

Spray Dry Flue Gas Desulfurization Systems



Proven spray drying absorption process reliably provides
SO₂ and hazardous air pollutant emissions reduction



RENEWABLE | ENVIRONMENTAL | THERMAL

Babcock & Wilcox (B&W) has been at the technological forefront in providing cost-effective solutions to tough emission control problems for nearly 40 years. Our continued research and commercial efforts in reducing emissions of nitrogen oxides (NO_x), sulfur oxides (SO_2 and SO_3), fine particulate ($\text{PM}_{2.5}$), mercury, acid gases (HCl and HF), and other hazardous air pollutants (HAPs) have led to many advancements in air pollution control technology.

Emission Reduction with High Availability and Reliability

B&W's commitment to providing the best in emission reduction technology for power generation continues with our spray dryer flue gas desulfurization (FGD) systems for controlling SO₂ emissions.

Our first coal-fired spray dryer absorber (SDA) installations now have more than 35 years of operating history. We are the exclusive North American licensee of GEA Process Engineering A/S, Denmark, for the GEA Niro SDA process. The two companies also work together worldwide on specific project opportunities. The first full-scale application of the GEA Niro SDA process for coal-fired boiler emissions control began operation in the United States (U.S.) in 1980. After more than 30 years, the process remains globally recognized by the industry as the spray dry FGD technology of choice. B&W and GEA Niro's continual record of utility, industrial and cogeneration SDA projects has achieved a steady, long-term market dominance.

SDA Features

Reliable rotary atomization

- Highest slurry atomizer capacity in the industry reduces the number of atomizers to maintain
- Low maintenance/high availability
- Abrasion and corrosion resistant components

Efficient flue gas dispersion system

- No damper or vane adjustments needed to follow boiler load
- Optimal mixing of flue gas and reagent
- Maximum atomizer-to-wall spacing

Optimized performance

- High solids reagent recycle
- Innovative process control
- Control of drying conditions to minimize potential deposition and corrosion
- Large SDA chambers

Typical B&W/GEA Niro SDA system installations operate at 90 to 95 percent SO₂ removal efficiency, with some plants running as high as 98 percent. SO₃, HCl and HF removal efficiencies are normally greater than 95 percent.



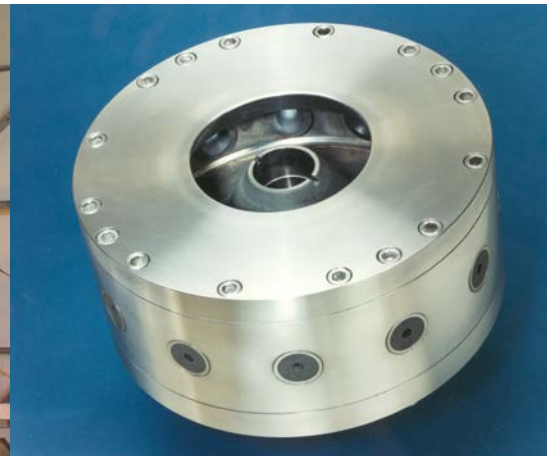
As the first SDA process demonstrated at full-scale in the U.S., the GEA Niro SDA technology has proven successful on more than 21,000 MW of utility and industrial coal-fired boilers as well as more than 80 waste-to-energy installations worldwide.

SDA Benefits

- High SO₂ removal efficiency
- Integral SO₃, HCl, HF, heavy metals and PM_{2.5} emissions reduction
- Low capital cost
- Low auxiliary power use
- High system availability
- Low operation and maintenance costs
- Low fresh water consumption
- Inherent oxidized mercury emissions reduction
- Integral consumption of plant waste water streams for zero liquid discharge operation



The B&W SDA provides significant turndown to accommodate boiler load variations while maintaining optimal performance.



