DP Landfill Remediation & Smell-Well System

The IUT Group
Member of the DP CleanTech Group

DP CleanTech
Creating value from waste

Introduction

In most countries, landfilling has at some time been a primary solution for disposal of waste. Over time it has been recognised that unless waste is rigorously separated and landfills are properly managed, they become a source of environmental and social hazards. This has led to more widespread practices of waste sorting to minimise the problem, but waste separation is still not universal and the negative impact of poor landfill management is prevalent in many countries. There is now a greater emphasis on how best to alleviate the immediate issues and prevent or eliminate their recurrence. There is also a need to reclaim land for development, and the economic and environmental benefits of waste recovery and re-use are being facilitated by more effective waste-to-energy and recycling technologies.

Furthermore, whilst landfill is increasingly the least preferred method of waste disposal, there is still a need for proper landfill design and management, and the requirement to manage existing landfills to minimize environmental and other problems.

Typical Problems from Landfills

- Contamination of groundwater aquifers from uncontrolled leachate
- Health hazards and residual risks associated with alternative solutions (such as encapsulation, pump and treat systems and in-situ processes)
- Problems from naturally occurring toxins and synthetic compounds
- Explosion and fire hazards from flammable gases and gas mixes
- High cost of after-care and control, particularly regarding the capture of leachate and gas emissions

Landfill mining and landfill remediation are cost- effective solutions to the need and desire to address these problems and can also generate additional benefits.

Benefits

- Elimination of environmental hazards from landfill for the local community
- The reclaimed site becomes eligible for new uses
- Significant reduction or elimination of ongoing landfill management costs
- When material is returned to the landfill, there is a possible volume reduction of up to 40%
- Re-sale value of recovered precious or scarce materials

The development of landfill remediation technologies and services which can eliminate the hazards; improve the environment and enable the transformation of landfills to usable real estate were pioneered and patented by IUT in the 1980's and are still the leading solutions with 60 references worldwide. DP merged with IUT GmbH in 2018 to create a stronger waste management portfolio with proven IUT technologies and knowhow.

Sustainable Landfill Remediation And Mining

The sensitive and unstable conditions of a landfill make site remediation a specialized skill and requires specific knowhow in planning, technology choice and project implementation.

Final rehabilitation of an existing problem site can only be achieved once the source of the hazard has been removed, using technologies which are harmless to humans and the environment. The use of such technologies must be adapted to the specific situation and requires a depth of knowledge that can only come from experience.

Project Evaluation and Implementation Process

1. Preliminary investigation of the landfill
2. Technical feasibility study
3. Economic feasibility study
4. Safety plan
5. Logistics, excavation, transport
6. Opening of the landfill and mining of material
7. Separation, chemical characterization and classification or mined waste according to original materials
8. Treatment of waste
9. Landfill replacement

Considerations

Landfill remediation projects can range from improvement of landfill management to full remediation of the landfill. Various technical, economic and environmental factors will impact the decision on project feasibility.

- Choice of technology
- Total remediation cost
- Ongoing landfill management cost
- Available quantity, quality and sale value of recovered materials suitable for recycling and waste-to-energy uses
- The potential real estate or development value of reclaimed land
- The local environmental impact of landfill site remediation

Landfill Remediation Challenges

Typical landfills are a combination of industrial/mixed solid waste, with each having its own unique composition. To address the problems and meet the specific project objectives requires great depth of knowledge and operational experience in order to define the best technologies and most effective landfill management plan.

- Unstable and potentially volatile materials
- Materials analysis and composition
- Selection of the most appropriate and effective segregation technology
- Need for different levels of methane gas extraction and treatment
- Difficult working conditions
- Dust abatement requirements
- Elimination of residual gas formation potential in the materials returned to the landfill
- Management of gas and odour formation
- Gas and odour purification
- Soil remediation

Technical Solutions

The selection of the best technologies to address these issues is based on experience and understanding of the specific situation. With 60 references, the IUT team can draw on over 30 years of landfill remediation technology, design and implementation expertise to address the requirements of any project.

