RELIABLE PUMPS
FOR LANDFILL LEACHATE

CHALLENGE

Safe and – most importantly – reliable and disturbance-free capturing of environmentally harmful leachate. Long pump service life, even with abrasive components in the liquid; and high chemical resistance of all parts that come into contact with the liquid.

SOLUTION

Stainless steel progressing cavity pumps with very long stator and rotor as well as stators made of elastomers that are specially adapted to the liquid.

RESULTS

Disturbance-free operation since 1993, low maintenance costs, and minimal need for spare parts.

Until its closing in 1979, the Hamburg-Georgswerder landfill was the largest landfill for hazardous waste in Europe. Located on Georgswerder island in the Elbe river, it is approximately 45 ha in size and 40 m high, with a volume of approximately seven million cubic meters. In the years following the Second World War, the landfill received large quantities of building debris and household waste. But in 1967, the site began receiving highly toxic industrial waste like dioxins and drums containing hazardous materials. In 1983 dangerous dioxins, which are a threat to both humans and animals, were detected in the site's leachate, particularly in the form of oil. Three years later, engineers began a multi-step process of covering and sealing the landfill with synthetic sheeting and glacial till. Wind turbines and solar plants have been installed on parts of the site. Now known as Energieberg or power mountain, these areas have been publicly accessible since early 2013.

Although the landfill has been sealed and no new waste is deposited at the site, leachate water must still be collected and treated before it can be directed into the public sewer



Aerial view of the sealed landfill

CIRCOR | ALLWEILER®

system. Groundwater must also be protected from harmful substances that have already escaped the site. Two discharging wells handle this task and the processed groundwater is directed into the Elbe river.

RING DRAINAGE FOR LEACHATE

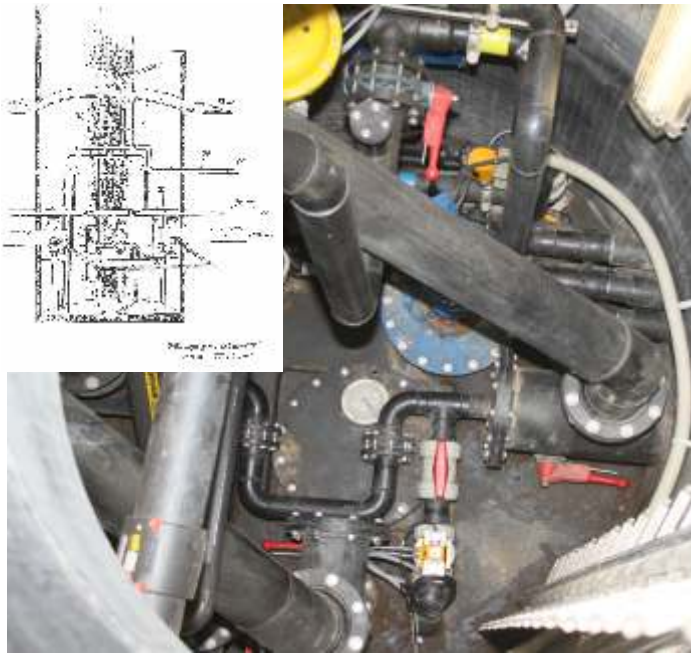
Since 1993, a 2.5-km ring drainage system with 44 shafts capture the leachate water. Thirteen of the shafts are pumping shafts. One Allweiler® progressive cavity pump has been installed in each of these shafts since 1994. They switch on automatically depending on the fill level of the shaft. They pump approximately 1.1 m³ of leachate water per hour through a pressurized piping system to the main three-stage processing plant. At the plant water, oil, and contaminated sludge are separated. All fractions are either used separately or disposed. The pumps move approximately 12,000 m³ per year, 95% of which is water; the remainder being oil. After processing, approximately 0.5 m³ of sediment remains. Delivery head to the sedimenter is 8 m, with a discharge pressure of about 3 bar. During normal operations, the pumps run at about 200 1/min and move between 4 and 7 m³ per hour.



Schematic drawing of the pump shaft with the progressive cavity pump in the vertical position.

