Environmental, engineering and regulatory aspects of one formerly illegal municipal dumpsite

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Abstract: Landfill and waste management regulations issued in Slovenia last few years generally comply with the European landfill directive. However, the best practical environmental options are often in net disaccordance with the correspondent requirements derived from regulations, when they are interpreted rigidly. A concrete example from the field will be presented, dealing with matters extending from landfill site hydrogeology, environmental science to geomechanics.

Key words: municipal landfill, waste management, hydrogeology, soil mechanics, Vipava valley.

Introduction

New regulation on waste disposal in Republic of Slovenia requires that existing municipal 'dumpsites' should either close down in the year 2004 or to comply with the requirements regarding degasification, leachate water collection and landfill body sealing in order to fulfill the standards needed to achieve the permission to operate a few years more, namely until the time new regional concept of waste management will become operational.
After the closure of many small landfills, a big economic opportunity will be given to the remaining landfill site operators, eventually being transformed into regional ones. Communities with their landfills already closed or destined to immediate closure automatically become handicapped by such succession of events. Previously existing practice and going on trends show, that the closure of their own landfill, as a rule, results in a multiple increase of the waste discharge fees paid by the residents or/and in a substantial outflow of the budget funds. Consequently, local authorities are not able to accumulate money for investments into any waste management activity on their territory. The fees cannot be raised even higher, because the residents are not willing to participate. Additionally, only landfill site operators have the right to the refundation of the state-owned landfill tax gathered from the residents and industry, which is a principal source for investments in the field of waste management.

Scientific paper

UPPER VIPAVA-VALLEY CASE (WESTERN SLOVENIA)

Facts about the local landfill and difficulties surrounding its further fate

The municipal landfill for non-hazardous waste close to town of Ajdovščina was quite typical of Slovene conditions somewhere in 2001 with respect to it's semi-legal status, appearance and size (~300,000 m^3 large, above-ground pile), waste structure and simple 'dump and cover' technology used. It still covers (year 2003) the needs of some 23,000 inhabitants as well as those of relatively large local industry.
Certain comparative preliminary studies sorted this landfill out as one of those in Slovenia to be closed down until the end of the year 2004. Reasons for such perception were environmental concerns, engineering deficiencies; it's exhausted capacity and regulatory issues. Additionally, a supposed- to- be regional landfill existed few tens of kilometers away, ready to take wastes from the two Upper Vipava valley municipalities.
In such situation, the local municipal company begun with the process of legalization of the existing landfill and ordered the elaboration of the environmental impact assessment study and the outline scheme for the reconstruction of the existing landfill. This time the company's personnel, reinforced by the environmental/geotechnical engineer, actively collaborated in the creation of this documents.
It was found that the present site with its immediate surroundings offered a realistic possibility for a minor landfill enlargement as well as to put up an adequate waste reclamation center and a compost facility there. The possibility to prolong local land filling for a decade would indirectly allow the two communities to set up an adequate waste management system. The remaining waste stream would then be diverted to the regional landfill. However, at first it was necessary to establish whether the pile's present location complied with the environmental and geomechanic criteria or not.

Environmental and geomechanical analyses about the state of the existing landfill site in 2001/2002

Comprehensive analyses were made on the basis of:
- already existent data and estimates
- repeated chemical- physical analysis of various waters and landfill gas samples
- on site oxygen-saturation measurements

Methods used:
- hydraulic calculations using official as well as estimated data
- environmental modeling using official as well as estimated data
- logical deduction using official as well as estimated data
- long- term observations and comparisons

Resulting findings were quite surprising, regarding that landfill reputation was bad:
- bearing capacity of the soil on which the pile was lying was more than sufficient;
- existing pile's slopes needed to be remediated only very locally;

- polluted water samples taken from the downgradient monitoring boreholes did not represent the groundwater, but the pumped-in nearby surface water;
- hydraulic gradient was directed out of the pile in all directions;
- groundwater could not be polluted by the waste pile's leachate water at all;
- any possibility about the break of pollutants through the geological strata below the pile was reversed;
- surface waters pollution derived from the landfill leachate water emissions was found to be surprisingly small, etc.

Remediation of the existent landfill during the winter/spring 2002/2003

Remediation project was made on basis of already presented findings from the stability and environmental impact assessments. The derived principal environmental goals were to capture and treat the leachate water, to reduce the emissions of polluted runoff water during the storms, to set up a system to intercept the lightweight fractures of waste during the strong winds events, to embellish the pile's appearance within the surrounding landscape and to accelerate the degradation/mineralization processes within the landfill body. Remediation works finished in may 2003, that is:

- A 4 to 9 meters high peripheral dyke was built from the excavated waste;
- Waste pile's outer slopes and berms as well as the crown of the peripheral dyke were covered by a ~1.2 m thick soil layer and recultivated;
- Drainage tubes were laid all around the pile, basin for the collected leachate water was built and leachate water cycling system established, etc.

Compliance with the regulations

The remediation has not been totally in accordance with the Slovene regulations regarding the requirements about the top cover of the closed part of landfill, which should be otherwise completely impermeable. Pragmatic solution regarding the interpretation of regulations was found.

Sealing the municipal waste landfill on its top would result not only in the waste of money, but would be environmentally unfriendly, too. Namely, the formation of gases would be depleted soon after the covering of the landfill, regarding that the anaerobic bacteria need water to survive. Gas collection system would thus be put out of operation before it would have begun to give real practical results. Leachate water collection system would become disfunctional, too, because no leachate would seep out of the waste body any more. Instead of controlled mineralization by monitoring leachate water quality and landfill gas production in the course of three decades after the landfill's closure, uncontrolled half-reactions would take place within the closed reactor. And the last (but not the least): slope stability difficulties would arise if the waste pile were covered by some sort of foil.

Slovene landfill regulations are based on the European Landfill Directive, and both of the acts are thought to be rigorous. Nevertheless, it seems that the European regulation makers were conscious, that many of the requirements may be reduced to an appropriate extent, if on the basis of an assessment of environmental risks is established that the landfill poses no

potential hazard to the environment. This important, somewhat hidden part of the regulations has given to the geoenvironmental scientists and engineers an opportunity to be able to rechannel some of the investments, which could be otherwise spent wrongly or irrationally, into the right direction. Namely, different municipal waste bodies generate very different leachates, and differences between the hydrogeological settings may be enormous. Uniform and rational solution for all the possible environmental settings simply does not exist, at least not considering the BPEO principle.

CONCLUSIONS

One of the widely spread ecological perceptions towards the waste disposal problems is that the expensive landfill equals to environmentally friendly landfill. It works hand in hand by the principle 'expensive landfill → more recycling', which was one of the driving forces in setting up the regulations, too. Generally, this somewhat confused 'synergy' should result in a good environmental practice, however, rigid approaches may lead to bad practical solutions on the field very easily.

Local municipal landfill near Ajdovščina was suspicious to be a big pollutant. However, comprehensive multidisciplinary analysis has shown that the existent waste pile could be remediated cheaply as well as the site is adequate for a smaller landfill enlargement.

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