WORLD WIDE WEAVE

Endurance test at the Pflegelberg central sewage plant

Real-time comparison of press belt mesh efficiency in sludge dewatering

Over a ten-week period at the Pflegelberg Central Sewage Treatment Plant, the leading specialist for filtration and process belt meshes GKD – GEBR. KUFFERATH AG (GKD) and the company Sülzle Klein GmbH tested the new press belt mesh type *Speed-Drain*, which combines high dewatering rates with reliable particle retention. The two companies compared the efficiency of the new mesh with that of the GKD mesh type 1003 previously used there, under real operating conditions on two structurally identical belt presses. Plant manager Michael Sturm expected the test to demonstrate enough of an improvement of dewatering results to reduce the run duration of the sewage sludge drying stage. From the very start, the new belt fulfilled all expectations. Thanks to its significantly better dewatering performance, compared to the 1003 mesh type, the dry matter content (DM) increased by 0.8% – enough to reduce dryer utilisation in Pflegelberg by about nine days a year (3%).

Founded in 1978, the Pflegelberg Central Sewage Treatment Plant near Wangen in Germany's Allgäu region maintains 57 outside facilities: 31 pumping stations, 11 rain overflow basins and 15 compressed air flushing stations. Operated by the Rural District of Ravensburg, the sewage treatment plant has the city of Wangen connected to it, along with the participating communities Neukirch and Amtzell and the municipality of Hergensweiler. One peculiarity of the plant is its location across the district boundary in the Rural District of Lake Constance, at the confluence of the Upper and Lower River Argen. As Lake Constance is the drinking-water reservoir for the whole

region, the sewage treatment plant must comply with very stringent limits on what it discharges into the lake, particularly in terms of phosphorus. Over the last 15 years, the Pflegelberg plant has treated an average of 7 million cubic metres of wastewater a year. The lowest volume of wastewater processed so far was 5.5 million cubic metres in the dry year 2003; the highest volume recorded so far was 8.5 million cubic metres in the high-rainfall year 2001. These values reflect a minimum throughput of 7,000 cubic metres and a maximum throughput of 62,000 cubic metres of wastewater a day, i.e. 720 litres a second. After the various treatment stages, between 850 and 900 tons of dried sewage sludge needs to be disposed of annually. The Pflegelberg Central Sewage Treatment Plant is designed for a population equivalent (PE) of 80,000 inhabitants, although the current wastewater volumes only equate to 60,000 PE. The serviced area actually only has 33,000 *real* inhabitants, with almost half of the treated volume coming from industrial and commercial dischargers, for example several dairies, metal-processing businesses and the Hospital in Wangen. Originally, the plant was configured to cater for a large textile industry company and the typical challenges of its wastewater, and it was not until 2011 that it was also equipped with digestion facilities. The slow, drawn-out decline of the company until its final closure in 2015 had consequences for wastewater volumes and treatment at the Pflegelberg Central Sewage Treatment Plant. The textile company's wastewater was not always easy to treat. So it remains to be seen in the current year whether and to what extent the circa 5% lower load on the treatment plant resulting from the closure will have a noticeable effect.

Eight employees are responsible for the smooth, 365-day-a-year operation of the treatment plant. On the plant's spacious grounds, which border on woodland, a new wastewater filtration plant was put into operation in 2000, and since then the whole treatment plant has been successively updated and

renewed. In 2005, for example, the chamber filter presses were replaced by two *SMP 2500-14* type belt filter presses made by the company Sülzle Klein. 2007 marked the start of sewage sludge drying on a *Pro 2/3* type low-pressure belt dryer (LTD) from Sülzle-Klein with waste-heat utilisation from a nearby private biogas plant. In 2011, sludge digestion went into operation with utilisation of the digester gas in the sewage plant's own cogeneration unit (CHP). The digestion tower is also heated with the waste heat from the nearby biogas plant. Even the building is heated by means of this energy. Today, the sewage treatment plant complies with the strict standards of the European Union (EU) and, in the annual ratings of the German Association for Water, Wastewater and Waste (DWA), regularly attains the quality assessment *very good*.

