



## DHI CASE STORY

## LANDFILLING OF SHREDDER RESIDUE

Reduced environmental impact and costs by shorter landfill after-care period

The management of landfills after closure (also known as the after-care period) is one of the most challenging issues related to landfilling of waste. This is because of the high impact potential spanning a duration of several hundred years. Our client was facing a similar challenge. In order to help them overcome it, we focussed on implementing accelerated percolation. This was done to effectively shorten the after-care period. It also helped to enhance the leaching of potential contaminants in the early years of the after-care period, thereby allowing proper leachate treatment and minimising environmental burden.



*Establishment of test cells at the bottom of a newly established landfill unit for shredder waste at Reno Djurs. Test cells are filled with drainage gravel and will be covered by landfilled shredder waste. Leachate can be collected separately from each cell ©DHI*

### LANDFILL LEACHATE AND CHALLENGING AFTER-CARE

Landfilling of waste generates landfill leachate. Landfill leachate can be defined as a liquid that has passed through the landfilled material, thereby extracting solutes, suspended solids or other components (both environmentally harmless and harmful) of the material through which it has passed. Typically, leachate contains:

- dissolved organic matter (for example, acids, aldehydes and sugars) common inorganic cations/anions including sulfate, chloride, Fe, Al, Zn and ammonia)
- heavy metals (for example, Pb, Ni, Cu, Hg)
- organic compounds such as Polychlorinated biphenyls (PCBs), Brominated flame retardants (BFRs) and dioxins

### SUMMARY

#### CLIENT

Reno Djurs A/S, Denmark

#### CHALLENGE

- Lack of knowledge of the leaching behaviour of shredder waste in landfills
- Possibility of negative environmental impacts of this leachate
- Need to estimate the duration (and related environmental impacts and costs) of the after-care period
- Need to explore the possibility of shortening the after-care period using accelerated percolation

#### SOLUTION

- Our expertise in leaching processes
- Laboratory leaching tests
- Tailor-made field tests

#### VALUE

- Major cost savings
- Reduced after-care period
- Reduced risk for environmental impacts from leachate

#### LOCATION / COUNTRY

Glatved, Denmark

If managed incorrectly or ineffectively, there is a high risk of soil and groundwater contamination during the operational time as well as after closure.

Typically, the after-care period for landfills is set to around 30 years. However, experience shows that unless a proactive approach is taken to stimulate the leaching process, it may take up to several hundred years for some contaminants to reach environmentally acceptable levels in the leachate. For any landfill operator, such a long period is both technically and economically unacceptable.

In order to help our client overcome this challenge, we used our expertise in leaching processes, laboratory leaching tests and tailor-made field tests. In so doing, we helped them by:

- providing accurate estimates of the duration of the after-care period for different leachate generation scenarios
- proposing a solution for shortening the after-care period

### COMBINING LABORATORY AND FIELD TESTS

We set up a specific test programme with the purpose of examining possible ways to reduce the after-care period and related costs through accelerated leaching and leachate recirculation. We planned and assisted with the practical setup of 10 test cells at the landfill site. Furthermore, a recirculation system was established. We carried out tests with recirculation and accelerated leaching in cooperation with Reno Djurs. Information on precipitation, temperature and amount of leachate produced from each cell were recorded. We also performed chemical analyses of leachate from the test cells and landfill sites. A number of different analyses and leaching tests were performed at our laboratory in Hørsholm. This was done in order to conduct a 'basic characterisation' of the shredder waste and to determine its particular leaching behaviour.

#### THE BASIC CHARACTERISATION OF SHREDDER WASTE INCLUDED

- Chemical analysis of the solid content of shredder waste
- Batch leaching tests (EN 12457-1) on monthly samples collected over the duration of one year
- One batch leaching test on a yearly sample produced from monthly sub-samples
- Percolation leaching test (CEN/TS 14405), pH-dependent leaching test (CEN/TS 14997) and column test for organic substances (method developed by us) performed on a yearly sample

For this purpose, we planned and assisted with the sampling of shredder waste at the landfill site. With assistance from the client, we carried out the necessary sample pre-treatment to gather representative samples for the subsequent analyses and tests.

### VALUABLE INFORMATION ON THE LEACHING BEHAVIOUR OF SHREDDER WASTE

The combination of suitable laboratory tests and tailored field tests provided valuable information about the leaching behaviour of shredder waste.

Field tests showed that there is an uneven flow of percolating water through the landfilled shredder waste. This results in dry sections filled with shredder waste. If these sections do not come into contact with water, leaching will not begin and duration of the after-care period will be prolonged significantly.

Leaching at the landfill site takes place under oxygen-reduced conditions. Results (from laboratory tests performed under oxidised conditions) showed that leaching will increase for a number of substances. Based on the laboratory and field data, we performed source term calculations. This simplified modelling exercise indicated that it would take several hundred years before the leachate from the shredder waste can fulfil environmental quality criteria. Our evaluations showed that the after-care period can be reduced to less than 100 years if leaching is accelerated. We showed that controlled infiltration of substantial amounts of water could potentially reduce the after-care period even further – to about 30 years.



*Preparation of representative samples for subsequent leaching tests at our laboratory in Hørsholm © DHI*

### LESSONS LEARNT

Innovative solutions for landfill operation can reduce the costs of, and duration for after-care period at Reno Djurs:

- Improved pre-treatment of shredder waste may enhance water contact and leaching
- Acceleration of leaching can substantially reduce the after-care period. This reduces the costs for maintaining environmental protection measures after site closure and will ultimately reduce the price charged for landfilling of shredder waste

Contact: Jiri Hyks—[jhy@dhigroup.com](mailto:jhy@dhigroup.com)  
For more information visit: [www.dhigroup.com](http://www.dhigroup.com)