

Spray Drying Absorption

The easy way to clean the flue gas
from waste incinerators



SDA: clean, compact, convenient

As economies around the world have developed rapidly, so the amount of refuse generated has accelerated correspondingly. In many countries, particularly densely populated ones, landfill sites are unable to cope with the increase. Governments here have looked to incineration to reduce waste volumes and slow the rate at which landfill sites are filling up. The incineration of Municipal Solid Waste (MSW) and industrial waste also holds the added benefit of producing energy in the form of steam-generated electricity and district heating.

However, as waste incinerators have spread, so have public concerns about their emissions. In response legislators worldwide have recurrently regulated incinerator operators to limit harmful flue gas emissions. Today, demonstrating you can meet very strict emission limits is central to the approval of any waste incineration project.

For incinerator operators this means providing adequate environmental safeguards, using the best available technology, while moderating costs. For many the answer to this balancing act lies in GEA Niro's spray drying absorption (SDA) technology.

Simply better

First conceived by GEA Niro in the 1970s, SDA has been quickly adopted by waste incinerators around the world because of its numerous demonstrable benefits.

SDA removes acid gases, particulates, trace metals and dioxins from flue gases – at rates well above legislative targets – and converts them into a light, free-flowing powder. However, it's in the sheer simplicity of SDA that its true merits lie. Using a minimum of equipment and raw materials, SDA requires far less capital expenditure upfront and lower running costs than many rival technologies. The process' uncomplicated basis also makes it remarkably robust (the first SDA systems, installed in 1980, are still in operation today) and flexible. The system is constantly self-adjusting to follow changes in flue gas composition. All of this means you can meet your commitment to regulators without incurring excessive costs.

A GEA Niro SDA system in combination with polishing wet scrubbers at two waste incineration lines in Germany, 2 x 300 TPD.

Two waste incineration lines in Germany fitted with GEA Niro SDA systems since 1986.



Two waste incineration lines in Germany, 2 x 300 TPD.



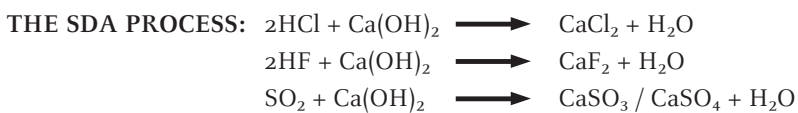
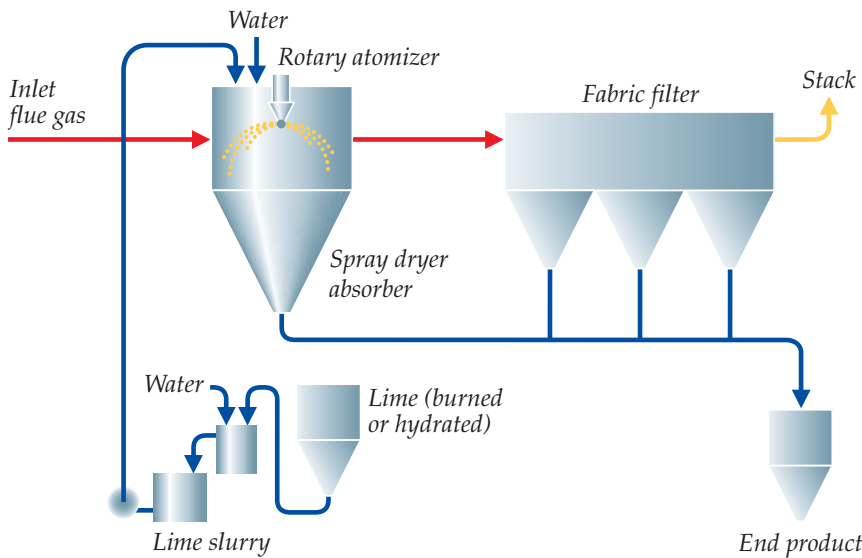
Key Benefits

