

Doosan Lentjes

# Technologies for the incineration of municipal sewage sludge



# Compliance with sewage sludge regulations

Doosan Lentjes is your reliable partner when it comes to the incineration of municipal sewage sludge. With our reliable incineration processes we help you to meet the legal requirements for both safe disposal and recovery of phosphorus. At the same time, our efficient flue gas cleaning technologies ensure full compliance with even the strictest emission directives.

## Reducing the impact of sewage sludge disposal

Sewage sludge contains considerable amounts of harmful, hormonally active endocrine disrupters, such as painkillers, ovulation inhibitors and antibiotics. When being sent to simple landfill or spread in agriculture, the endocrine disrupters remain part of the food chain and can cause serious damage to human health by disturbing growth and development or negatively affecting reproduction. However, our sewage sludge incineration processes contribute to the destruction of these substances by the high temperatures and thus remove them from the chain.

## Recovery of phosphorus

Phosphorus is a vital but limited resource, which is listed by the EU as a critical raw material. Efforts to use it more efficiently have led to a reorganisation of sludge sludge treatment. Sewage sludge contains valuable phosphorus, which can only be recovered by mono-combustion. Phosphorus can be extracted from the ashes left over from incineration in a separate process step.

## Established mono-incineration process

In the field of mono-combustion, the bubbling bed process has proven to be the method of choice for the thermal treatment of sewage sludge. This process offers advantages in terms of combustion efficiency, which is maximised by excellent heat and mass transfer conditions in the fluidised bed furnace.

## BREF-compliance

Flue gas cleaning systems tailored to your individual needs ensure that all emission regulations are fully complied with in accordance with the strict European BREF regulations. The low emission levels will help you to obtain long-term operating permits for your plant. This supports your efforts for a safe and environmentally friendly disposal of your sewage sludge.

Ready to recover phosphorus

Disposal safety

Compliance with European BREF requirements

Established mono-combustion processes

# Turnkey know-how

Doosan Lentjes has many years of experience in the field of sewage sludge incineration. We supply reliable complete plants based on the proven bubbling bed technology. These include subsystems for dewatering, pre-drying, incineration, heat recovery and flue gas cleaning. Depending on the quantity of sewage sludge to be treated, we offer correspondingly customised process solutions.

## Dewatering / drying

Mechanical dewatering usually takes place in the wastewater treatment plants. However, if required, we also offer dewatering as an integrated part of our plant concept. In this case, depending on the nature of the sewage sludge, centrifuges, chamber filter presses or screw presses can be used, which achieve a degree of dewatering of up to 30% dry residue (DR).

In order to ensure self-sufficient combustion, the mechanically pre-dewatered sewage sludge must be further dried. Disk or thin-layer dryers are usually applied here, which use either thermal oil or steam as heating medium.

## Incineration process

Our bubbling bed furnace consists of a cylindrical, lined combustion chamber, a nozzle base and a start-up burner arranged in the

combustion air duct. From below, the combustion air flows through the nozzle grate and fluidises the sand bed into which the dried sewage sludge is fed. It mixes with the bed materials and burns at an optimum temperature of at least 850°C. Combustion air heated according to the DR content ensures an autothermal combustion process in full compliance with legal regulations.



**Heat recovery**

Depending on the capacity, the heat generated during combustion is either used for the self-sufficient operation of the plant or is also made available for external applications. In the former case, the flue gas produced during combustion is cooled in a thermal oil boiler with a downstream air preheater. The heated oil is used to dry sewage sludge. In plants whose capacity permits, the waste heat from the flue gas can be used for air preheating and steam generation. The steam not required for drying can be used to produce district heating or electricity.

**Flue gas cleaning / ash separation**

The proven bubbling bed process has an integrated emission control: in contrast to conventional process, the comparatively low combustion temperature of just over 850° minimises the formation of thermal nitrogen oxides (NO<sub>x</sub>). Depending on the limit values to be complied with, NO<sub>x</sub> emissions can be further reduced in a selective non-catalytic reduction (SNCR) process by injecting ammonia water.

Behind the bubbling bed furnace, the cooled flue gas enters the electrostatic precipitator (ESP), in which more than 99% of the solid particles can be removed. This offers the option of recovering phosphorus from the separated ash in a further process step.

Depending on the project-specific needs, a suitable flue gas cleaning process is applied. With our proven dry conditioned Circoclean® system, gases such as sulphur dioxide, HCl, HF, hydrocarbons and heavy metals like mercury are separated in a reactor.

Lime hydrate and activated carbon are used as absorbents, which are injected directly into the reactor. To ensure optimum reaction conditions with regard to flue gas temperature and moisture content, additional water is injected directly into the reactor.

Remaining residues are separated in the downstream fabric filter, most of which are recirculated into the reactor to ensure optimum utilisation of the absorbents.

