



TURNOVER[®] ROTARY KILN

INCINERATION TECHNOLOGY FOR THE
SAFE DISPOSAL OF HOSPITAL AND
HAZARDOUS WASTE



WATERLEAU

protecting the 4 elements

INCINERATION TECHNOLOGY FOR THE SAFE DISPOSAL OF HOSPITAL AND HAZARDOUS WASTE

Waterleau has developed an incineration technology designed to treat specific waste flows that cannot be treated in a grate or fluidized bed furnace. For the treatment of hazardous waste, Waterleau has designed a TURNOVER® rotary kiln. The slow rotating kiln allows a continuous mixing of its waste content and a perfect combustion of solid and liquid hazardous waste. The TURNOVER® technology is particularly adapted for the treatment of high risk medical waste and packaged hazardous industrial waste. Higher concentrations of sulphur and chloride in these types of waste require a more sophisticated flue gas cleaning, designed by the Waterleau Air treatment engineers.

HOSPITAL WASTE

Hospital waste is a difficult and dangerous waste because of the high concentration of chemically or biologically toxic substances. Hospital waste is usually classified in the following categories:

Non-specific hospital waste

Equivalent to standard household waste, i.e. residues of normal human activity.

Specific hospital waste

These are the typical residues of medical treatment. For this reason high-risk medical waste is packaged in special plastic containers or in cardboard boxes with a special, second, plastic liner. It is not only generated in hospitals but also in laboratories, homes for elderly people, etc.

TREATMENT OF HOSPITAL WASTE

Thermal treatment of hospital waste differs from the treatment of non-toxic waste (e.g. household waste, MSW, industrial waste,...):

- Storage and handling require more attention to safety
- Spills or leaks are to be avoided at all cost
- Shredding is not possible because this would release dangerous substances.
- Higher temperatures are required: 1100°C instead of 850°C during 2 seconds
- Higher concentrations of S (Sulfur) and Cl (Chloride) require a more sophisticated flue gas cleaning
- Efficiency of energy recovery is not the first concern: safety and guaranteed destruction of pathogens is more important.



AVOIDING RISK OF CONTAMINATION

During the feeding of the incinerator, special care is taken to avoid human contact with the hospital waste. An intricate and sophisticated feeding system, not requiring any human manipulation, transports the special waste packages to the different feeding points of the incinerator. Each opening is a lock-type system with double gates allowing feeding without directly exposing the incinerator to the outside atmosphere. From each opening, the waste drops by gravity into the incinerator.

TURNING AND BURNING

The Waterleau TURNOVER® incinerator itself is of the rotary kiln type, i.e. a horizontally mounted, slowly rotating metal tube with an internal lining of refractory material. One of the unique features of the TURNOVER® plant is that incineration process inside the kiln takes place in a so-called reducing atmosphere. The waste is thus subjected to a gasification process with controlled addition of combustion air, so that the solid waste is converted to combustible gases (CO, H₂,...) and solid ash. This gasification process allows for a higher efficiency and lower temperatures inside the kiln. The TURNOVER® rotary kiln can accept liquid or slurry waste and also toxic waste.

The solid residues of the combustion process are evacuated by the bottom ash extractor equipped with a water lock, to avoid entry of outside air. The combustion gases are burned out completely in the post-combustion chamber (PCC) so that the gases reach the legally required temperature of at least 1100°C for at least 2 seconds.

ENERGY RECOVERY

Upon leaving the PCC, the flue gases directly enter the steam boiler in which they are cooled to a temperature of approx. 200°C. The steam boiler, of the horizontal type, and designed by Waterleau, converts the heat in the flue gases into steam, which is used to drive a steam turbine. The medical waste is thus effectively converted into useful energy (electricity), some of which is used to supply the plant's own consumption. The rest of the electrical power is injected in the public grid.

In the first pass of the boiler, an SNCR (selective non-catalytic reduction) deNO_x system is installed to reduce the concentration of nitrogen oxides (NO_x) to well below the legal emission limit value.



