

LONG TERM POST-CLOSURE CARE OF LANDFILLS REQUIRES PROFITABLE POST-CLOSURE LAND-USE

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SUMMARY: Landfills do require post-closure care, if they were filled with waste which was not pre-treated and if landfill operation did not manage to degrade organic waste and/or to leach chemical waste. Landfill post-closure care is costly, but money usually is not available. For this reason, landfill post-closure care will be carried out insufficiently. The responsible authorities will not have available enough experts to supervise post-closure care. If filled and covered/capped landfill sites could be used economically, landfill post-closure care could be (at least) partly paid from the profit of the leaseholder. In particular, the leaseholder would insist on monitoring of landfill emissions which may endanger his business. Opposite opinions are discussed.

1 Introduction

Landfills, in particular landfills for municipal solid waste (MSW) must not be ignored after they are filled, covered or capped. Biological degradation processes, chemical leaching processes do not stop with closure. Even after the closure of landfill sites these processes have not decreased enough for the emissions not to have an environmental impact.

The research report SUSTAINABLE LANDFILL IN THE UK: A REVIEW OF CURRENT KNOWLEDGE AND OUTSTANDING R & D NEEDS and also research results in Germany, which form the basis for the German Landfill Strategy, but also the intentions behind the EU directive on landfilling of waste, underline the problems of landfilling untreated MSW.

2 What post-closure care is required for how long?

Usually necessary is the monitoring of:

(i) landfill gas (volume and composition), (ii) leachate (volume and composition), (iii) groundwater (composition), (iv) settlement (landfill bottom, landfill surface), (v) biological degradation processes in the landfill body, (vi) efficiency of bottom liner and cap systems, (vii) efficiency of the "water budget layer" (revegetation layer, top soil layer).

Based on the monitoring results, certain measures will be determined, for example:

(i) repair or re-construction of landfill gas extraction facilities and landfill gas utilization equipment, (ii) repair or re-construction of leachate collection systems, (iii) repair or re-construction of landfill capping system, (iv) maintenance of vegetation, (v) biological in-situ-stabilisation by leachate infiltration or aeration of the landfill body.

Landfill after-care depends on individual circumstances. It is therefore impossible to determine the duration of post-closure period. Art. 10 of the EC Landfill Directive demands 30 years of post-closure care. However, this length of time only forms the basis for calculation of landfill charges and financial security.

Ehrig developed very interesting proposals to determine necessary post-closure care periods after evaluating monitoring data of 75 MSW landfills (located mainly in North Rhine Westphalia, Germany). Conclusions are:

Recent landfill research has shown, that emissions from landfills on the water path will be above the German threshold values for 100 to 300 years. For more than 1000 years discharge of leachate into waters will not be permissible. Therefore, a new strategy is necessary for how long post-closure care could be done and organized. Current strategies are not reasonable as landfill operators will not be held liable for such a long time.

With regard to landfill gas generation Ehrig concluded:

Data describing landfill gas generation show that at maximum 30 to 40 years after stopping landfilling an active landfill gas extraction will be necessary. Later on only marginal gas emissions will occur.

With regard to leachate generation was concluded:

Frequently the end of the post-closure care period is assumed to be at the time when German threshold limits for discharge of leachate into waters are reached. This means for COD and nitrogen in many cases post-closure periods of 200 to 300 years. Of particular importance is to be aware that every reduction of water infiltration into the landfill body will extend post-closure care periods. Therefore capping is critical.

Discussion regarding the issue of "leachate and post-closure care" in Germany can only be understood with a knowledge of the German legislation. The most important issues for post-closure use of a landfill site are landfill gas generation, landfill gas emissions as well as settlement of the landfilled waste.

3 Why is economical land-use of closed landfills helpful to perform post-closure care?

Landfill post-closure care is costly. Once landfills are filled, society tends to lose interest in them. The public forgets or ignores that landfills were designed, licensed and constructed to store waste forever.

Usually, there is no financial security to pay for landfill post-closure care or money put aside has since been allocated otherwise. The public does not want to pay for post-closure care from charges paid for today's waste disposal. And often law courts support them, because the legal framework in Germany is insufficient in most parts of Germany (Laender) to provide post-closure care.

The communities, where landfills are sited, are usually not interested in filled landfills too. In Germany there is an Environmental Liability Law much admired by many politicians, which has the effect that no one would ever buy a closed landfill site, as he could be held liable for high compensation charges for environmental damage and health problems pretended to be caused by landfill emissions.