For emission requirements according to the European BREF, a two-stage combination scrubber is additionally used. This consists of an acidic and an alkaline cleaning stage. In the acidic stage NH<sub>3</sub> and Hg are separated, while in the alkaline stage gases such as SO<sub>2</sub> and HCl are absorbed. The combination of dry-conditioned flue gas cleaning and combination scrubber enables optimised additive management through proportional separation in both systems.

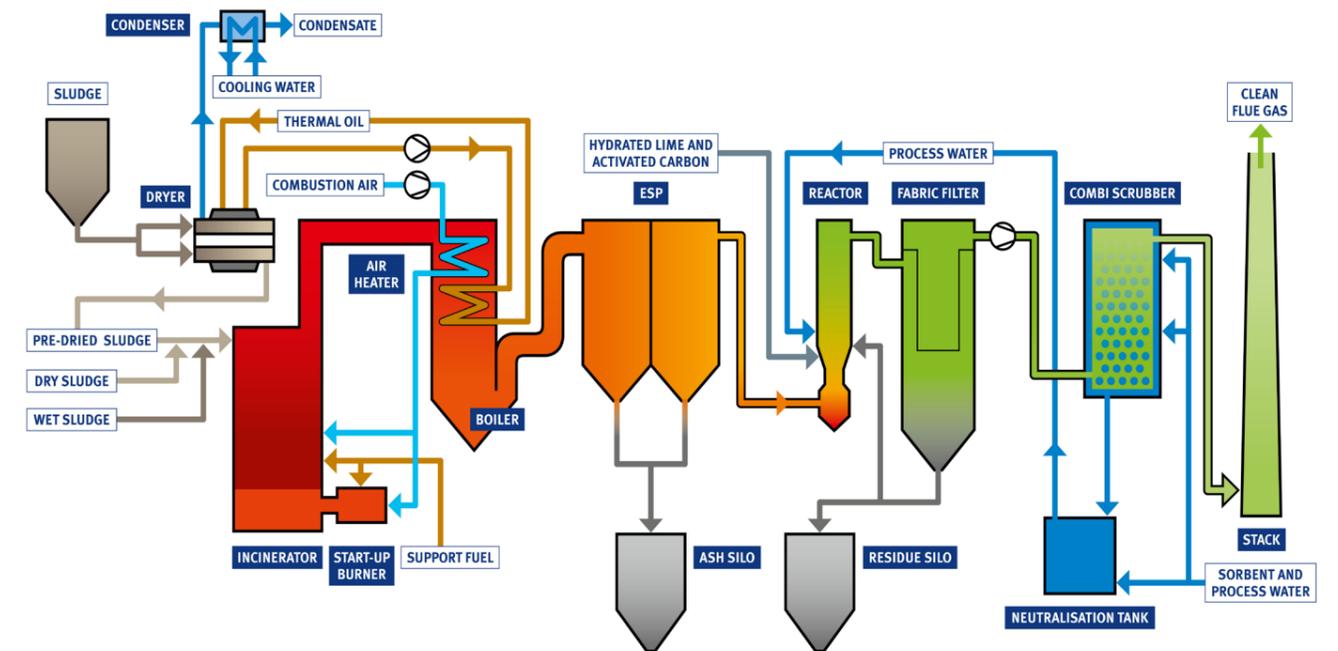
**Civil works: Cooperation with Arikon**

The Berlin-based construction company Arikon is carrying out the entire planning of the construction technology for the project on the basis of the existing planning status of the tender and the plant design developed by Doosan Lentjes.

