Landfill site rehabilitation with closed hydraulic and pollution cycle.

The aim is to allow degradation processes within landfill to stabilise the landfill and thus minimise potential long term environmental impacts. Landfill operation and after closure management should be therefore designed so that degradation processes are largely completed before the material lifetime ends. In contrast to the permanent storage approach, a process-based landfill concept allows an active landfill management based on the understanding of the biological, chemical and physical processes involved. It focuses on enabling the degradation processes to stabilise the waste and brings forward the inert state of a landfill and therefore offers to avoid long-term environmental risk. In this manner a demonstration Life Environment project «The Sustainable Rehabilitation of Landfill Sites» has been established on the municipal solid waste landfill site at Ormoz, Slovenia.

As the first step of all the rehabilitation work on the landfill site, a constructed wetland (CW) has been constructed for treatment of leachate to immediately stop the direct pollution of nearby stream and agricultural land. After the construction of collecting reservoir and irrigation system on the finalized first rehabilitation phase, complete recirculation of leachate has been established.

The CW is composed of six beds with subsuperficial horizontal and intermittent vertical flow, covering 1000 m².

The beds are lined with impermeable plastic layer, equipped with drainage system, filled with sand and gravel mixture of different hydraulic conductivity, and planted with Salix spp. This creates a new purpose for the growth of the trees.

The pipes of the irrigation system are placed in the depth of 30 cm. Water can be pumped several times during the day according to the accumulation in the collecting reservoir. The landfill cover consist of cover layer of lower quality soil to level the upper compacted waste layer, gas drainage gravel layer, 0.2 m closure clay layer, layer of mixed loam soil material and final humus layer. In the first phase willows (Salix spp) were planted, with 3 m distance between rows and grass with 5% of white clover.

As the second step of the demonstration project refers to process-based approach of landfill management after its closure. The Slovenian legislation in the Regulations of Deposition of Waste, Official Gazette of the Republic of Slovenia (OG RS 05/88) permits that the surface of the landfill body for non-hazardous waste, where biodegradable substances are deposited, can be covered in such a manner, that the percolation of water into the landfill body is possible, what enables the process of mineralization of biodegradable matter.

The landfill site at Ormoz, north-eastern part of Slovenia started as an illegal dump site in a shallow depression. With the beginning of organised collection and deposition of municipal waste in the municipality, it was used for a regular depositing of wastes for the local community. Recently the capacity of the landfill has been filled up. The rehabilitation become urgent as the dump did not meet the requirements of Slovenian legislation for the deposition of waste.

In searching for a solution the management confronted with high costs of the closure and rehabilitation of the landfill. In the mean time it was impossible to find suitable place for a new landfill site. Therefore the management decided for a reconstruction of the existing landfill.

The majority of current techniques in landfill management and aftercare primarily based on a collection of leachate with the permanent storage and containment of waste to minimise negative impacts of the landfill on the environment. The fact is that all materials (mineral clay liners, synthetic lining material like HDPE) break down over geological time scale. Therefore wastes cannot be isolated for an infinite period. It became clear that with so far existing way of landfill closure the problem of waste would be postponed to our next generations.

The new aim is to allow degradation processes within landfill to stabilise the landfill and thus minimise potential long term environmental impacts. Landfill operation and after closure management should be therefore designed so that degradation processes are largely completed before the material lifetime ends. In contrast to the permanent storage approach, a process-based landfill concept allows an active landfill management based on the understanding of the biological, chemical and physical processes involved. It focuses on enabling the degradation processes to stabilise the waste and brings forward the inert state of a landfill and therefore offers to avoid long-term environmental risk. In this manner a demonstration Life Environment project «The Sustainable Rehabilitation of Landfill Sites» has been established on the municipal solid waste landfill site at Ormoz, Slovenia.

DRAIN CELL CONCEPT TOWARD PROCESS BASED APPROACH

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