So, how could one achieve, that post-closure care will be carried out as required and for the necessary length of time? The simplest solution is, if the filled landfill area would be commercially used.

Possibilities for post-closure use are for example:

(i) areas for recreation parks, (ii) ski slopes, (iii) restaurants with a view, (iv) sites for innovative energy plants such as wind turbines or photovoltaic, (v) company storage areas, (vi) waste treatment plants.

4 What hinders the post-closure utilization of landfill sites?

Utilization of filled MSW landfills is hindered by: (i) civil servants in ministries, agencies, etc., permanent looking for more stringent criteria for landfills, (ii) NGO environmental activists protesting against locating a landfill or landfill extension and blaming landfills as environmental hazards, and as a follow up preventing anybody from utilizing filled landfills, (iii) higher cost for post-closure control of landfill emissions to avoid any risk for landfill site users, the landfill operator has to pay for.

This is not to say, that MSW landfills do not cause an environmental impact. However, it must be made clear that MSW landfills, at least in Germany do not pose environmental hazards provided they are: (i) lined at the landfill bottom, (ii) have leachate collection and leachate treatment, (iii) have landfill gas extraction and landfill gas utilization and (iv) are monitored as required to confirm results of the environmental impact assessment.

The neighbourhood and the landfill workers were not endangered during landfill operation. Therefore, no danger is to expect once landfill operation has ceased, landfill surface is covered and landfill emissions are monitored and controlled.

If landfill utilization brings economic benefit for the leaseholder of the filled landfill area, costs for landfill post-closure care could possibly be paid from the profit. At least the leaseholder has an economic interest in monitoring and implementing necessary post-closure care, which responsible communities and authorities, perhaps are not willing or not able to do.

These are possible considerations on post-closure care of closed landfills and profitable post-closure land-use. However, checking them with experts from responsible authorities, landfill operators as well as consultants it became obvious that they may be seen also unrealistic and undeliverable from the point of view of practice.

Opposite considerations are:

Post-closure use of landfills is critical in particular because of landfill gas emissions, which may cause health defects, fires, explosions. Licence authorities tend to forbid free accessibility of the landfill area. If utilization of closed MSW landfills would be allowed to use for example as recreation parks, health risks caused by landfill gas emissions through caps, in particular desiccation cracks in mineral caps, has to be taken into account. In order to prevent all risks from landfill emissions the monitoring effort would be extremely high, so that any financial benefit from post-closure land-use would be unlikely. Agricultural post-closure land-use is not feasible. If a landfill is capped, the cap system must not be damaged. If however, the landfill is not capped, negative effects on agricultural products are possible.

Also, most existing or recently closed landfills considered here, which are technically well equipped, are sited a considerable distances away from residential areas or industrial areas, and many landfills are hidden in forest areas. Therefore the likely interest in commercial or recreational use or fun parks would be low. This would be different with “badly” sited landfills – landfills sited close to built up areas -, where some parties may be much more interested in post-closure land-use, as the land has a high value.

As mentioned above landfill gas generation becomes negligible after 30 to 40 years with resulting from use before the time cannot be justified but the use of closed landfills should be reconsidered once this period is over.

In Germany there are sufficient legal possibilities to ensure a landfill operator perform adequate post-closure care. Responsible authorities only have to make use of the regulations. To release public landfill operators too early from their post-closure care obligations is not of public interest. Private landfill operators should as soon as possible deposit financial securities for post-closure care - for at least 30 years.

There may be special cases where post-closure land-use is in the commercial or public interest and a decision should be made for each particular case.

In summary: representatives from responsible authorities disagree that post-closure care will not be performed as necessary without profitable post-closure land-use.

Generally, landfill operators are most interested in minimizing post-closure care costs. A public open land-use is usually increasing post-closure care costs, and therefore not in their interest. The idea of a profitable commercial post-closure land-use is beyond the imagination of many experts.

