

# INNOVATIVE SEWAGE SLUDGE UTILISATION CONCEPT AT HALLE

## CASE STUDY



The German Waste Sewage Sludge Ordinance that entered into force on October 3, 2017 is leading to a reorientation of the sewage sludge utilisation practice. Moreover, the Fertilizer Regulation and the amendments made to the Act on Fertilizers strongly restrict the use of sewage sludge for agricultural purposes. The restricted application of sewage sludge on land leads to a higher rate of thermally utilised sludge. According to the existing estimates, the volumes of sewage sludge for mono-incineration will increase to more than 1.2 million tons per year by 2032. The incineration capacities currently available in Germany, however, cover only approximately half that volume. The shortage in incineration capacities in Germany and the resulting rise of incineration costs forces sewage plant operators to act.

Since the Waste Sewage Sludge Ordinance came into force, many plant operators and sludge disposal companies are increasingly looking for alternatives to spreading the sewage sludge on land and for solutions to recover nutrients. By 2013, sewage plant operators have to present a report about which measures they intend to take to recover phosphorus and how they plan to manage the disposal of their sewage sludge in the future.

The installation of small decentralized incineration plants like at Halle-Lochau in Saxony-Anhalt can be a promising approach. It is planned at Halle-Lochau to build and operate a sewage sludge mono-incineration plant with internal energy production via a steam turbine

and generator. The mono-incineration of the sewage sludge will be based on the system of the company sludge2energy GmbH (S2E) and take place in a stationary fluidized bed furnace. The stationary fluidized bed technology has established itself as a proven method of thermal sewage sludge utilisation. It is a particularly efficient and low-emission technology for incineration plants. The plant will be planned and installed by sludge2energy GmbH, a joint enterprise of HUBER SE and WTE Wassertechnik GmbH, a subsidiary of EVN AG.

A request for the provisional decision was submitted for the sewage sludge treatment plant at Halle-Lochau according to Article 9 of the Federal Immission Control Act (BImSchV). The request and positive preliminary decision was granted in 2018. The building permit documents were submitted in autumn 2018. Permanent operation of the plant is planned to start in summer 2020.

### CONCEPT OF THE SEWAGE SLUDGE MONO-INCINERATION PLANT HALLE-LOCHAU

The S2E sewage sludge mono-incineration plant will be built on an industrial and commercial area in Saxony-Anhalt. The space requirements of the plant are approximately 6,000 m<sup>2</sup> including traffic and storage areas.

At the sewage sludge utilisation plant Halle-Lochau, both dewatered sludge (25% DS) and externally fully dried municipal sludge (90% DR) will be treated thermally in

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the future. The plant is designed to ensure that both 33,000 tons of dewatered sewage sludge and 2,700 tons of externally dried sludge can be utilized.

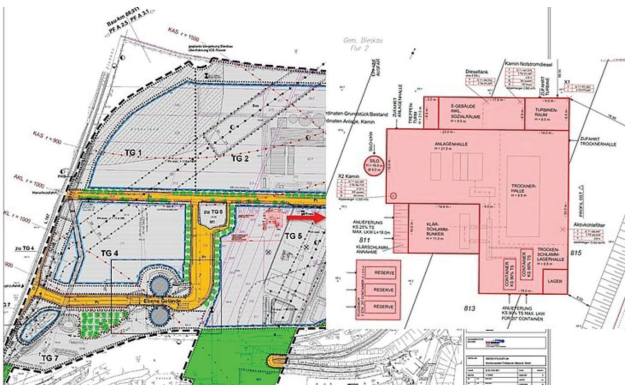
Sewage sludge incineration plant are combustion plants for the incineration of waste according to the specifications of the ordinance on the incineration and co-incineration of waste (Federal Immission Control Act, 17th BImSchV). Building and operating stationary plants for waste disposal is therefore subject to an immission control approval procedure according to Article 4 para. 1 sentence 1 of BImSchG. A plant is subject to approval if this type of plant is listed in the Attachment to the 4th BImSchV and reaches the performance threshold / plant capacity specified in the Attachment. The thermal sewage sludge utilisation plant is designed for a capacity of < 50 t/d sewage sludge to be dried and approximately 2.9 t/h sewage sludge to be incinerated. The erection and operation of the sewage sludge utilisation plant at

Halle-Lochau is therefore a building project that requires permission according to the classification defined by the Federal Emission Control Law (4th BImSchG). In the present stage of planning, the sewage sludge mono-incineration plant is to be classified as subject to approval according to the 4th BImSchV, ordinance on plants requiring approval, Attachment no. 8.1.1.4. A simplified approval procedure (without public participation) according to Article 19 BImSchG is required for this plant capacity and classification.