Smell-Well System

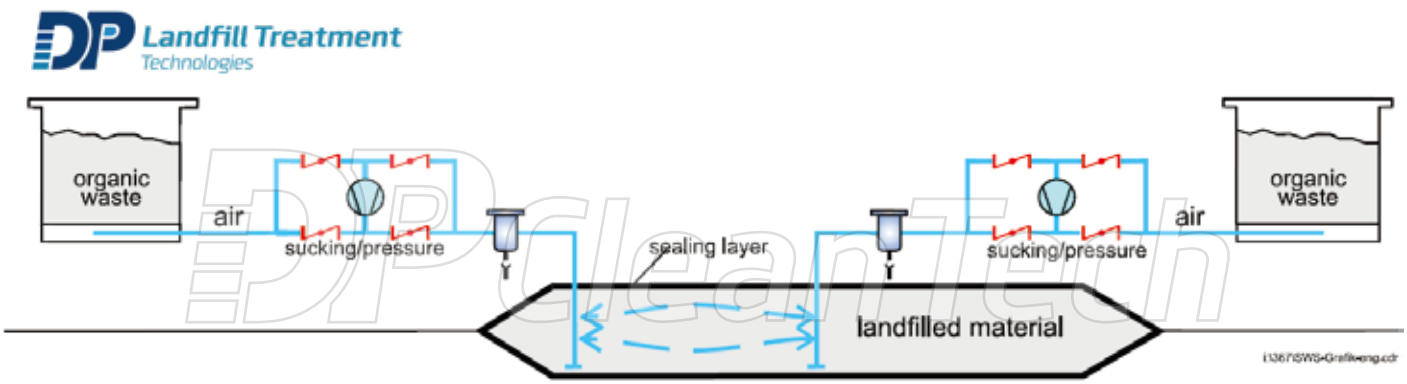
One of the major hazards associated with landfill is the production of toxic and noxious gases. The Smell-Well System both removes and prevents the formation of methane and other odorous and hazardous landfill gases using aeration techniques. Air is forced into the landfill whilst the gas present in the landfill is extracted and purified by passing it out via lances and through biofilters. Only this unique, patented system allows safe and unimpeded work on the landfill site.

The Smell-Well System for the stabilization of landfills has been proven reliable even under extreme temperature conditions, such as >50 °C in the Emirate of Sharjah, United Arab Emirates and -30 °C in Quebec, Canada.

Biofilter facilities for aeration of the landfill areas and connection to lance cap

The Smell-Well Process and Principles

The primary source of noxious smells is anaerobic bacteria activity. Reducing anaerobic activity, cleaning the noxious air and preventing further odorous gas formation can be achieved by simultaneously blowing air into the landfill; and drawing off the foul-smelling gas and air to be cleaned in a biofilter. The supply air to replace the drawn off gas is also passed through the biofilter where it is heated and enriched with aerobic bacteria – this encourages an aerobic atmosphere and prevents the formation of anaerobic conditions. The multi-level biofilter was developed by IUT and has been optimised for the reduction of odour and methane emissions.



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One of the problems connected to odour stabilisation is the need to keep water levels constant. Where landfills have no drainage, moisture levels are very high, leading to condensation and blocking of the piping system used to draw off the gas/air mixture. To solve this problem, the direction of the airflow is reversed every hour. This is done by means of butterfly flaps, so that the lances both blow air into the landfill, and also draw it off.

At the same time, the high temperature biofilter needs to retain moisture. The water passing through the biofilter is evaporated to steam and recirculated back to the landfill, creating a closed loop. Excess water is collected in special water collection systems. Using this method, it is possible to operate the system for many years without having to add water to the biofilter.

To supply the landfill material with sufficient air, lances of a length of 3.5m (standard lance) or 1-15m (flexible lance) are forced into the landfill in a grid-like array, at intervals of 5 to 6 (up to 10)m. The hourly reversal of the air flow prevents canalization inside the buried material and facilitates a continuous aeration of the excavation area.

The Smell-Well System has been in successful operation for more than 30 years and has primarily been used in household and commercial waste landfills.