- Removal efficiencies well above regulatory requirements
- Removes acid gases, trace metals and dioxins in one common process
- Low capital expenditure
- Low water consumption
- Low auxiliary power consumption
- Highly flexible: adjusts to variations in waste composition
- No need to reheat flue gas
- Absorbers made of mild steel – no high alloy materials
- No lining
- Can use low-quality water, incl. waste water or sea water
- No waste water generated
- No sludge treatment equipment
- Fly-ash pre-collection optional

Remove multiple pollutants in one common process

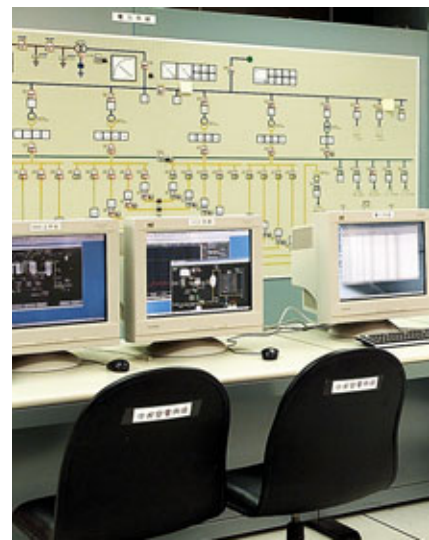
A rotary atomizer disperses the absorbent slurry into billions of tiny droplets.

SDA is based on a simple concept, honed over the years into a precise, effective system. Hot, untreated flue gas is fed into a spray drying absorption chamber and comes immediately into contact with a fine spray of alkaline slurry (usually slaked lime). Virtually all the acidic components in the flue gas (HCl, HF, SO₂, SO₃) are absorbed into the alkaline droplets, while the water is evaporated simultaneously. Precise control of the gas distribution, slurry flow rate and droplet size ensures droplets are converted into a fine powder. The injection of activated carbon into the flue gas can be used to enhance the removal of mercury and dioxins. Some fly ash and reaction products drop to the bottom of the absorber and are discharged. The treated flue gas continues on to a dust collector, where any remaining suspended solids are removed. The cleaned gases are then expelled through the stack.



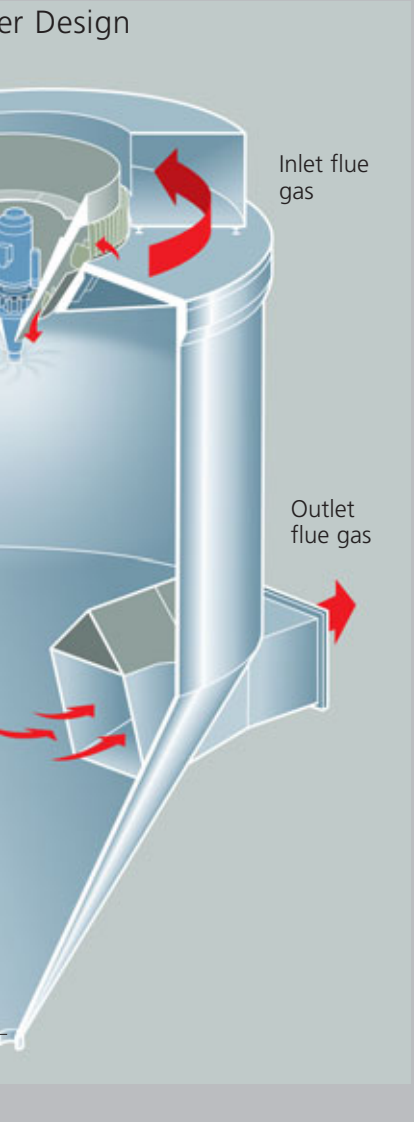
Flexible and functional

A highly tolerant system, SDA is self-adapting to changes in flue gas flow rate, temperature and composition. On a practical level, SDA is suitable for incinerators of all types and sizes, requiring only a single absorber and a single rotary atomizer per incineration line. In addition, the SDA process is easily integrated with other flue gas cleaning technologies. The basic SDA process can be enhanced by additional process options in order to meet the specific needs of an individual project, such as incinerators with a very high concentration of pollutants and/or very strict emissions requirements.





