

SUSTAINABLE SEWAGE SLUDGE INCINERATION FOR ZÜRICH CANTON

Outotec's turnkey thermal sewage sludge incineration plant produces minimal environmental emissions while maximizing energy recovery and the production of saleable by-products.

The Outotec Sewage Sludge Incineration Plant 100, completed in summer 2015 for the Disposal and Recycling Department of Zürich (ERZ), treats sewage sludge from over 70 wastewater treatment plants. Overall, the site is Switzerland's largest thermal sewage sludge treatment facility, handling all the sludge produced in the Zürich canton area, amounting to 100,000 metric tons a year. The plant itself comprises a sludge reception hall, a self-sustaining fluidized bed combustion plant, and a state-of-the-art flue gas cleaning system. It meets the strictest environmental regulations, is economically viable, and also enables the recovery of valuable phosphorus.

CHALLENGES

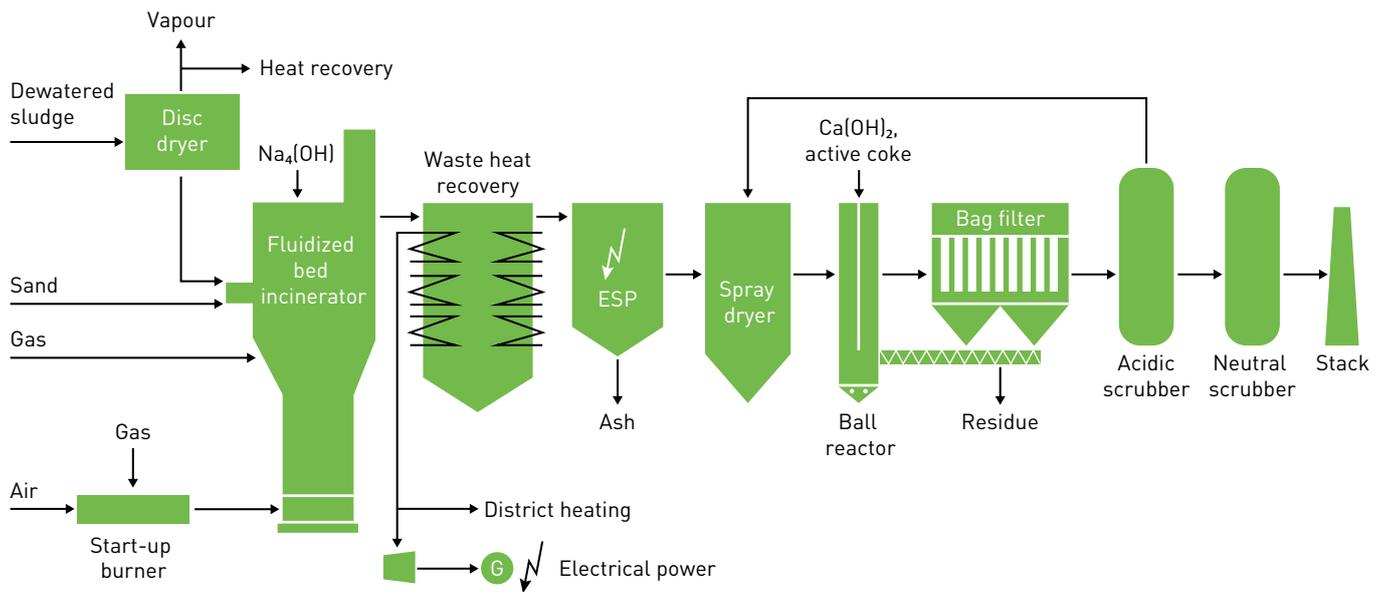
- Limitations for sewage sludge disposal in landfill and as fertilizer
- High transport and logistics costs for sludge containing > 70% water
- Strict emissions limits

SOLUTION

- Thermal incineration of sewage sludge using Outotec fluidized bed technology
- Thermal dryer using steam from the internal process to avoid additional fossil fuel use
- State-of-the-art flue gas cleaning system

BENEFITS

- Self-sustaining thermal treatment
- Minimal environmental emissions
- Residue ash can be used for phosphorus recovery



Outotec Sewage Sludge Incineration Plant 100

Cost-effective solution for centralized sludge treatment

There are approximately 70 wastewater treatment plants generating sewage sludge in the Zürich canton area, which was previously disposed of using various costly methods. It was estimated that building a new centralized sludge incineration plant for the canton would reduce sludge-disposal costs by almost 50 percent. The plant would also support both the canton’s aim to conserve resources and its commitment to recycling. Furthermore, ash from sewage sludge has a high phosphorus content – a valuable, limited resource that can be used in several different applications.

After an internal evaluation that took into consideration economic viability, energy consumption, CO₂ balance, transport logistics, and available space for a new phosphorus recycling plant, a site at Werdhölzli, owned by the City of Zürich, was chosen.

