GEMÜ valves in modern sludge recycling system design

The Mühlhausen sewage clarification plant relies on GEMÜ valves in their modern sludge recycling system design
In light of the amendments to German ordinances on fertilizer and sewage, an increasing number of sewage clarification plant operators are faced with the question of what to do with the sludge. Large sewage clarification plants, such as the Mühlhausen municipal sewage plant, Stadtentwässerung Stuttgart (SES), have already begun to invest in sewage incineration technology for the conversion of sludge into energy. GEMÜ valves are employed in the sludge drying step, assuring safe operation of the sludge conversion process. Currently, 150 tons of dried sludge are thermally recycled every day in the central combustion system in Mühlhausen. This includes also sludge originating outside of Stuttgart. Due to increased demand for combustion solutions, the main sewage clarification plant accepts sludge from clarification plants all over the region.

How sludge can be recycled
Before sludge can be incinerated, moisture is removed from the solid/ liquid mixture in several steps. First, centrifuges concentrate the sludge to 25% solids on dry basis. Next, a disc dryer that is heated by steam concentrates it further to 45% solid content. Once this concentration is reached, the sludge is ready for incineration.

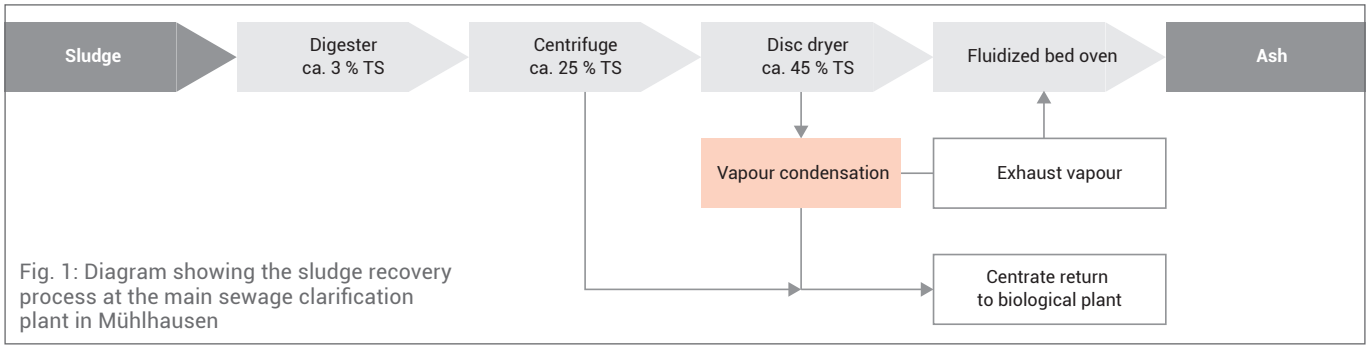
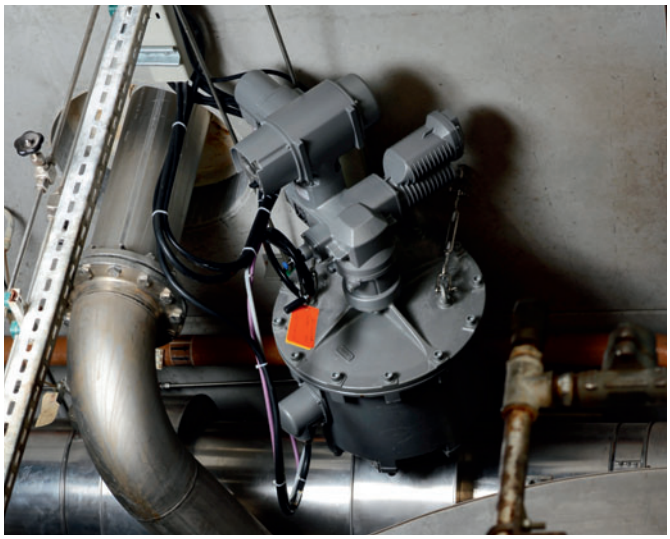


Fig. 1: Diagram showing the sludge recovery process at the main sewage clarification plant in Mühlhausen

The drying process generates a by-product known as „exhaust vapour" – a mixture consisting of gases and air saturated with water vapour that contains liquid and gaseous impurities. In the contex of cost-effective clarification plant operation, the vapour can be used as an energy source to ensure self-sufficiency in the plant's heating network.


Sludge is concentrated in disc dryers


In case of emergency: If there is a power failure, the GEMÜ butterfly valve opens automatically to prevent damage to the plant

Increasing demand requires tougher plants

Increasing quantities of sludge are pushing many incineration and drying plant operators to the limits of their capacity. This may subsequently lead to difficulties in the drying processes and cause strong unpleasant smells.
In order to guarantee that stable operation can continue, technical expansion and modification are required.
In the case of the Mühlhausen sewage clarification plant, an investment project was approved and implemented in order to increase the capacity of the external sludge processing facility as a response to increasing demand.
One important aspect of this project was to optimize vapour condensation as part of the drying process. Upgrading the plant was intended to improve the centrifuges' draining performance, reduce unpleasant smells in the surrounding area, and optimize heat recovery in the local heat network.
In the existing two-stage vapour condensation process, the first stage was converted from a system that directly heated the sludge to a heat recovery system for the local heat network. The energy from the incurring vapour, which reaches temperatures of approx. 90–100 °C, is fed into the existing local heat network via heat exchangers. The local heat network provides process heat and heat to the building. In the second stage of the process, the vapour is cooled further with condensate and scrubbed in order to minimize unpleasant smells.

GEMÜ valves for safe processes

Valves used in sludge drying processes not only need to withstand high operating temperatures. The body and seal materials must also be highly resistant to the substances contained in the vapour. Depending on the chemical composition of the sludge, the impurities in the vapour may vary and exhibit a range of corrosive properties.
The acids and alkalis contained in the medium will attack the seals on butterfly valves if the sleeves are not made of suitable material. For example, the use of elastomer seals such as NBR and EPDM is inadvisable when working with this vapour, since the influence of high temperatures and chemically corrosive media accelerates the rubber ageing process and leads to visible, measurable changes. This can subsequently lead to hardening and crack formation or cause the rubber to become sticky. If the elastic properties of the sleeve deteriorate, it may eventually lead to the failing of the butterfly valve's sealing function entirely. A combination of fluoroplastics and elastomers is more suitable for this purpose. A PTFE sleeve protects the elastic backliner from high temperatures and corrosive media.
Taking these operating parameters into account, the decision-makers at the Mühlhausen sewage clarification plant have opted to use GEMÜ butterfly valves from the 490 Edessa series with PTFE sleeves in their plant. Even plant faults that cause the system to reach temperatures above 100 °C will not damage these valves, as the PTFE sleeves are sufficiently resistant to the substances contained in the vapour.
Furthermore, an electrically actuated butterfly valve with spring force function is installed near the dryer for optimum safety. In the event of a power failure, this butterfly valve opens automatically. In such a case, steam pressure build-up due to residual heat will be released, avoiding damage to equipment and piplines.
Employing state-of-the-art technology to optimize vapour condensation, the Mühlhausen sewage clarification plant is now able to process higher quantities of sludge. This optimizes both the safety of the system in the event of faults and the recovery of the heat. It has also allowed the plant to achieve their aim of minimizing unpleasant smells.

The vapour is fed into the local heat network via heat exchangers

GEMÜ butterfly valves with PTFE sleeves are used when working with corrosive media and high temperatures

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