An activated carbon injection system installed at a Danish waste facility with 4 incineration lines.



The Rotary Atomizer and Gas Disperser

Central to GEA Niro's SDA process is the concept of using a spray dryer as both an absorber and dryer simultaneously. Achieving this hinges on two crucial pieces of equipment – the GEA Niro rotary atomizer and gas disperser. The former atomises feed slurry into billions of droplets, while the latter ensures the correct gas dispersion to optimise drying and reaction conditions. GEA Niro has developed special gas dispersers for different types of waste incineration, such as MSW or hazardous waste. Some special gas dispersers are capable of handling flue gas temperatures of up to 1200°C.

Years of development and refinement have resulted in an atomizer that is extremely reliable, able to operate continuously for more than 2,000 hours and requires little maintenance. Other key advantages of the GEA Niro atomizer include:

- High capacity – one atomizer per incineration line
- Low maintenance
- Patented wear-resistant design (WEARSERT™)
- Proprietary feed distributor design (VOLUTE™)
- High availability
- Durable – lifespan over 30 years
- Broad turn down range
- Separate atomizer feed pipe for lime slurry and quench water allows rapid control of flue gas emissions and temperature, and prevents scaling.



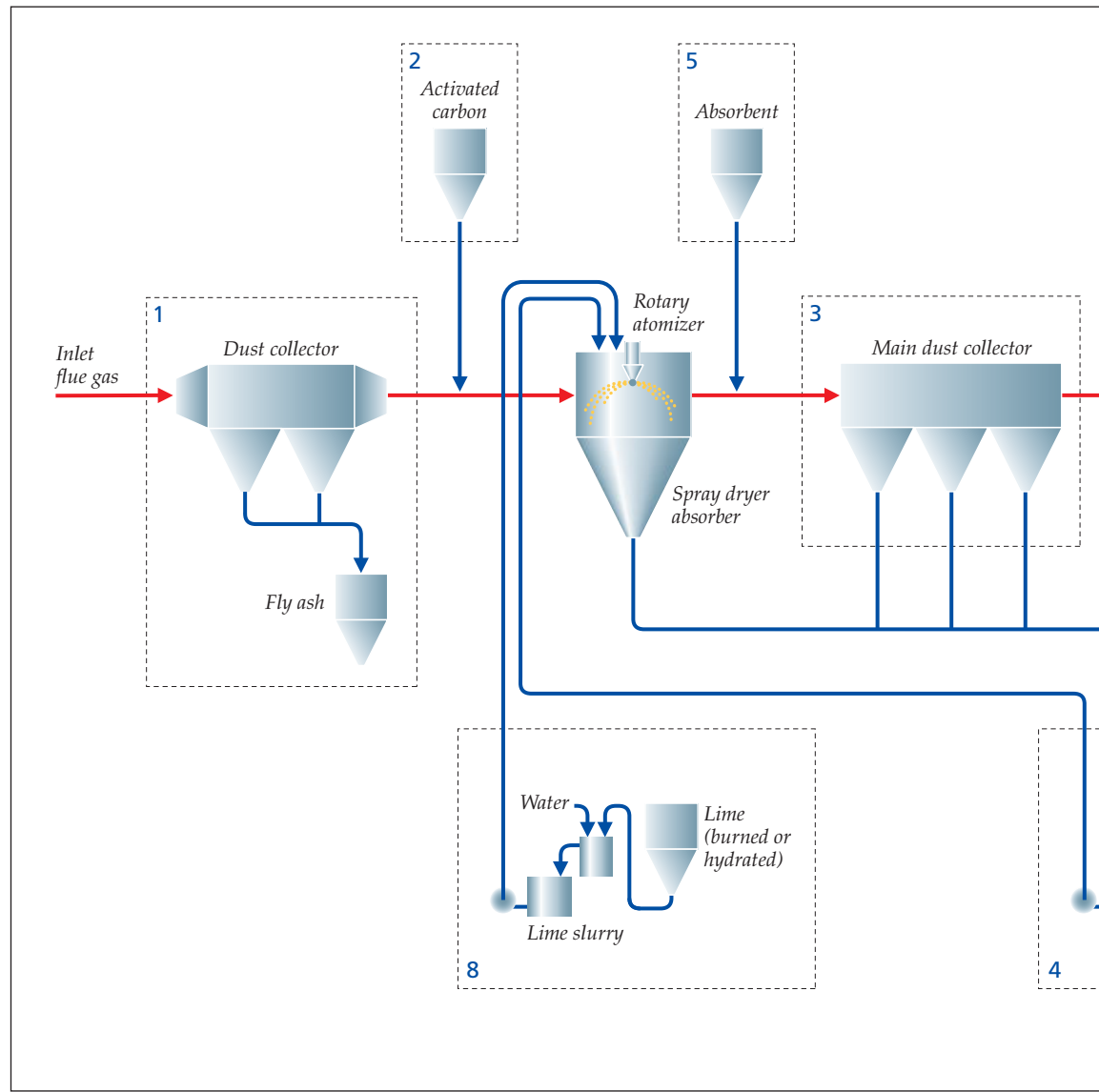
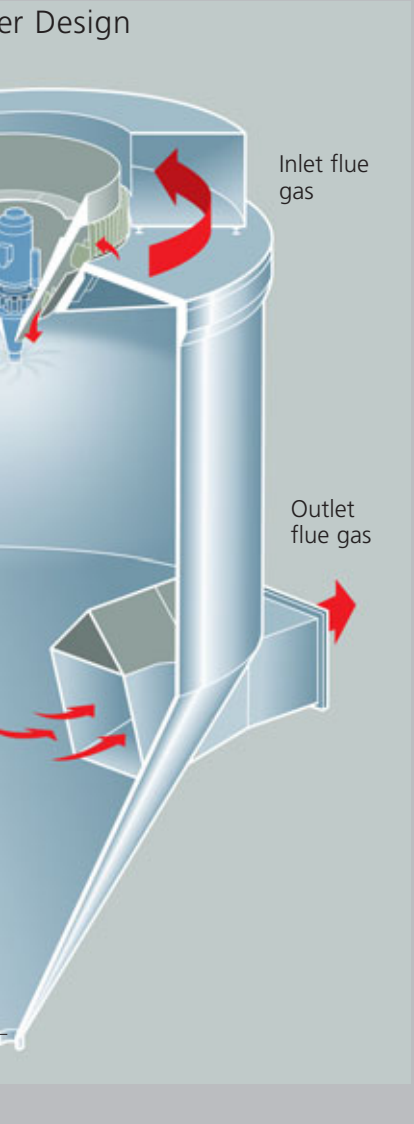
A single rotary atomizer can treat the flue gas from even the largest incineration line.



The abrasion-resistant atomizer wheel and insert design ensures reliable continuous operation, with a minimum of maintenance.



GEA Niro patented rotary atomizer wheel insert.



Operation of an SDA plant is typically handled from the central control room, without extra staffing.

The GEA Niro SDA system for waste incineration plants may incorporate one or more of the following special features

1. Fly ash pre-collection

The SDA process can optionally include fly ash pre-collection for separating the different residue streams.

2. Mercury and dioxin control

A patented activated carbon injection system can easily be incorporated into the process to ensure low mercury and dioxin emissions. Powdery activated carbon or powdery activated coke, when injected into the hot flue gas upstream, into or downstream of the SDA, entraps mercury and dioxins prior to being removed in the main dust collector.

