Leachate recirculation – an international & local perspective

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Abstract

Modern landfill operational practices look to minimise the generation of leachate by diverting surface water and covering waste as soon as is practicable. However, there needs to be a balance between this objective and encouraging biological degradation of the waste mass within an acceptable time frame. Controlled leachate recirculation is one method that looks to address both these potentially conflicting objectives. Simonne will draw on examples from her involvement in a number of leachate recirculation projects locally and internationally to dispel some of the commonly held myths, highlight the potential pitfalls and provide some practical guidance.

Environment Agency guidance LFTGN03 as:

‘the practice of returning leachate to the landfill from which it has been abstracted’

(Environment Agency 2004).

Reasons for leachate recirculation

- Seeding new basal layers to establish methanogenesis
- Managing leachate quality feed to leachate treatment plants
- Leachate flow management (peak flow buffering/absorptive capacity)
- Accelerating settlement/increasing airspace
- Stimulating gas generation
- Accelerating stabilisation of organic waste
- Contaminant flushing
- Fire/elevated temperature control

Typical recirculation systems – at or near surface

- Low pressure surface application

  e.g. bowser/sprinkler bar to irrigate leachate at the tipping face; open trenches or pits in surface of waste; and open-ended pipes laid on waste surface.

- Systems immediately below top liner

  e.g. linear tyre or rubble filled trenches; perforated pipes in a trench filled with drainage material. Some systems were designed to be horizontal and some to include a fall in the trenches.

- Horizontal linear structures at depth within wastes (i.e. constructed during filling)

  e.g. ‘spiders’ consisting of horizontal pipes connecting radially to a central access sump/pipe; horizontal pipes or trenches with vertical access points or side slope risers.

Typical recirculation systems – below surface

- Horizontal linear structures at depth within wastes (i.e. constructed during filling)

  e.g. ‘spiders’ consisting of horizontal pipes connecting radially to a central access sump/pipe; horizontal pipes or trenches with vertical access points or side slope risers.

- Vertical wells

  e.g. existing leachate abstraction/monitoring wells or gas wells). Large (160 mm dia at 30 – 50 m centres) or small (50 to 100 mm dia at 20 m centres).

- Deep vertical trenches

Challenges

- Stability concerns
  - Lower waste strength, lubricated slip planes
- Clogging of injection infrastructure
  - Tends to be more of a problem with acetogenic leachate
- Flooding of gas wells
- Increased settlement
- Odour, landfill gas release and the potential for air ingress
- Perching/surface outbreaks

Myths

- Clogging of basal drainage layer
- Increased head on liner
- Adverse impact on leachate quality

Infrastructure design

- International literature: areal application rates from 1 to 30 m^3/ha/day
- Impact of waste properties
  - Incoming & in situ moisture content
  - Field capacity
  - Hydraulic permeability
    - Vertical and horizontal variability
    - Compaction
- Separation distances
  - Landfill slopes to avoid breakouts
  - Landfill gas wells to avoid flooding
- Batch/intermittent loading
- Robust component design

Monitoring requirements

- Operational performance of recirculation infrastructure
  - Wear and tear
  - Signs of clogging
- Effects on waste decomposition and leachate quality
  - Settlement
  - Landfill gas composition
  - Leachate contaminant levels
- Water balance and volumetric aspects
  - Leachate collection
  - Head on the liner
- Environmental risk aspects
  - Receiving waters (surface & ground)
  - Landfill gas emissions