



State of practices and recommendations for bioreactor landfills

Bioreactor Landfill



- ❖ French Federation of Waste Management Services (FNADE) and French Environment Protection Agency (ADEME) have created in 2007 a working group in order to realize a guide, the objective of which is to facilitate the implementation of bioreactor landfill for non hazardous waste (MSW & C&I including biodegradable waste).
- ❖ The creation of this guide is based on teamwork, a selected bibliography, visites to bioreactor landfill sites, operators feedbacks and interviews with researchers and technicians.
- ❖ This guide comprises a state of the practices and implementation recommendations for bioreactors landfill. It is intended for professionals of non hazardous waste landfill (conception & construction designers, operators, authorities, ..).

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DESCRIPTION

- ✦ The bioreactor represents a major evolution of the standard actual waste treatment techniques.
- ✦ This guide defines what is a bioreactor landfill. It consists in controlling and in accelerating anaerobic degradation processes of waste within a protective containment liner by control of moisture in waste mass, temperature and quality of waste.
- ✦ This treatment way is based on the managed acceleration of the anaerobic degradation process of the evolutive fraction of the municipal solid waste leading to its mineralisation.
- ✦ This process is optimised through a managed diffusion of the humidity within the waste mass: the needed parameter to ensure optimised physico-chemical and biological conditions of stabilisation.
- ✦ This diffusion of humidity is realised thanks a controlled recirculation of leachate.

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STAKES

This waste management recognized by European and French regulations, can have important environmental interests in comparison with traditional or conventional landfills.

1. Control and management of waste biodegradation

The process management is realised by controlling and managing leachate and landfill gas production via the adjustment of the quantity of injected leachate.

2. Reduction of greenhouse gases emissions

Collection and recovery of landfill gas (biogas) help efficiently the reduction of greenhouse gases emissions thanks the management of methane contained in it.

3. Decrease of the duration of waste stabilisation

The expected duration of stabilisation is well below the forecasted one for conventional landfills. The waste mineralization is reached more quickly.

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DESIGN

- ✎ The bioreactor may have some equipments different of conventional landfill.
- ✎ The main differences may involve:
 - ✓ Waste preparation before disposal
 - ✓ Leachate re-circulation requires specific equipment: re-injection plant, piping network, instrumentation, monitoring devices, storage pond;
 - ✓ Biogas network intensified and control the biogas production
 - ✓ The expected elements to manage leachates and biogas: performed pipes, main collection header, ponds or more site-specifically designed
 - ✓ More monitoring (settlement, biogas, leachate) and gas and water tight cover.

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However, implementation of bioreactor landfill requires material and human means and depends on many parameters (configuration site, climate, ...).

In order to provide professionals with environmental bioreactor landfills specifications, the guide describes :

- ✓ Implementation conditions and operational practices,
- ✓ System specifications (re-circulation systems...),
- ✓ Techniques and methods available for preparation of waste and leachate and biogas management,
- ✓ Advantages, drawbacks and application limits associated to these techniques and methods,
- ✓ Standards for monitoring and sampling programme,
- ✓ Risks and difficulties that may be encountered.

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ADVANTAGES

1 Increase of landfill gas production

Landfill gas production is accelerated and increased in a shorter period of time; landfill gas collection is optimised which increased the opportunity for landfill gas to energy recovery.

This leads to the reduction of the consumption of fossil energy.

2 Decrease of odour risks

As the gas & water tight cover of the site, the landfill gas collection network is developed in order to manage the increased production. A better landfill gas management for recovery allows a reduction of odour nuisance risk.

3 Reduction of organic load of leachate

The more leachate are re-circulated, the more their biodegradable organic load decrease.

4 Acceleration of mechanical stabilisation

Settlements occur at short term and allow a quicker sustainable cover. The installation of the final cover sooner decreases greenhouse gases emissions, improve landfill gas collection and reduce the leachate production.

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- ❖ Non hazardous waste management in bioreactor landfill, when is possible, allows a significant reduction of environmental impacts linked to the waste disposal. Indeed, it enables to limit and have a better effect of long-term environmental impacts.
- ❖ Nevertheless, bioreactor landfill implementation has to respect some development and operational conditions detailed in the guidance and to be adapted to each site specifications.

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Thank you for your attention !