The Disposal and Recycling Department of Zürich (ERZ) purifies all wastewater on behalf of the City of Zürich. In Werdhölzli, ERZ runs one of Switzerland’s most technologically advanced wastewater treatment plants, treating 70–90 million m³ of effluent annually.

Commissioned in 1926, the plant has been frequently upgraded with the most advanced technologies available. ERZ takes an active role in environmental protection, waste management, energy supply, and wastewater treatment. With this in mind, the conservation of natural resources is of the highest priority.

In order to enable the environmentally sound treatment of sewage sludge generated from wastewater purification, the City of Zürich – represented by ERZ – appointed Outotec as the general contractor for the realization of a central, turnkey plant to exclusively treat all sludge from the Zürich canton area until the end of 2035.

Outotec’s solution was chosen ahead of tenders from six other companies as it was the most economical in terms of both investment and operating costs.

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With this facility ERZ is able to process sewage sludge from the entire Zürich canton area at a central location with a capacity of 100,000 t/a of dewatered sewage sludge, corresponding to a dry substance content of approximately 30,000 t/a.



The Outotec sludge incineration process

The dewatered sewage sludge is collected and stored in a bunker, where it is mixed by a crane and then transported to the dryer. After being partly dried by steam from the process, the sludge is fed to an Outotec fluidized bed (FB) incinerator. The vaporized water from the dryer is condensed in a vapor-condensing unit and the recovered heat is used for district heating across the city of Zürich.

The plant is self-sustaining, requiring no external electricity or fuel apart from natural gas for the start-up phase. The bunker's venting air is preheated with a flue-gas air preheater in the boiler and then routed to the air distribution nozzles inside the (FB) incinerator. To further reduce NO_x emissions, a selective non-catalytic reaction with ammonia water injection and a dedicated post-reaction chamber is used.

The FB incinerator's hot flue gases are used to produce steam for a steam turbine as well as to pre-dry the sludge. The boiler system consists of a superheater, evaporators, economizer, and air preheater. The cooled flue gas from the economizer enters an electrostatic precipitator where over 99 percent of the ash is separated. In future it will be possible to retrofit the Outotec ASH DEC process to convert the ash into phosphate fertilizer.

After de-dusting, the flue gas is cleaned with the help of additives using a spray drying system, adsorption reactor, and baghouse filter. The flue gas is then treated in a two-stage scrubber system before it exits the plant via a stack. The scrubber effluent is recycled to the spray dryer for evaporation.

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Project realization

In Switzerland, public investments exceeding CHF 20 million must be authorized by a referendum, which took place in March 2013. The result of 96% in favor exceeded all expectations. The project costs will be recovered through the disposal fees for the delivered sludge and will therefore have no impact on the City of Zürich's budget.

Peter Wiederkehr, deputy director and COO of ERZ, says: "Outotec's expertise in fluidized bed technology and know-how across the whole sludge incineration and flue gas treatment process chain proved to be particularly helpful."

The electrical energy generated by its turbines also covers the plant's own requirements and, in addition, can supply 5 MW of heat to the district heating network. The plant falls within the strict emission limits of the Swiss Clean Air Act and those of the European Union.

Project scope

Outotec's turnkey solution covered everything from the approval planning application, to the detail engineering, equipment supply, plant construction, and commissioning. Outotec was also responsible for production ramp-up and on-site staff training.

DESIGN DATA

Throughput	100,000 t/y
Sludge dryer	
Inlet DS content	22-30%
Water evaporation	5,000 kg/h
Steam consumption	7,000 kg/h
Outlet DS content	35-45%
Fluidized bed incinerator	
Fluidized air flow (STP)	16,000 m ³ /h
Oxygen content	7-11 vol.% dry
Flue gas flow outlet (STP)	26,500 m ³ /h
Temperature	870-950°C
Heat recovery boiler	
Steam temperature	450°C
Steam pressure	60 bar
Steam generation	9 t/h
Steam turbine and generator set	
Electrical power output	900 kWel
Flue gas cleaning	
Flue gas quantity, wet (STP)	<30,000 m ³ /h
Flue gas outlet temperature	70-80°C
Emissions (guaranteed values per m ³ STP dry flue gas)	
Dust	< 10 mg
Pb + Zn	< 1 mg
Hg	< 0.1 mg
Cd	< 0.1 mg
SO ₂	< 50 mg
NO _x	< 80 mg
HCl	< 10 mg
HF	< 1 mg
NH ₃	< 5 mg
CO	< 50 mg
PCDD/PCDF	< 0.1 ng TEQ

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Outotec provides leading technologies and services for the sustainable use of Earth's natural resources. As the global leader in minerals and metals processing technology, we have developed many breakthrough technologies over the decades for our customers in metals and mining industry. We also provide innovative solutions for industrial water treatment, the utilization of alternative energy sources and the chemical industry. Outotec shares are listed on NASDAQ OMX Helsinki. www.outotec.com