FLUE GAS TREATMENT

The flue gases are cleaned in a sophisticated four step treatment system consisting of:

- 1 Electrostatic precipitator (ESP) for dust removal
- 2 Acid wet scrubber for the removal of most of the acids (HCl, HF, SO_x,...)
- 3 Neutral wet scrubber for the removal of the remaining acids. Both scrubbers use limestone (CaCO₃) as neutralizing agent
- 4 Wet dioxin adsorption system

The first stage is the electrostatic precipitator (ESP), which removes the dust particles from the flue gases, using a strong electromagnetic field between the particles and the electrodes. The dust is collected and transported in a special system, and is evacuated together with the boiler ash (dust collected in the boiler).

The second stage is called the acid scrubber. Here the gases are quenched (cooled to saturation temperature, approx. 65°C) and cleaned with large quantities of water at a relatively low pH, hence the name 'acid scrubber'. The water removes from the gases some highly acid pollutants, mainly HCl and HF.

The second scrubber is the neutral scrubber, because it uses water a pH of close to 7. This scrubber removes the remaining acids, mainly SO_x. Both scrubbers also help to remove the remaining dust particles in the flue gases.

The acids collected in the scrubber water are neutralized using limestone. The use of limestone (CaCO₃) instead of the more traditional slaked lime (Ca(OH)₂) as neutralizing agent is yet another first for this kind of installation. The scrubbers use the DYNAWAVE[®] system supplied by MECS Europe.

The next step is the ID-fan, which keeps the total installation upstream of the fan in underpressure, to avoid any escape of harmful gases to the outside.



The final step of the gas cleaning process is the activated carbon filter, a series of four filters in parallel to remove the dioxins, furans (PCDD/F) and heavy metals (such as mercury) from the flue gases.

Finally the gases are evacuated to the atmosphere via the stack. A sophisticated continuous emission monitoring system is installed in the stack, to check the respect of the legal requirements of the emissions.

THE MEDIPOWER® PLANT

Waterleau has built the MEDIPOWER® plant for Indaver in the port of Antwerp. This installation treats solid and liquid hazardous waste. ctively kills all pathogens and transforms the dangerous chemical substances into harmless components.