Three treatment stages

In the first mechanical treatment stage, bar screens with steel bars at 3-centimetre intervals remove large objects like paper and hygiene articles from the influent. The washed and dewatered screenings are then disposed of in containers. For large volumes of influent, two rain overflow basins serve as intermediate storage reservoirs, each with a capacity of 1,178 cubic metres. A wastewater lifting plant with spiral-feed pumps regulates the flow of the wastewater into the fine screen system. Here, remaining solids down to a size of six millimetres are filtered out. The sand and grease trap pumps away the sand contained in the water after it has settled and washes it out. At the same time, floating fat is removed from the system and disposed of. Because the treatment plant was initially designed as an aerobic stabilisation facility to cater for the local textile industry at that time, i.e. operating without digesters, there was no need for a primary sedimentation tank. This means that the belated integration of such a primary clarifier in the context of the installation of a digestion system would have been extremely costly. Instead,

the treatment plant at Wangen adapted its processes and, to this day, still manages to do without primary clarification.

Active microorganisms

In the biological treatment stage, microorganisms break down the pollutants contained in the wastewater. The oxygen required for this process is introduced through surface aeration in the two aeration basins. Agitators in these basins, each one with a capacity of 9,000 cubic metres, ensure the required homogenisation of the water-sludge mixture. In the three secondary clarification basins, each with a capacity of von 4,500 cubic metres, the activated sludge clots settle and are then removed as return sludge. These basins were renovated in 2014/2015 and converted from underwater scrapers to scraper bridges with toothed track technology. In Michael Sturm's opinion, the new bridges have the advantage of not requiring any track heating, a relevant factor in such a snowy region. This not only makes maintenance easier but also contributes to the reduction of energy costs and an increase in operational reliability.

Phosphate precipitation

The location of the treatment plant in the Lake Constance catchment area means that the statutory limit value of 0.3 milligrams a litre for total phosphate must not be exceeded. For this reason, precipitants containing aluminium are already added in the aeration basin parallel to the bio-degradation process. The precipitation process is continued in the settling basin through addition of an iron (III)-chloride solution. What still remains in terms of phosphate content is then precipitated in the sand filter through repeated addition of the iron (III)-chloride solution. The sand filter consists of twelve filter chambers, with a total filter area of 200 square metres of pumice sand and silica sand, which reliably filter out the phosphate compounds. Thanks to this triple precipitation policy, the Pflegelberg treatment plant

maintains an annual average of 0.12 milligrams a litre of total phosphates, well under the statutory threshold value of 0.3 milligrams.

Dewatering to the max

The sludge dewatering facility needs to remove 78% of the water content from about 18,000 cubic metres of sewage sludge a year. To achieve this, the overflow sludge from the biological stage is first concentrated in a static thickener to between 2.5 and 3% dry matter content (DM). Then, a mechanical pre-dewatering belt increases the dry matter content to between 6 and 7%. After that, the sludge is left to ferment for up to 30 days in a 1,100-cubic-metre-capacity digestion tower, where it is constantly circulated by two pumps. To maximise the energy gain from this fermentation process, the treatment plant adds co-substrates. Fermentation at 41°C reduces the sludge volume by about 20%. At the same time, about 900 cubic metres of digester gas are produced every day, the gas flowing into the adjacent co-generation plant. The power yield from this system covers 21% of the plant's own energy requirements. Subsequently, the digested sludge is dewatered on two belt filter presses to a dry matter content level of 22%. Each of the belt filter presses in Pflegelberg dewater about 9,000 cubic metres of sewage sludge a year. At four working days a week, that works out at about 42 cubic metres of sludge a day. The output from the belt filter presses is transported – by means of a thickened sludge pump working with short blasts of compressed air – to the sludge bunker 90 metres away next to the sludge dryer. Depending on the time of year, sewage sludges in the Pflegelberg Central Sewage Treatment Plant have varying consistencies. In winter, higher content levels of organic substances result in lower dewatering rates, meaning more time and expense for the drying stage. While the dry matter content in the winter months is only around 20%, it climbs a few percent higher in summer, resulting in an annual average DM of 22%.

High and dry

A belt dryer using waste-heat from the biogas plant removes the residual moisture from the dewatered sludge. The resulting dry granulate is incinerated in a cement works. It takes about three hours for sewage sludge with an initial dry matter content of 22% to be dried to a DM of 91% in the low-temperature dryer. Every hour, a new 600 kilogram charge of sludge is loaded with a so-called diffuser onto the dryer belts, which also come from GKD, evenly distributed and dried with a through-flow of air at 80°C. On average, the treatment plant produces 850 to 900 tons of dried sludge a year in this way. This works out to a weight reduction of 3,150 tons, or 79%. But for that, the dryer has to run around the clock for five-and-a-half days a week, which adds up to 6,800 operating hours a year. In winter, due to the higher volumes of sludge, the equipment is at the limits of its capacity. So every single percent more DM in the dewatered sludge helps to reduce the total operating hours of the dryer. The dried granulate is kept in a 16-metre-high storage silo for about a week, until there is enough to fill a silo truck. In the course of a year, around 40 silo trucks full of sludge are produced and transported to the cement works for incineration.

