

Peristaltic pumps for moving filtration water

The Eversburg sewage treatment plant is designed to serve 250,000 population equivalents and is one of three plants operated by the city of Osnabrück in northern Germany. But in 2005, its actual load was closer to 309,000 population equivalents (COD 80 mg/l), pushing the nitrogen input level above the plant's capabilities.

To deal with this situation, engineer Peter Sikora organized a team to develop a process-based alternative to biological elimination of nitrogen. Their proposal was evaluated within the scope of the plant's idea management program, known as "My Idea". At its core, the proposal involves the use of existing basins and established biological process engineering.

The decision in favor of this solution was accompanied by a step-by-step implementation plan: A feasibility study in the lab led to a pilot plant. Positive results here were scaled up to operational experiments in small basins. These findings served as the foundation for implementing a major system to serve 60,000 inhabitants.

Demanding pumping tasks

The pumps moving filtration water into the nitrogen elimination plant are a critical aspect of the concept. The pH of the water ranges from 11 to 11.5, temperature is approximately 30 °C, and conditioning is provided by lime and Iron III. Originally the plant used centrifugal pumps, but their mechanical seals calcified, the pumps leaked, and aggressive lime water penetrated into the motors. As a result, the pumps could stay in service for only a few weeks at a time.

In 2006, the plant began using Allweiler peristaltic pumps as an alternative to the centrifugal pumps from another manufacturer. "The pumps have been running around the clock without any problems even since," according to Mr. Sikora. The hose material is so durable that neither the lime nor any other component of the filtration water results in any significant wear. In addition to mechanical and chemical loads, the filtrate can also emit ammonia. As a result, the pump must be able to handle not just a critical liquid phase but a difficult gas phase as well.

Allweiler engineers provided detailed advisory services and collaborated closely with the team at the plant in order to optimize the processes in such a way that neither pulsation nor calcification should affect operations.

Peristaltic pumps have proven their value

The peristaltic pumps have been running in a redundant configuration inside a separate pump house since 2008. "Having these pumps run reliably and without any interruptions is extremely critical for our plant," says Peter Sikora. Before the pump house was constructed, the first pump ran outdoors for more than a year.

Allweiler peristaltic pumps are designed without a seal, making them virtually maintenance-free. This is confirmed by more than 8,000 operational hours without interruption. The pumps can be dry-mounted so they are easily accessible at all times. Suction head of about 4 m does not present a problem. A frequency converter enables precise regulation of the pumps and saves energy. Since peristaltic pumps are "displacement" pumps, their capacity has a linear relationship to pump speed. As a result, volume flow can be controlled with precision, eliminating the need for additional volume-monitoring devices. The pumps operate within a speed range of approximately 20 to up to 35 rpm.

In addition to the two peristaltic pumps for nitrogen elimination – lovingly referred to as "Neli" – the Eversburg treatment plant has yet more Allweiler pumps in operation. These include progressing cavity pumps (configured both as small proportioning pumps and as larger delivery pumps), peristaltic pumps, and propeller pumps in "Neli's" SB reactor.

Requirements

- A complete solution for extremely reliable and low-maintenance pumping of filtration water in a nitrogen-elimination plant.

Solution

- Twin Allweiler peristaltic pumps.

Results

- More than 8,000 operating hours without disturbance or maintenance; low operating and energy costs; no process interruptions reported.





Caption: Nitrogen loads 2005



Caption: Nitrogen loads 2011



Caption: SB reactors in the nitrogen-elimination system



Caption: Michael Brunschon (supply and disposal foreman, responsible for plant engineering) and Dipl. Ing. Peter Sikora (director of treatment and pumps).



Caption: Allweiler peristaltic pump of the ASH construction type in the nitrogen-elimination system's pump house.





Caption: Peristaltic pumps are installed as redundant units.



Caption: Allweiler propeller pump ("PT 300" series) for circulation (400 m³/h with 1.1 kW power requirement)

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