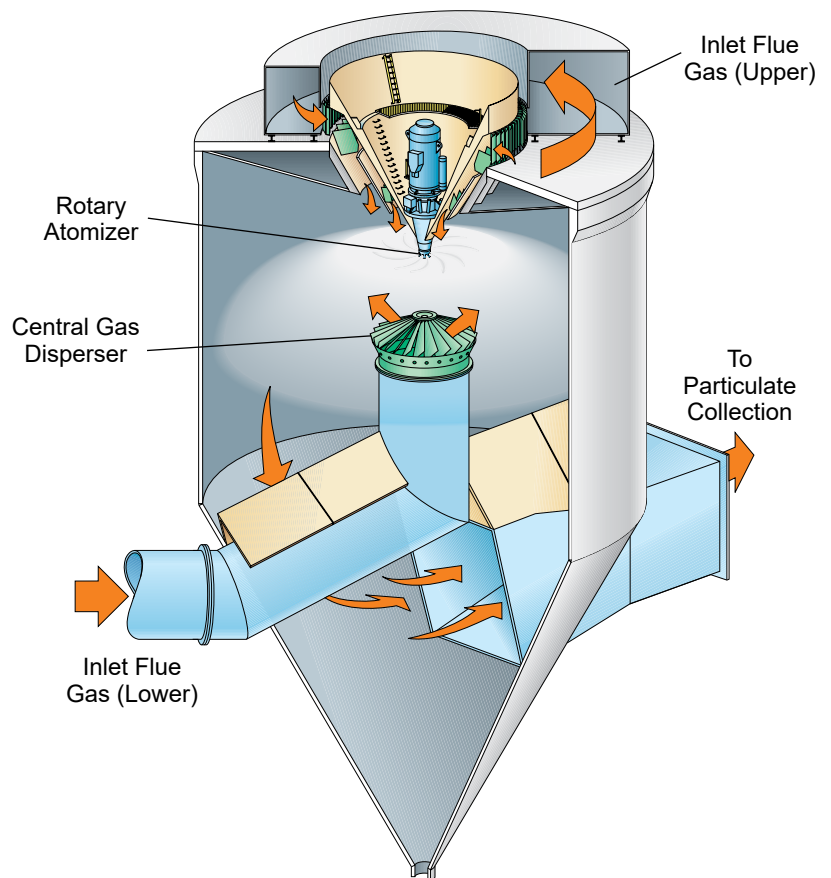
Process Provides Efficiency and Reliability

The heart of the SDA system is the GEA Niro rotary atomizer used to atomize a mixture of lime and recycle slurry into a fine spray. The spray droplets are well distributed and mix with the hot, untreated flue gas. A series of chemical reactions result in the removal of SO_2 , SO_3 , HCl and HF from the gas, and the simultaneous evaporation of the water. A single, central atomizer promotes an even distribution of the fine spray throughout the chamber while minimizing any potential for wall wetting and deposition. The alkaline slurry is converted into a dry, free-flowing powder of calcium/sulfur compounds. Flyash from the boiler and the dry reaction products are then collected downstream of the spray chamber.