Central process

In 2005, the sewage plant at Wangen decided to replace the old chamber filter presses with belt filter presses. The reason for this move was not just the benefits of a better rate of dewatering but also – compared to a centrifuge – the considerably lower consumption of polymers and power. Another argument for the replacement of the chamber filter presses was the low procurement cost and easy maintenance of the belt filter presses. And their smaller footprint meant that there was more than enough available space in the plant to accommodate them. Since their commissioning in 2005, the belt filter presses have been operating with GKD Type *1003* filter belts. Each of the belt filter presses in the Pflegelberg Central Sewage Treatment

Plant dewaters between 6 and 12 cubic metres of slurry an hour. To achieve the highest possible dewatering performance, the presses run extra slowly at 0.9 metres a minute. Spray jets positioned under the belt flush the belts after the press cake is released to re-open any mesh pores that might have become clogged. With the comparison test under real conditions, Michael Sturm wanted to use the opportunity to find a more efficient dewatering option for his sludge, in the hope of reducing the load on the downstream process stage of drying the sewage sludge on the dryer. Before it is loaded onto the belt filter presses, the fermented sludge from the digestion tower has to have polymer added to it. A pump then transports the sludge continuously onto the feed zone, where chicanes ensure good drainage. Through a curved compression zone, the sludge is transported between an upper and lower belt over a filter drum and into the roller compression zone. Under a belt tension of up to 14 bar, the sludge makes its way between the two 2.5-metre-wide and 16.9- respectively 18.5-metre-long belts of the belt filter press. Thanks to their decreasing diameters, the 14 rollers in the compression zone successively increase the pressure exerted on the sludge. The different radial distances of the two belts to the roller, and therefore the difference in their lengths, creates a shear effect on the sludge which intensifies the dewatering effect. But for uninterrupted operation of the belt filter press, it is absolutely essential that no sludge is pressed through the belts or squeezed out at the sides. And, in addition to this requirement for reliable particle retention, the belts must also durably withstand the enormous forces working on them while at the same time ensuring a high rate of dewatering.

Michael Sturm's good experiences with the GKD Type *1003* mesh belts used so far on the presses was a major factor in his decision to make the dewatering stage at the Pflegelberg plant available for a test with the innovative new filter belt. "How well our sludge responds to dewatering

varies according to seasonal factors and other external influences. And there's a corresponding fluctuation in our polymer consumption. With the *1003* mesh, so far we've had a really good belt that really meets the demands of our particular sludge profile." And he also thinks the flat (PAD) seam "… is really good. It only protrudes a little, so it doesn't put undue stress on the components." His requirements regarding the new belt type were therefore very high. What he wanted to see was clear proof of increased dewatering efficiency without any of the mesh's optimal qualities of durability, retention and cross-stability being forfeited. What he hoped for was to be able to raise the dry matter content by 1 or 2% with the new belts, because an improved DM of the sludge would increase the throughput rate in the low-temperature dryer and create additional reserve capacity. In terms of other evaluation parameters, filtrate clarity and polymer consumption were both decisive criteria for Michael Sturm.

Turbo for belt filter presses

The new *Speed-Drain* belt mesh installed by GKD for the comparison test proved its high level of dewatering performance impressively, both in the gravity section and in the roller compression section of the press. Its warp wires of various special plastic materials – only half as thick compared to the polyester monofilaments of the belt mesh previously used – give it considerably more but smaller mesh openings. In this way, two properties that should actually be mutually exclusive – high dewatering performance and reliable particle retention even under pressure – are ingeniously combined in a single product.

The first round of talks between the parties involved in the comparison test – the Pflegelberg Central Sewage Treatment Plant, GKD and Sülzle Klein – were conducted in December. A good eight weeks later, after the necessary personnel planning had been made in Pflegelberg, the test commenced. On

the day before, Michael Sturm had the sludge dewatering equipment powered down and the cleaned. It took GKD and Sülzle Klein one day to refit the two presses – one with a belt of the previously used Type *1003* mesh, the other, a structurally identical second belt filter press, with the new belt type *Speed-Drain* – and put them back into operation. On the next day, the two presses were running simultaneously again in normal operation mode – and under exactly identical conditions regarding flocculants, sludge and time. After ten weeks of testing, regularly taken samples from both presses allowed valid conclusions about the new filter belt mesh to be drawn.