The plant for thermal sewage sludge utilisation is designed to maximise the performance limits given by the simplified approval procedure. The thermal sewage sludge utilisation plant consists of the following main components:

- sludge acceptance,
- sludge drying,
- combustion system and boiler,
- energy utilisation (back-pressure turbine),
- 2-stage flue gas treatment,
- chimney with emission measurement, and
- ash silo.

A partial flow of the dewatered sewage sludge is at first fully dried in a low-temperature dryer, type BT 20 of HUBER SE. Before incinerated, the partial flow of the



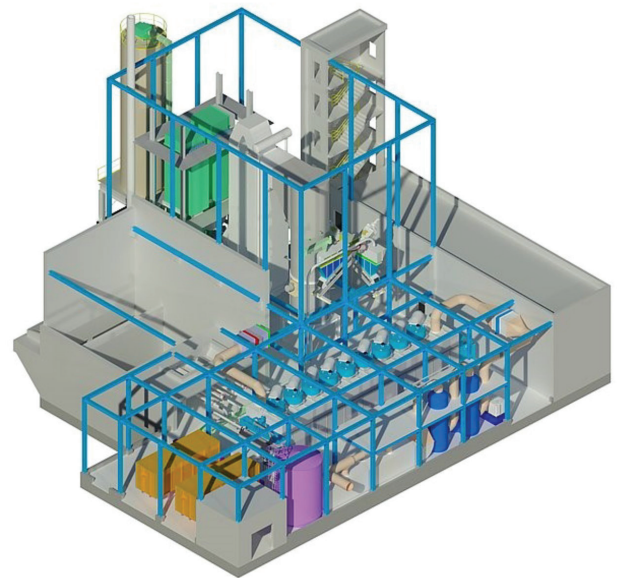
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sewage sludge dried to 90% dry residue is backmixed with the rest of the dewatered sewage sludge to obtain approx. 45% DR and ensure an autothermal incineration. Backmixing is adjusted to suit the fluidized bed furnace and further depends on the quality of the sewage sludge. The heat supply required by the dryer comes from the incineration exhaust heat.

The location where the mono-incineration plant Halle-Lochau will be erected is not a sewage treatment works. The complete plant must therefore be designed to operate virtually without producing wastewater. Special focus is therefore to be placed on safe disposal/utilisation of the vapours generated with sewage sludge drying. The variant of quasi wastewater-free sewage sludge drying with a supply-exhaust air dryer has turned out to be an efficient and economical sludge drying concept. The exhaust air from the belt dryer is passed on to separate chemical treatment. The wastewater from the acid scrubber is an ammonium sulphate solution (ASL), commonly used as fertilizer in agriculture. The amount of residues generated in the alkaline scrubber stage is so small that the residues can be passed to the incineration process.

At Halle-Lochau, the sewage sludge is thermally utilized in an individually planned stationary fluidized bed furnace of sludge2energy (S2E Fluidizer). The furnace is designed to ensure the supplied sewage sludge can be utilised thermally in a continuous process without adding any auxiliary fuels. A back-pressure steam turbine is used for recovery of the energy from the vapour generated in the boiler plant. Most part of the exhaust steam from the turbine is used to dry the dewatered sewage sludge. Due to the optimized energy concept, the plant's own electrical energy demand can be fully covered. As the flue gas is cleaned in a dry process, no additional wastewaters are generated which would have to be treated separately. The emission limits required by the 17th BImSchV are reliably met by this type of flue gas treatment. Flue gas purification is designed to include a pre-separator to ensure that virtually the complete sewage sludge ash is removed from the flue gas already before addition of the sorbent and can thus be used for



later phosphorus recovery.

The solution that achieves the highest phosphorus recovery rate and, at the same time, eliminates all contaminants is mono-incineration of sewage sludge with downstream recycling of phosphorus from the generated sewage sludge ashes. Through sludge drying and incineration, the sludge disposal volume is minimized to approximately 10%. The sewage sludge from the fluidized bed furnace at Halle-Lochau (approx. 4.000 t/a), low in pollutants, is an important phosphorus carrier and thus a valuable source material for the future phosphorus fertilizer production.

The current legal framework conditions for sewage sludge utilisation pose great challenges for sewage treatment plant operators. If the presented size of incineration plant is transferred to other locations in Germany, this could lead to the quick expansion of the mono-incineration capacities on those sites and contribute substantially to solving the present case of emergency in the field of sewage sludge disposal. Decentralised mono-incineration plants can therefore be a main component of a future-oriented sewage sludge utilisation concept in Germany.