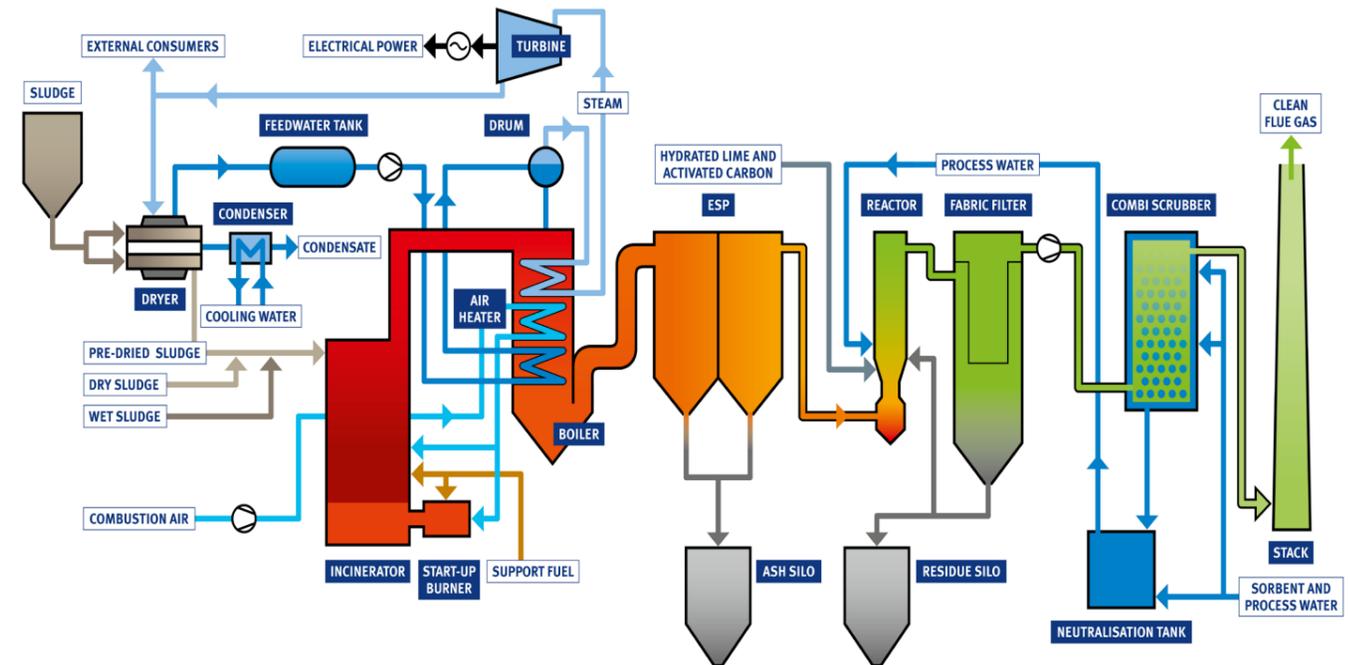
This includes the object and structural design for the structural system, the building physics as well as fire protection certificates. Furthermore, the planning of the building services and electrical engineering for the operation of the building, separated from the process engineering system is part of their work.

The interfaces between Doosan Lentjes and Arikon are defined in an internal matrix, checked and adjusted accordingly for each project. During the execution of the project on site, Arikon's scope of services extends from site clearance, the installation and provision of the entire site equipment to all trades of construction engineering.

**Auto thermal combustion process**



**Additional steam generation for external applications**



**Delivery of the entire process chain from one source**

**Taking over the role of general contractor**

**Compliance with all European emission requirements**

# Selected sewage sludge references

## DRSH-Dordrecht, the Netherlands

**Fuel:**

Dewatered sewage sludge

**Technical data:**

Total plant capacity (dry substance): 90.000 t/a

Number of lines: 4

Thermal capacity: 31.25 MW<sub>th</sub>

The Dordrecht sewage sludge incineration plant started operation in 1993. It is used by the four water boards in Delfland, Rijnland, Schieland and Hollandse Eilanden en Waarden.

The incineration plant includes a central sewage sludge input and storage station. To ensure autothermal combustion, the four lines operate with disc dryers.

The combustion process takes place in bubbling bed furnaces. Waste heat is recovered from the flue gases in waste heat boilers with integrated air preheaters. The saturated steam generated is primarily used for sewage sludge drying. The flue gas cleaning system comprises an electrostatic precipitator, multi-stage scrubbers, a cooling system and a fixed-bed adsorber.



## Crossness, UK

**Fuel:**

Sewage sludge

**Technical data:**

Total plant capacity (dry substance): 56.000 t/a

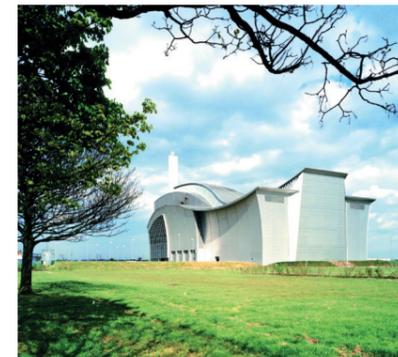
Number of lines: 2

Thermal capacity: 32.8 MW<sub>th</sub>

The ELSI (East London Sludge Incineration) plant was commissioned in 1998 and handed over to the customer, the British water company Thames Water, in the same year.

The two sister plants in Beckton and Crossness fall well below the emission values legally stipulated at the time in accordance with the 17<sup>th</sup> BImSchV.

The ELSI project comprised the turnkey assembly and commissioning of the two incineration plants in East London. The Beckton plant has three incineration lines, the Crossness plant has two. Both utilise the sewage sludge of about four million inhabitants.



## Doosan Lentjes

Doosan Lentjes provides proprietary environmental technologies for thermal waste treatment and energy generation. Our areas of expertise include the incineration of renewable fuels such as waste, sewage sludge and biomass, heat recovery systems and flue gas cleaning equipment. We deliver flexible solutions for long-term waste disposal safety and climate-friendly steam and power generation.

As a member of the global Doosan Group, Doosan Lentjes is part of a strong international network of companies providing complementary technologies, skills and value to customers the world over.



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