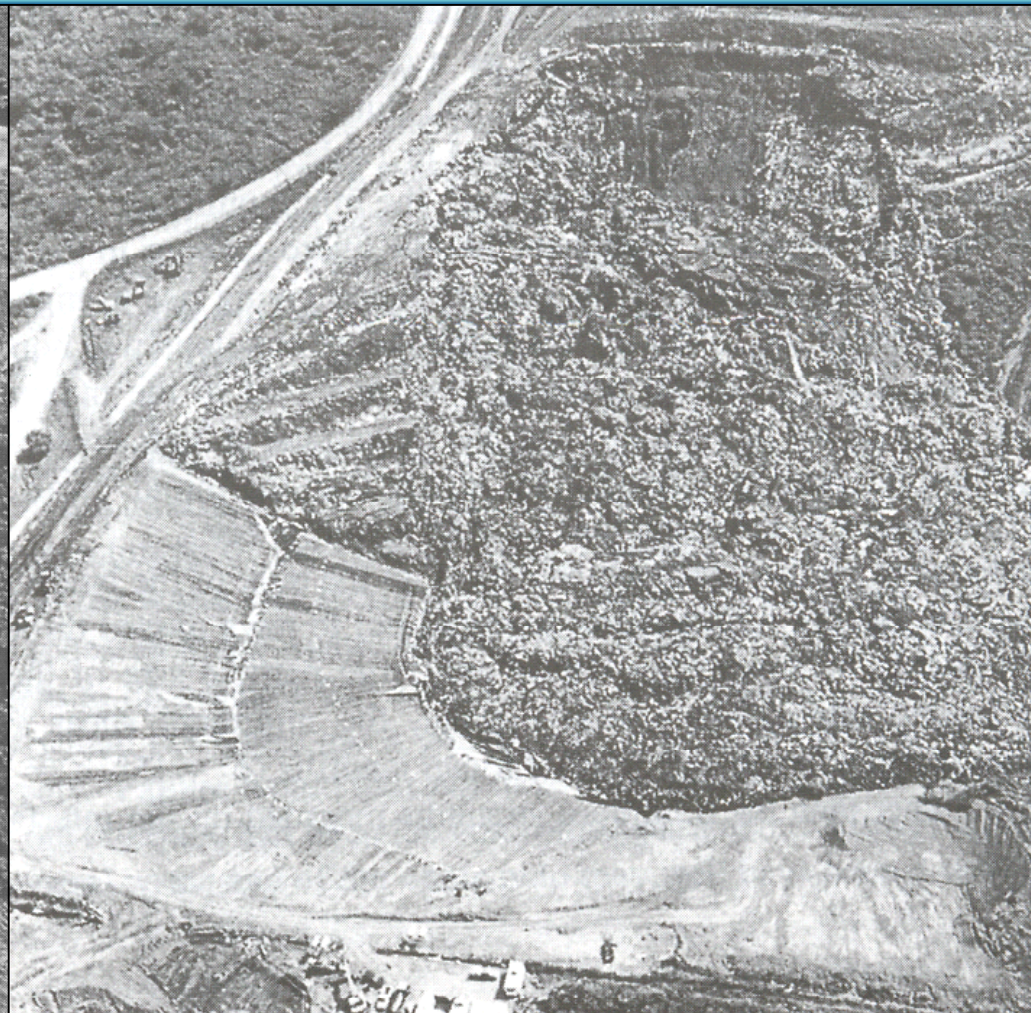
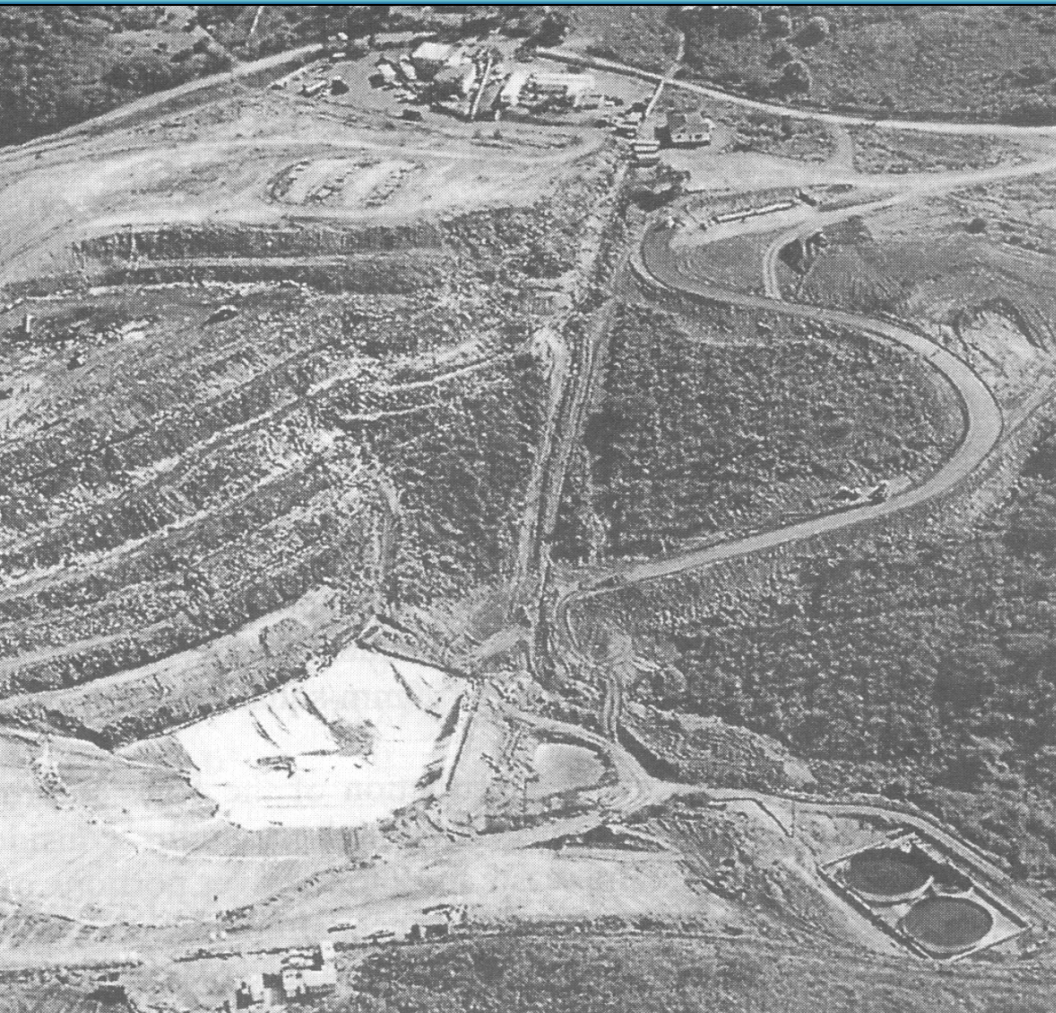
- not by prescriptive formulae

