

Long-term strategies aiming at minimising the aftercare period of landfills

Ole Hjelmar, DHI – Water & Environment, Denmark, email: oh@dhi.dk
Jorgen G. Hansen, Danish Environmental Protection Agency, email: jgh@mst.dk

Background

The major environmental concerns associated with landfills are usually related to the generation and eventual discharge of leachate into the environment. This is particularly true for the aftercare phase of a landfill, when impacts such as noise, dust and traffic caused by the operation of the landfill no longer are relevant. The most important aspects of disposal strategy are therefore expressed in terms of formation, fate and management of the leachate. Both the quantity and quality of the leachate formed depend upon the characteristics of the waste, the design and operation of the landfill and the climatic conditions.

Landfilling and the associated regulatory controls have generally been based on the implied assumption that the waste will become harmless in terms of emission of leachate in a relatively short time due to stabilisation and mineralisation reactions. It is often assumed that a landfill may be safely abandoned and perhaps even forgotten after a period of e.g. 30 - 50 years. This may have been true for the domestic waste produced in earlier times, but it is unverified (and unlikely if not pursued by special efforts) for the often very complex separate or mixed streams of organic and inorganic waste produced and landfilled in large quantities by modern industrial society. In addition, some of the landfilling techniques employed (e.g. the application of low permeability covers) are likely to reduce rather than increase the rate of stabilisation of the waste.

The "final storage quality" of the waste (that is the criteria determining whether or not it will be environmentally safe to leave a landfill site to itself without active leachate management and environmental protection systems), and the time needed to reach this point is generally not very well defined. The definition of final storage quality and various landfill strategies and options aiming at reaching final storage quality within the shortest possible time-span will be discussed in view of the EU Landfill Directive (Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste. Official Journal of the European Communities, 16.7.1999, L182/1-19) and the associated (pending) criteria for acceptance of waste at landfills. Efforts at minimising the aftercare period plays an important role in the current Danish legislation on waste management and landfilling, and some of the relevant regulatory provisions and their background will be discussed. The presentation will focus on the leaching of behaviour of various inorganic wastes in relation to disposal strategy and include presentation 29 years of field observations of the leachate from a MSWI ash landfill.

The EU Landfill Directive

The EU Landfill Directive (LFD) defines three major classes of landfills: landfills for hazardous waste, landfills for non-hazardous waste and landfills for inert waste. It is the over-

all objective of the LFD to “provide for measures, procedures and guidance to prevent or reduce as far as possible negative effects on the environment, in particular the pollution of surface water, groundwater, soil and air, and on the global environment, including the greenhouse effect, as well as any resulting risk to human health from landfilling of waste, during the whole life-cycle of the landfill.” The duration of the aftercare period is discussed only in terms of economy, and the LFD does not provide any guidance on landfill design and operation aimed at minimising the aftercare period. It is, however, possible at EU Member State level e.g. to define sub-categories of non-hazardous waste landfills to accommodate national strategies intended to minimise the aftercare period.

Danish landfilling regulations

For a number of years it has been the Danish landfill policy not to rely on active environmental protection systems (leachate collection and treatment systems) beyond a period which may be considered realistic compared with the life expectancy of these systems. Another basic principle has been that each generation should take care of its own waste. This has resulted in regulations prescribing, that wastes, which are incompatible in terms of leachate management cannot be landfilled together. It has also resulted in a preference for disposal of inorganic waste (incineration of most MSW) and a requirement that the leachate from a landfill must become acceptable in the surrounding environment no later than 30 years after closure of the landfill. Indirectly, these requirements call for waste pre-treatment and/or special operational procedures during the initial period of the landfill's lifetime (e.g. flushing/enhanced leaching and subsequent treatment of the leachate). The Danish guidelines and regulations for landfilling are being revised as part of the implementation of the LFD.

Field observations of MSWI ash leachate

The quantity and quality of the leachate from a MSWI ash landfill has been monitored over a period of 29 years (established in 1973). It may be regarded as a crude indication of the time needed to reach final storage quality for this type of waste. The amount of leachate produced during the 29 years corresponds to an average L/S of approx. 1.1 l/kg and is due to infiltration of approx. 30 % of the precipitation through a cover of 1 m of grass-grown top soil. As an average for 1998 to 2001 the still reducing leachate contained 1500 mg/l Na, 270 mg/l K, 2100 mg/l SO_4^{2-} , 540 mg/l Cl^- , 0.6 mg/l $\text{NH}_3\text{-N}$, 0.005 mg/l Pb, 0.0006 mg/l Cd and 0.03 mg/l Cu. Although this constitutes a substantial decrease in contamination level since 1973, the salt leaching from the ash is probably not yet at a level which can be considered indicative of final storage quality of the waste.

Conclusions

The final storage quality and the duration of the aftercare period are generally not addressed explicitly in waste disposal legislation, including the EU Landfill Directive. The LFD does, however, allow the EU Member States to cope with these issues at a national level. Field observations indicate that it may take more than 30 years for landfilled MSWI ash to reach final storage quality unless special measures are applied to enhance the leaching process.