3. Main dust collector

The SDA process can use an ESP or a fabric filter as its main dust collector. Lower emissions values for all pollutants are achievable with a fabric filter as the main dust collector.

4. Product recycling

A partial recycling of the dried products back into the reagent feed may be incorporated. Recycling serves three different purposes: better utilization of the absorbent, enhanced drying conditions in the spray dryer and lower end-product volume.

5. Peak control

Large and rapid variations in the inlet concentrations of HCl and SO₂ can be controlled by injecting a dry absorbent upstream of the main dust collector. The dry absorbent can be in the form of normal hydrated lime, special high-surface lime or combinations of lime and activated carbon/coke.

6. High Performance SDA (HPSDA)

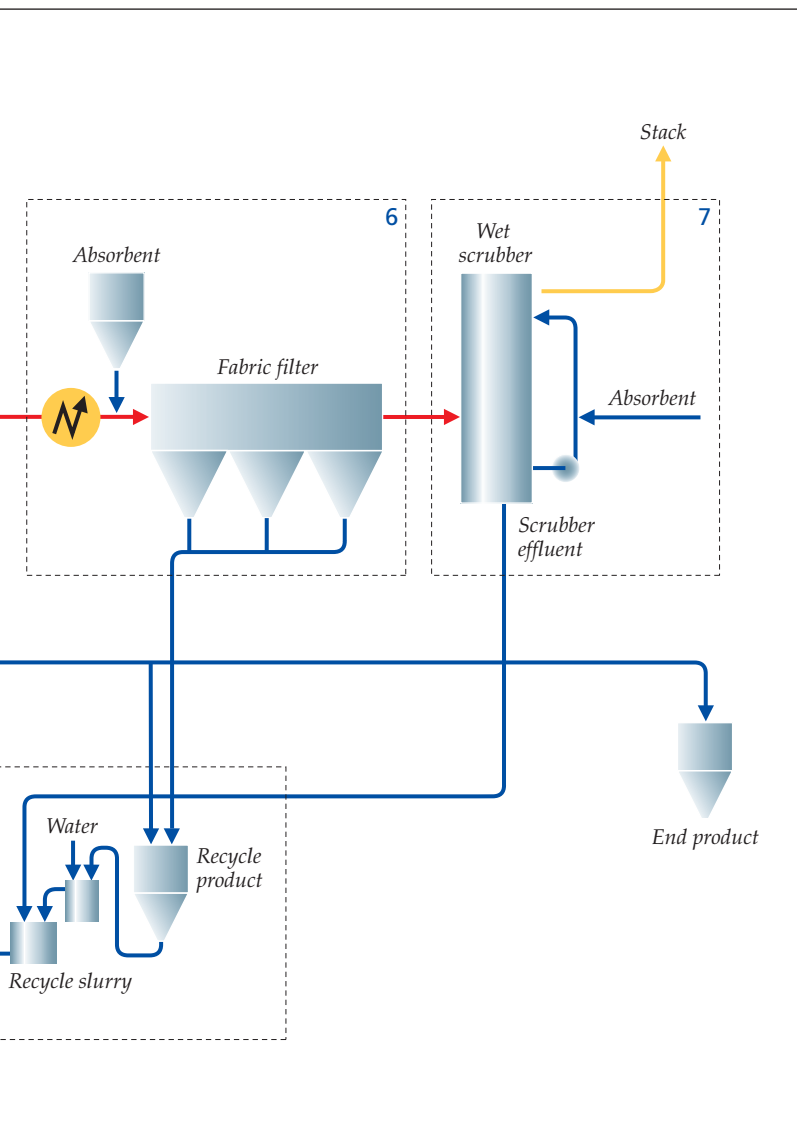
The HPSDA-system includes an additional fabric filter installed downstream of the main dust collector. The flue gas between the two filters can optionally be cooled in a heat exchanger to optimise the process. A dry absorbent is introduced in the duct upstream of the fabric filter. The dry absorbent can be in the form of normal hydrated lime, special high-surface lime or combinations of lime and activated carbon/coke. HPSDA has the following advantages: better utilization of the absorbent, control of high inlet acid concentrations, high removal rates, heat recovery and lower end-product volume.