Clearly superior

From the very start, it was obvious that the new filter belt was doing more than just meeting expectations. With a constant circa 0.8% higher dry matter content at a throughput rate of 6.5 cubic metres an hour, it gave a convincing demonstration of its excellent dewatering capabilities. For Volker Meuser, Senior Sales & Application Manager at GKD, this was a further confirmation of the experience with *Speed-Drain* already gathered from other sewage treatment plants. "Now, we can also give our customers hard comparative data on the two belts under exactly identical process conditions, and show them in detail what the added value of our new belt type really is." And the new filter belt type even promises excellent dewatering efficiency for thinner slurries than the ones processed in Pflegelberg. In the opinion of Henning Schneider, Head of Design and Manufacture at Sülzle Klein, there are also positive prospects for future equipment sizes: "The high rate of dewatering in the straining zone makes the idea of machines with shorter straining sections feasible. For the customer, this would mean not only smaller space requirements but also lower procurement costs." Plant manager Michael Sturm is more than satisfied with the test results. "*Speed-Drain*'s good particle retention made sure that, even in continuous operation, the sludge didn't penetrate the mesh and the belts didn't stick together." But the main

reason for his overall positive conclusion about GKD's new belt mesh *Speed-Drain* was the significant increase in dewatering performance: "The test under real conditions with our sludge has now given me a solid basis for deciding how we can optimise our sludge dewatering. The detailed long-term evaluations show that a changeover to the new belt type will definitely pay off, and will enable me to reduce the load on our sewage sludge drying stage by about 200 hours a year." For this reason, the mechanical pre-dewatering belt was also fitted with the new belt. And here, too, it fulfilled expectations: the dry matter content of the sludge on the belt thickener has already gone up by 0.3% – a result that even further reduces the load on the drying stage.

18.683 characters incl. spaces

GKD – GEBR. KUFFERATH AG

The owner-run technical weaver GKD – GEBR. KUFFERATH AG is the global market leader for metal and plastic woven solutions. Under the umbrella of GKD – WORLD WIDE WEAVE the company combines three independent business units: SOLID WEAVE (industrial meshes), WEAVE IN MOTION (process belt meshes) and CREATIVE WEAVE (architectural meshes). With its seven plants – including the headquarters in Germany and other facilities in the US, Great Britain, South Africa, China, India and Chile – as well as its branches in France, Spain, Dubai, Qatar and worldwide representatives, GKD is never far from its customers.

For more information:
GKD – GEBR. KUFFERATH AG
Metallweberstraße 46
D-52353 Düren
Tel.: +49 (0) 2421 / 803-0
Fax: +49 (0) 2421 / 803-227
E-Mail: weaveinmotion@gkd.de
www.gkd.de

Please send a reprint to:
impetus.PR
Ursula Herrling-Tusch
Charlottenburger Allee 27-29
D-52068 Aachen
Tel.: +49 (0) 241 / 189 25-10
Fax: +49 (0) 241 / 189 25-29
E-mail: herrling-tusch@impetus-pr.de

Endurance test at the Pflegelberg central sewage plant

Real-time comparison of press belt mesh efficiency in sludge dewatering

Picture 1: The loading of the slurry onto the new filter belt type Speed-Drain by GKD.

Picture 2: GKD's new belt mesh of the type Speed-Drain in the feed and pre-dewatering zone, where chicanes ensure good drainage.

Picture 3: With warp wires of various special plastic materials, the Speed-Drain filter belt provides through considerably more but smaller mesh openings a better dewatering.

Picture 4: Thanks to their decreasing diameters, the 14 rollers in the compression zone successively increase the pressure exerted on the sludge.

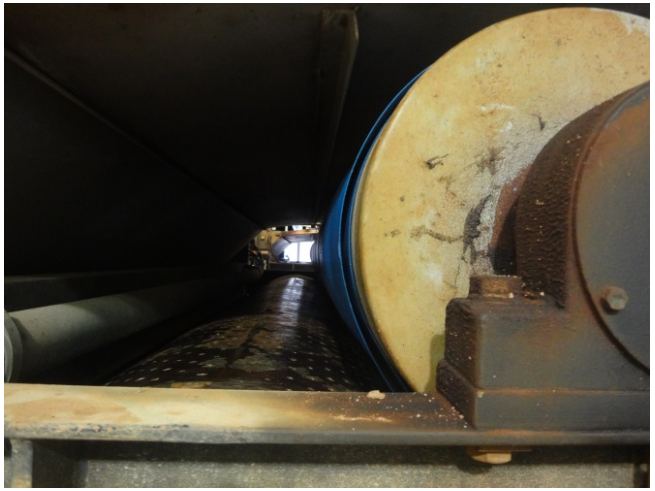
We will be happy to send you the desired images in printable resolution by e-mail.

