HELIOSOLIDS®
FLUIDIZED BED INCINERATOR

THE POWER OF SLUDGE
Tons of sludge are leaving wastewater treatment plants each day. Spreading the sludge on agricultural land or in a sanitary landfill is not always a feasible solution. Indeed, the better the water treatment, the more complete the concentration of noxious wastes in the sludge, the “dirtier” the sludge. This is especially the case when untreated industrial waste water is connected to the sewage system. Incineration is a safe way of turning a problem waste into an opportunity. The HELIOSOLIDS® fluidized bed incinerator integrates incineration of different kinds of sludge, with heat recovery and flue gas cleaning.

THE POWER OF SLUDGE

FLUIDIZED BED REACTOR

The HELIOSOLIDS® fluidized bed reactor is a fluidized bed furnace for the staged combustion of bio-solids, industrial sludge and fine solids. The reactor features integrated heat recovery, a stable fluidization and combustion process, and integrated flue gas cleaning.

A fluidized bed is a sand bed through which air is blown vertically from bottom to top at a speed that keeps the individual sand particles floating. The HELIOSOLIDS® fluidized bed reactor is a so-called bubbling bed, which means that the fluidization air speed is such that the particles are not carried away with the air. The sand bed behaves like a boiling liquid.

In order to separate the fluidization air from the particles, the reactor diameter widens just above the bed, so that the air speed decreases in this zone below the fluidization speed and the particles thus drop back in the bed. This air-particle separation zone is called the freeboard.

The fluidization air is used as combustion air in the incineration process. The product to be incinerated is introduced in the reactor just above the bed. The fluidization air is injected in the sand bed using a specially designed distributor plate that has to guarantee an even distribution of the air in the bed, and to avoid that sand flows back in the air duct. The distributor plate is proprietary Waterleau technology.
TWO OPERATING MODES

The HELIOSOLIDS® fluidized bed reactor exists in two modes, depending on the calorific value of the waste being incinerated.

1. For low calorific waste such as sludge, the fluidization air is preheated by the energy released in the reactor, using an integrated air/gas heat exchanger. The lower the heating value of the product to be incinerated, the higher the fluidization air temperature needs to be in order to reach ‘so-called’ autothermal combustion (i.e. not requiring auxiliary fuel).

2. For products with a high heating value, the fluidization air does not need to be preheated. The reactor can now be integrated in a steam boiler or thermal oil boiler to recover a maximum amount of energy and keep the reactor temperature under control (avoid sand bed agglomeration).

The flue gases leaving the reactor are cooled in a boiler or heat exchanger and treated in a flue gas cleaning system.

Depending on the inert content of the product to be incinerated, the sand bed may be equipped with an ash extraction device to remove the large inert objects from the sand. In case of sludge incineration, the inert matter consists of small sand particles that either remain in the sand bed or are entrained by the air (elutriated) and captured in the dust filtering system.
APPLICATIONS

Biosolids; meat and bone meal (MBM); carbon soot; municipal WWTP sludge, industrial WWTP sludge; shredded animal residues; bleaching earth; paper mill sludge; oily sludge and slurry; spent activated carbon; spent grains; shredded wood and pellets; paint and paint sludge; acid oils, gums, soap stock; manure and chicken litter; reactor bottoms; shredded packaging material,…

AUTOTHERMAL

Often the product is too wet to allow complete combustion without support fuel. In that case it may be wise to predry the product using mechanical dewatering or thermal dewatering systems (see Waterleau’s HYDROGONE® technology). If this is not possible, a support fuel is required. This can be a gas (natural gas, biogas,…), but also a solid or liquid fuel or solid waste (e.g. paper, labels, plastics,…)

ADVANTAGES HELIOSOLIDS®

<table>
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<tr>
<th>FLEXIBILITY</th>
<th>Perfect Combustion</th>
<th>High ROI</th>
<th>Low Flue Gas Emissions</th>
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<tbody>
<tr>
<td>- Wide range of separate or mixed injected waste streams</td>
<td>- The three T’s of combustion: High T, long residence Time, high Turbulence</td>
<td>- Short construction time, long lifetime, high availability</td>
<td>- Integrated desulphurisation</td>
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<td>- Easy on/off</td>
<td>- Staged combustion by secondary air injection</td>
<td>- Low maintenance: no moving parts, controlled combustion</td>
<td>- Low NOx, CO and hydrocarbon emissions</td>
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<td>- Large turn-down ratio</td>
<td>- Intense mixing of combustion gases and air</td>
<td>- Fully automated operation</td>
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Many petroleum refineries around the world have disposed of their sludge in natural or artificial lagoons. This sludge is usually an emulsion of heavy hydrocarbons (tar) in water and has a high sulphur content (‘acid tar’). These lagoons create a serious environmental risk of ground, water and air pollution. Treatment, however, is difficult because of the high water and high acid content. Waterleau has won a project for the treatment of 80,000 tons per year of this refinery sludge using a HELIOSOLID® fluidized bed incineration plant with energy recovery and flue gas cleaning.

Our client needs to dispose of 250 tons per day of refinery sludge. The sludge has a moisture content between 50 and 70%. The sludge is injected in the HELIOSOLID® fluidized bed reactor. The flue gases are cooled in a customized steam boiler, first mainly through radiation, and then mainly by convective heat transfer. The steam is used to drive a small backpressure turbine which makes sufficient power for the plant’s own consumption (island mode).

The flue gases are cleaned in the DRYCLEAN® flue gas cleaning system which collects dust and absorbs and neutralizes the $\text{SO}_2$ and other acids in the flue gases.

The ID fan assures a slight negative pressure in the furnace of the HELIOSOLID®, conveys the flue gases through the different components and finally ejects them into the atmosphere through the stack. Auxiliary fossil fuel is not required during normal operation, only for start-up and shut down.
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.