7. Wet scrubber

A polishing wet scrubber downstream of the main dust collector leads to the same advantages as the HPSDA system: better utilization of the absorbent, control of high inlet acid concentrations, high removal rates and lower end-product volume.

8. Fresh lime supply

The fresh lime supply to the atomizer may be omitted if a sufficient amount of the absorbent is available from other sources. This may be in combination with the HPSDA, where all the absorbent can be introduced into a secondary filter, or when all the acid gases are removed in a wet scrubber and the spray dryer serves as an effluent dryer only.



GEA Niro's SDA process is extremely effective. Acid gases, trace metals and dioxins are removed from flue gases at very high efficiencies.

Removal rates of acid gases are managed with the aid of an emissions monitor system and are freely adjustable by varying the flow rate of the lime slurry to the atomizer.

Pollutant	Removal efficiencies
HCl	99.9%
SO ₂	99.0%
HF	99.9%
Hg	98.0%
Dioxin	99.9%

A pioneer of SDA

In the mid-1970s, GEA Niro began testing the idea of using spray dryers to absorb acid compounds and trace metals in combustion gases, with considerable success. By 1980 the process was patented and made commercially available. SDA's operational and economical advantages mean it has been eagerly adopted by incinerator operators throughout Europe, the USA and Asia.

Bringing expertise to bear

GEA Niro remains the world authority on SDA applications for flue gas cleaning, offering an unprecedented range of experience, process know-how and equipment. To date we have fitted over 450 rotary atomizers at more than 160 installations around the world. More importantly, we ensure this knowledge translates into tangible benefits for our customers. A familiarity with incinerator design and legislative demands enables GEA Niro to quickly and professionally generate basic engineering designs for new SDA installations. And, whenever possible, we personally oversee the implementation and start-up phase of all projects to satisfy customers (and ourselves) that the process and equipment perform as expected.

A lasting commitment

Investing in an SDA system is really just the first step in a relationship that we hope is as durable and enduring as our technology itself.

GEA Niro is a world leader in industrial drying applications and has operations in more than 50 countries. Our global after-sales division is dedicated solely to serving customers with routine maintenance checks, original GEA Niro spare parts and emergency technical support. Of course, our SDA-specialist engineers are also at hand for more complex repairs or process inquiries. Finally, our after-sales division can provide training on both operation and maintenance issues, helping customers help themselves.

With GEA Niro you can be confident you're never far away from local support of a world-class standard. That's because when you invest in an SDA system from GEA Niro, you also gain the commitment of 4,000 employees, devoted to keeping your business performing optimally at all times.

A Danish waste incineration facility equipped with four identical SDA systems.



Left : A GEA Niro SDA system at two waste incineration lines in Germany, 2 x 300 TPD.



Right: GEA Niro SDA-specialists are at hand for process enquiries.

Lime slaking system at a Danish waste incinerator.



Erection of a gas disperser at a German incineration plant.



A Taiwanese waste incineration facility with two GEA Niro SDA systems, 2 x 300 TPD.



Paste lime slaking system.



Experience

GEA Niro has contracted and installed more than 10,000 plants worldwide

GEA Niro is a world leader in industrial drying, with spray drying, spray cooling/congealing, flash drying, freeze drying, granulation and fluid bed processing as core technologies. Having installed more than 10,000 plants around the globe, GEA Niro is known for delivering solutions that meet customers' exact requirements. The GEA Niro companies are part of GEA Process Engineering.



GEA Process Engineering

GEA Niro

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