Accreditations

The Smell-Well System holds global patents and meets the following requirements

German "GUV 17.4" regulation

It is accredited by

German "Berufsgenossenschaft"

German TÜV

Case Studies and References

Municipality of Sharjah, UAE

The situation

Sharjah is the third largest Emirate in the UAE and is experiencing rapid urban development. An area that was targeted for development contained a 200ha old landfill, filled with 7.5mill m^3 of MSW, construction and demolition waste, industrial waste (oil sludge, paints etc), making this the largest landfill site remediation project in the world at that time. The site was further polluted by groundwater and waste water effluent. The dump was closed in 2000, but the Emirate wished to rehabilitate the landfill to enable the land to be used for urban infrastructure and development.

In April 2004, EMIRATES ENVIRONMENTAL TECHNOLOGY Co. LLc. (EET), part of The IUT Group. was contracted to design and manage the landfill remediation project, which was was monitored by Halcrow International Partnership and the American University of Sharjah.

The solution

In June 2004, the detailed landfill investigation was conducted, based on a 50m grid. Analysis of the waste was done on site using a fully equipped chemical laboratory.

Aerobisation of the site using Smell-Well technology began in November 2004, and the remediation process in January 2005. Two Smell-Well plants prepared the landfill for daily excavation and sorting of 12,000 m^3 of material per day.

The excavation took place at 3m levels and the excavated waste was transported to two semi- mobile treatment plants. The treatment plants were a combination of screening, separation, shedder and sorting elements, and comprised 4 lines with a total capacity of 8,500 tons per day (tpd).

The treatment ensured that the material met European Health and Safety standards on gas production potential and other criteria. After treatment, approximately 60% of the excavated volume was used to backfill the site. During backfilling, the waste was continuously tested and the site locations catalogued. Gas levels have been monitored on an ongoing basis, and the results show that there has been no gas production to the present day.

Specific project features

- Optimised waste sorting and treatment technology
- On-site chemical laboratory
- Pure and inert materials used as backfill
- Maximum safety and security for nearby residents and operatives
- 160 person workforce
- Specialised vehicle fleet and logistics

Landfill site remediation project Sharjah/UAE
2 sorting systems, 4 lines operating 24/7

Project results

The infrastructure development of the rehabilitated area began immediately after backfilling, and the site now hosts multistorey residential and retail buildings, a highway, an "Islamic Center" and mosque, and a hospital.

3.3% of recyclable materials were recovered from the landfill, consisting mainly of metals and wood. The remaining residue was packed in baling machines to reduce the volume before disposal at the new Sharjah landfill.

Case Studies and References

The "Depot Rive North" Project in Quebec, Canada

The situation

In 2007, the Depot Rive North landfill in Quebec consisted of 4 phases - with 3 phases completed, and 4th phase under construction. The owner (Tecsult Inc.) wished to increase the volume available for landfill and the most economical way to do this was to conduct a landfill mining and remediation exercise on the 3.7mill m^3 Phase 3 site to create additional volume. This approach also bypassed the difficulty of obtaining approvals for a new landfill site. It was estimated that the landfill volume could be increased by approximately 50% through a combination of mining and lowering the bottom of the landfill.

Project development and execution

The remediation work started in September 2007 and finished in June 2013. The work needed to proceed without pause despite difficult climactic conditions, and the reliable performance of IUT's Smell-Well system was a critical component throughout the remediation process.

The temperature inside the landfill allowed the melting of the snow over the pipe system and kept the system open. However, it was necessary to protect the biofilters against the low temperatures in order to maintain the biological activity. The system proved itself able to function reliably and consistently in temperatures down to -30°C, and under heavy snow conditions.

The target was to produce a landfill cover material (fine fraction) which could form a methane oxidizing level which would reduce the later gas emissions from the landfill surface.

The remaining "oversize" fraction was compacted and buried again in the new area of the landfill. The excavation took place at 3 m levels, the treatment of the excavated material took place in mobile rotating drum screens. The project was completed successfully in June 2013.

Contact Us

DP has 7 offices around the world in 6 countries – China, Denmark, Poland, Thailand, UAE and UK.

To ensure that we can address your needs appropriately, please email **info@dpcleantech.com** for enquiries or further information.

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