We do have a legislation change

Landfill Directive – Annex 1

Lining, leachate drainage, landfill gas and stability requirements

So a recent development is the requirement for a formal stability risk assessment....





Latest developments – lining

Still using traditional clay and geomembrane configurations predominantly

GCL and BES rarely used in basal engineering

Some movement away from prescriptive requirements to a more risk based process where the design must demonstrate that it is fit for purpose

Some increase in the likely use of Dense Asphaltic Concrete....

AC liners



Latest developments – leachate drainage

Now have an agreed protocol with industry to allow them to use 300mm thick drainage blankets

Based on a number of requirements that the design must contain;

Minimum gradient, coverage of the whole base, type of aggregate, stone strength, pipework specification and spacing, surveyed.

A similar protocol has been agreed for the use of tyres in drainage blankets.

Now had a number of trials on the use of geocomposites.

Latest developments - monitoring

With some of our steeper walled quarries and piggyback lining situations we are requiring instrumentation of the lining system

We can then assess the performance of the liner and check that it is functioning as designed.

Action plan in place if monitoring shows something problematical.



Best practice – Clay lining

We require a minimum thickness of 0.5m for a basal clay liner

This erodes the safety margins when compared to 1.0m

Especially when we unearth surveying problems!

Reliance on contractors survey

Now much more focused on this and the need for the surveying to be part of the CQA process

Best practice - Capping

Require all
geosynthetic caps to be
welded

Operators becoming
much more interested
in settlement
predictions



Best practice - guidance

Agency have just re-launched its landfill engineering guidance

351_09, LFE1 - Our approach to landfill engineering (Version 1)

<http://publications.environment-agency.gov.uk/pdf/GEHO0409BPNJ-e-e.pdf>

352_09, LFE 2 - Cylinder testing geomembranes and their protective materials (Version 1)

<http://publications.environment-agency.gov.uk/pdf/GEHO0409BPND-e-e.pdf>

353_09, LFE3 - Using geosynthetic clay liners in landfill engineering (Version 1)

<http://publications.environment-agency.gov.uk/pdf/GEHO0409BPNE-e-e.pdf>

354_09, LFE4 - Earthworks on landfill sites (Version 1)

<http://publications.environment-agency.gov.uk/pdf/GEHO0409BPNF-e-e.pdf>

355_09, LFE5 - Using geomembranes in landfill engineering (Version 1)

<http://publications.environment-agency.gov.uk/pdf/GEHO0409BPNH-e-e.pdf>

356_09, LFE6 - Guidance on using landfill cover materials (Version 1)

<http://publications.environment-agency.gov.uk/pdf/GEHO0409BPNI-e-e.pdf>

357_09, LFE7 - Using nonwoven protector geotextiles in landfill engineering (Version 1)

<http://publications.environment-agency.gov.uk/pdf/GEHO0409BPNL-e-e.pdf>

358_09, LFE8 - Geophysical testing of geomembranes used in landfills (Version 1)

<http://publications.environment-agency.gov.uk/pdf/GEHO0409BPNV-e-e.pdf>

359_09, LFE9 - Compliance testing earthworks on landfill sites using nuclear density gauges (Version 1)

THANK YOU, ANY QUESTIONS ?