impetus.PR
Agentur für Corporate Communications GmbH

Ursula Herrling-Tusch
Charlottenburger Allee 27-29
D-52068 Aachen
Tel: +49 [0] 241 / 1 89 25-10
Fax: +49 [0] 241 / 1 89 25-29
E-Mail: herrling-tusch@impetus-pr.de

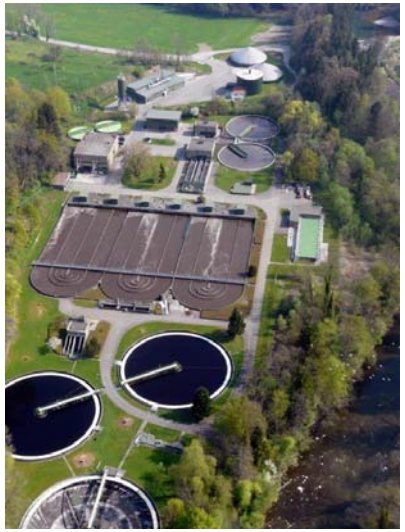
Endurance test at the Pflegelberg central sewage plant

Real-time comparison of press belt mesh efficiency in sludge dewatering



Picture 5: Under a belt tension of up to 14 bar, the sludge makes its way between the two belts of the belt filter press.

Picture 6: Thanks to its significantly better dewatering performance, the dry matter content (DM) increased by 0.8%.



Picture 7: Founded in 1978, the Pflegelberg Central Sewage Treatment Plant near Wangen in Germany's Allgäu region maintains 31 pumping stations, 11 rain overflow basins and 15 compressed air flushing stations.

Picture 8: Bar screens with steel bars at 3-centimetre intervals remove large objects like paper and hygiene articles from the influent.

Picture 9: A wastewater lifting plant with spiral-feed pumps regulates the flow of the wastewater into the fine screen system.

We will be happy to send you the desired images in printable resolution by e-mail.

impetus.PR
Agentur für Corporate Communications GmbH

Ursula Herrling-Tusch
Charlottenburger Allee 27-29
D-52068 Aachen
Tel: +49 [0] 241 / 1 89 25-10
Fax: +49 [0] 241 / 1 89 25-29
E-Mail: herrling-tusch@impetus-pr.de

Endurance test at the Pflegelberg central sewage plant

Real-time comparison of press belt mesh efficiency in sludge dewatering

Picture 10: In the fine screen system remaining solids down to a size of six millimetres are filtered out.

Picture 11: The washed and dewatered screenings are disposed of in containers.

Picture 12: The sand and grease trap pumps away the sand contained in the water after it has settled and washes it out. At the same time, floating fat is removed.

Picture 13: Plant manager Michael Sturm shows the sampler at the end of the sand trap.

We will be happy to send you the desired images in printable resolution by e-mail.

impetus.PR
Agentur für Corporate Communications GmbH

Ursula Herrling-Tusch
Charlottenburger Allee 27-29
D-52068 Aachen
Tel: +49 [0] 241 / 1 89 25-10
Fax: +49 [0] 241 / 1 89 25-29
E-Mail: herrling-tusch@impetus-pr.de

Endurance test at the Pflegelberg central sewage plant

Real-time comparison of press belt mesh efficiency in sludge dewatering

Picture 14: In the two aeration basins, each one with a capacity of 9,000 cubic metres, agitators ensure the required homogenisation of the water-sludge mixture.

Picture 15: The secondary clarification basins were renovated in 2014/2015 and converted from underwater scrapers to scraper bridges with toothed track technology.

Picture 16: In the sand filter the phosphate compounds are reliably filtered out in twelve filter chambers with a total filter area of 200 square metres of pumice sand and silica sand.

Picture 17: The sludge is left to ferment for up to 30 days in a 1,100-cubic-metre-capacity digestion tower, where it is constantly circulated by two pumps.

We will be happy to send you the desired images in printable resolution by e-mail.

impetus.PR
Agentur für Corporate Communications GmbH

Ursula Herrling-Tusch
Charlottenburger Allee 27-29
D-52068 Aachen
Tel: +49 [0] 241 / 1 89 25-10
Fax: +49 [0] 241 / 1 89 25-29
E-Mail: herrling-tusch@impetus-pr.de