5 Examples for post-closure land-use in Germany

In Germany there are some extraordinary examples for post-closure use of closed landfills. On most of these landfills landfilling (sometimes only waste dumping) began decades ago and the landfills have been closed since some years. Most of those landfill sites have in common, that they are located not far away from residential or industrial areas. If the land, the landfill site is located on, is close to residential areas and therefore has a high value, and if the filled landfill is seen as big nuisance to the community before an adequate land-use, there will be a high interest in restoration by the local authorities. Examples in Germany are:

Landfill site NEUMUEHLE, Amberg, Bavaria

Landfilled waste: Demolition material, MSW, industrial waste, incinerator residues, galvanic sludge, Closure: approximately 1965, Siting: Close a housing area, Problems: Risk of explosion due to landfill gas, groundwater pollution, Solution: Aerobic stabilization of landfilled waste. Begin: 2001, Post-closure land-use: commercial area, horse riding club

Landfill site AM LINDENBACH, County Garmisch-Partenkirchen, Bavaria,

Landfilled waste: MSW, demolition material, Closure: 1983, Siting: close to a natural conservation park, Problems: Environmental impact on the nature conservation park, water pollution, high leachate treatment costs, Solution: Waste excavation and landfilling in a landfill needing waste to be filled.

Landfill site LEICHENDORF, Zirndorf, County Fuerth, Bavaria,

Landfilled waste: MSW, demolition material, and in the last years mainly incinerator residues, Siting: filled clay pit close to a commercially used area, land close to Playmobil enterprise facilities, Problems: minor landfill gas emissions, leachate generation, Solution: mineral cap, landfill gas extraction, not adequate used land close to Playmobil enterprise facilities, Post-closure land-use: Playmobil Fun Park, construction began June 1998; Playmobil Fun-park opened Mai 2000. See also <http://www.playmobil.com/usfunparks/zirndorf/zirndorf.html>

Landfill site CRACAUER ANGER, Magdeburg, Sachsen-Anhalt, Landfilled Waste: MSW, Demolition material, 90 Mio m³, height: 40 m, Closure: 1997, Siting: At the outskirts of the City of Magdeburg, close to the river ELBE, Problems: landfill gas, groundwater pollution, Solution: landfill capping, landfill gas extraction and landfill gas utilization, post-closure land-use: Part of the area for a Federal Gardening Exhibition 1999. After the exhibition: part of a park close to the

river ELBE. <http://www.magdeburg-aktuell.de/Events/Archiv/Buga/start.asp> or search for “cracauer anger” +deponie

Landfill site Neuss and Slag hill Bochum, North-Rhine Westfalia, land-use: alpine indoor winter sports center. See: <http://www.allrounder.de>

6 Final Remarks

Landfills do require post-closure care, if they were filled with waste which was not pre-treated and if landfill operation did not manage to degrade organic waste and/or to leach chemical waste.

Landfill post-closure care is costly, but money usually is not available. For this reason, landfill post-closure care will be carried out insufficiently. The responsible authorities will not have available enough experts to supervise post-closure care.

If filled and covered/capped landfill sites could be used economically, landfill post-closure care could be (at least) partly paid from the profit of the leaseholder. In particular, the leaseholder would insist on monitoring of landfill emissions which may endanger his business.

These opinion is not shared by all experts from responsible authorities as well as from landfill operators and consultants. It is said that MSW landfills with regard to control of landfill gas and settlement of the landfill body were not suitable for public open land-use. Licensing such a land-use would be possible only on the basis of a case to case study. From the point of view of landfill operators post-closure care is much more expensive if the closed site is open for the public. The additional costs will be higher than the income or benefits of the land-use. Legislation in Germany is stringent enough to ensure landfill operators to perform post-closure care. The landfill gas issue will last only 30 to 40 years after landfill closure, if the landfill is operated according to the best available technology.

Who will be right in the end? How will post-closure care be carried out in most EC Member States?

References

- Verordnung über Anforderungen an das Einleiten von Abwasser in Gewässer (Abwasserverordnung - AbwV) Fassung vom 9. Februar 1999 (BGBl. I 1999 S. 86) Anhang 51
Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste (EC Landfill Directive).
In: Official Journal of the European Community, L 182/1 16.7.1999
online available http://www.landfillonline.de/recht/eg/eg_deporili.htm#eudeporili
- Ehrig, J, Kruempelbeck, I. (2000) Nachsorge von Deponien (post-closure care of landfills). In. ATV-Schriftenreihe 20, ATV – DVWK – Bundestagung 2000. GFA Gesellschaft zur Foerderung der Abwassertechnik e.V. page 595 to 607
online available (Oct. 1st, 2001) <http://www.landfillonline.de/fachlit/pdf/ehrigatv00.pdf>
- Sustainable landfill in the UK: A Review of current knowledge and outstanding R & D needs
Research report prepared for: The Nordlands Foundation and ESART by Keith Knox, Knox Associates, February 2000, online available <http://www.esart.org> > projects > completed