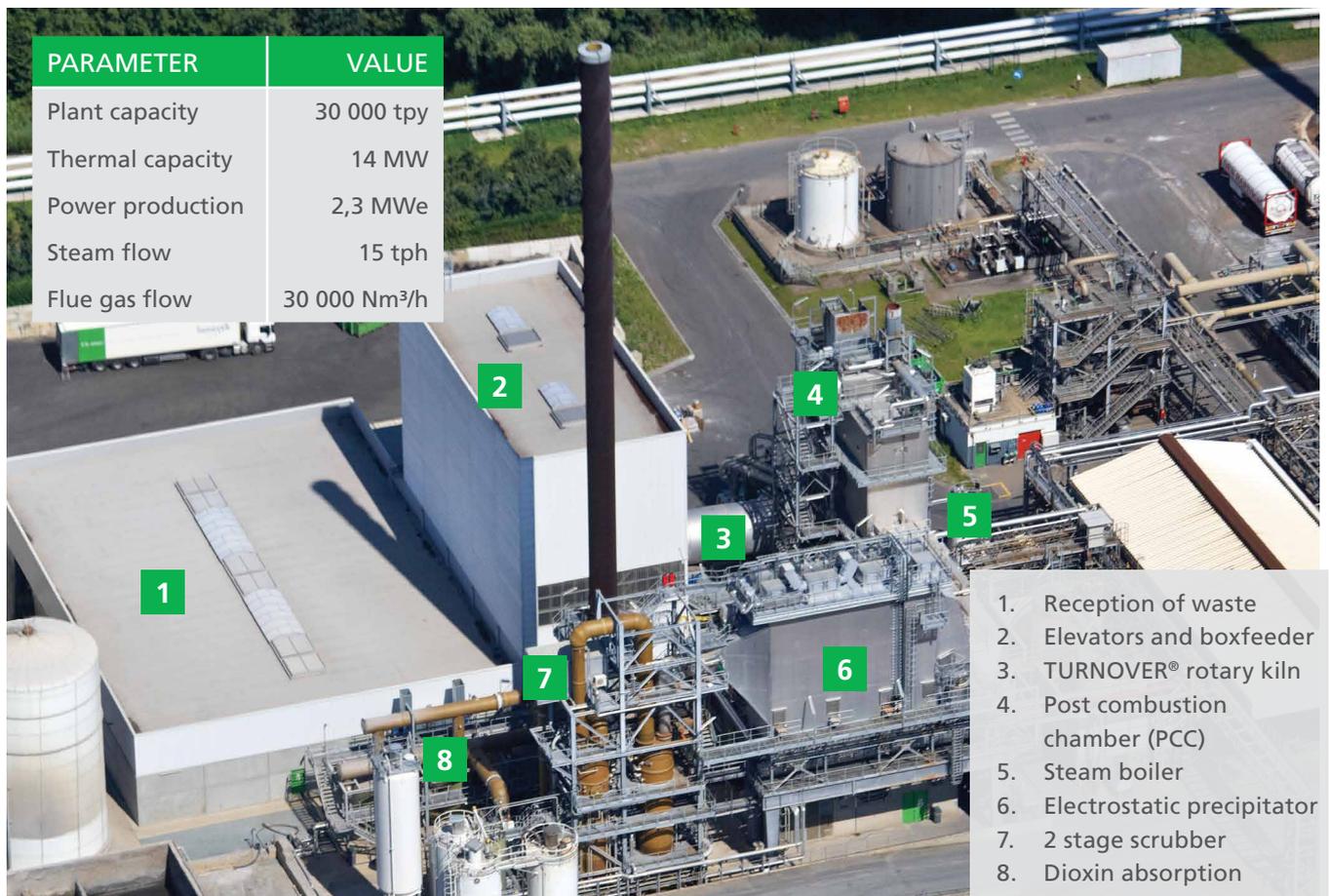
The MediPower® Plant, with a capacity of 30,000 tons per year, is capable of treating all specific medical waste generated in Belgium (approx. 10,000 tons per year). The rest of the capacity is filled with packaged hazardous industrial waste (metal or plastic containers up to 200 liter) and hazardous liquid waste (both high-calorific and low calorific waste).

In many aspects this project is very innovative:

- The waste to be treated is packaged and the packages are fed as whole, without, breaking them or opening them.
- Unique combination of treatment of different solid and liquid hazardous waste flows.
- The combustion process in reducing atmosphere (gasification).
- The flue gas cleaning using limestone (and not lime).
- Integration of the steam system in that of the two other incinerators on site.

The new incinerator in the Antwerp harbor is one of the largest in the world making use of the latest technology for hazardous waste treatment and featuring state-of-the-art air treatment design. Fully automated feeding lines reduce human intervention and contamination risks to a minimum. Hazardous waste is turned into energy in a proven-concept and absolutely safe design, meeting the requirements of waste producing industries by offering sustainable solutions and contributing to the green and recycling society.

MediPower® is a registered trademark of Indaver



TURNOVER[®]: THE MOST ADVANCED AND SAFEST INCINERATION TECHNOLOGY FOR MEDICAL AND HAZARDOUS WASTE TREATMENT

DESIGN
ENGINEERING
CONSTRUCTION
OPERATION
MAINTENANCE

PROTECTING THE 4 ELEMENTS



We all have the responsibility to handle our natural resources in a careful and sustainable way. Waterleau develops environmental technologies and offers sustainable solutions for water, air and waste treatment, as well as for energy recovery. As an EPC contractor and operator, Waterleau counts more than 1000 references for municipal and industrial clients around the world.



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