CONTAMINATED AND AGGRESSIVE

Because the leachate water is highly contaminated and chemically aggressive and has the potential to produce flammable gases, the pumps are installed vertically in the shafts. Only the suction portion with the stator and rotor



View into a pump shaft, part of the ring drainage system. The vertically installed pump is blue in the image.

are located in the pipes. The coupling and motor are hermetically sealed and installed above the suction part without any contact with the liquid. All parts that contact with the pumped liquid are made of stainless steel in order to ensure disturbance-free operation. The large variety of material mixtures offered by CIRCOR proved valuable when selecting elastomers for the stator. Maker of the Allweiler brand, CIRCOR is one of the few manufacturers of progressive cavity pumps that also produces its own stator coatings. Allweiler®'s plant offers 20 different elastomers, so customers can select the one that will result in the lowest level of abrasion with their particular liquid. In fact, several different stator materials were chosen for use at Georgswerder. A special Viton mixture adapted to the leachate's oil component has proven to be more durable than Perbunan. Industrial mechanic Falko Sellenk at the operating company Sira is responsible for pumps at the site. According to him: "These pumps are extraordinarily reliable and need little maintenance.



Falko Sellenk: "These pumps are extraordinarily reliable and need little maintenance."

In the past few years, the only spare parts we needed were two stators and one joint." Customers can also choose between different joint versions with varying levels of quality versus cost.



Progressive cavity pump in a shaft

Pumps from Allweiler® were selected in 1993 for several reasons. First, even back then the manufacturer offered a wide range of materials and was able to deliver the desired grade 4462 of stainless steel. Secondly, even 20 years ago Allweiler® provided good technical consultation, excellent service, and good references in environmental applications. Finally, the price was "appropriately economical" according to the employee who handled the purchase at that time. "The primary supplier at that time introduced us to Allweiler®. During discussions with the client, contractor, and experts, the decision was made to install Allweiler® pumps because of their impressive engineering principles and because they exhibited a higher level of quality than their competitors," explains Maren Gätjens, the engineer at the Hamburg Environment and Energy authority, which is responsible for this landfill.

BARRIER PROTECTS GROUNDWATER

Since 1998, a barrier outside of the landfill captures contaminated liquids that have already left the site. Well pumps move these liquids to the groundwater processing facility. The treated water then flows into the Elbe.



The two ALL-OPTIFLOW® pumps that pump groundwater within the barrier.

In contrast to the ring drainage pumps, the progressive cavity pumps of the ALL-OPTIFLOW® series operate continuously in the wells. They are dry-mounted and operate 360 days per year. Outlet pressure is 3 bar and capacity nearly 10 m³ per hour. The groundwater that they pump contains high levels of iron (about 100 mg/l), making them aggressive. Due to the chemical properties of the liquid and the need to operate continuously, these pumps have a much shorter service life than those used in ring drainage. "On average, we need one new stator every year," according to Mr. Sellenk. But without the special design of the Allweiler® pumps, the service life would be even shorter. With its unusually long stator and rotor, pumps of the ALL-OPTIFLOW® series are designed for a long service life, even when pumping difficult liquids. Here as well, the stator elastomer is designed specifically for the properties of this liquid. Rotors of the ALL-OPTIFLOW® series also exhibit a special "sharkskin" surface that improves efficiency.



Allweiler® progressive cavity pump of the SEBP series in the groundwater treatment facility. Following a strictly defined settling time, these pumps move the settled water phase out of the sludge holding containers and into the preliminary pumping system.

GOOD PUMPS AND GOOD SERVICE

Looking back, it is clear that the decisions made in 1993 and 1998 to use the two pump types from Allweiler® were the right choices. Considering the potential for environmental contamination, disturbance-free operation is a high priority.



Engineer Maren Gätjens: "The Allweiler® pumps have really proven themselves."

According to Mrs. Gätjens: "We have had only positive experiences. It starts with competent support and extends to rapid, timely delivery of spare parts." Although spare parts are rarely needed, Allweiler®'s use of many common parts has proven to be convenient. Storage expenses are low and maintenance is straightforward. Mr. Sellenk states: "Dismantling the pumps is easy. When we do have to replace something, it goes quickly."

CIRCOR, ALLWEILER, IMO, TUSHACO and WARREN are registered trademarks and HOUTTUIN is a trademark of CIRCOR or its subsidiaries in the U.S. and/or other countries. (c) 2018, CIRCOR. All rights reserved.