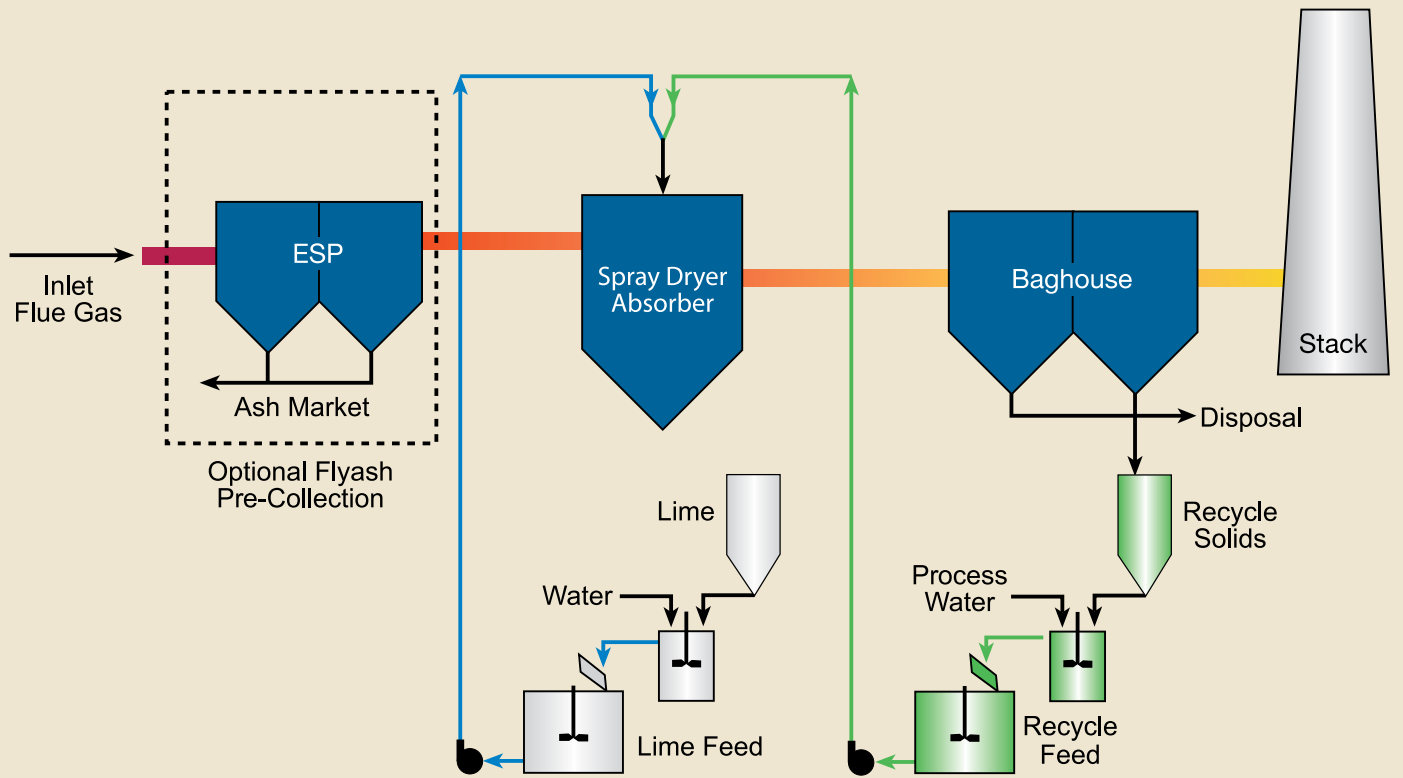
A portion of the solids collected downstream of the absorber are mixed with water (often lower quality waste water) to form the primary reagent feed to the atomizer. These solids contain un-reacted lime and alkaline minerals from the flyash. Fresh lime slurry is added directly to the atomizer feed to maintain the required level of alkalinity in the feed slurry to achieve the desired level of SO_2 removal. The total amount of slurry fed to the atomizer is controlled to maintain the desired outlet temperature. This solids recycle process reduces the consumption of fresh reagent and maintains optimal drying performance in the spray chamber.

The cooled and treated flue gas exits the SDA and is directed to a particulate collector, typically a fabric filter. The particulate collector is designed and operated as an integral part of the acid gas removal process as the solids continue to react with SO_2 , SO_3 , HCl and HF in the humidified flue gas.

The single, centrally located rotary atomizer minimizes the potential for wall wetting and deposition, which provides optimum reagent utilization. Its abrasion-resistant construction and flexible shaft design can tolerate imbalances and provides reliable, continuous operation between scheduled maintenance.



The unique flue gas dispersion system of the B&W SDA, coupled with the rotary atomizer, ensures a uniform distribution of slurry and provides for intimate contact with the flue gas to optimize absorption efficiency and drying in the spray chamber. For large utility boiler applications (illustrated here), flue gas enters the spray dry absorber at two locations: the roof gas disperser and the central gas disperser. Smaller, lower gas flow installations require only a roof gas disperser.



A reagent recycle system reduces lime consumption and enhances drying performance. Also shown is optional flyash pre-collection, which may be incorporated in the design to yield a readily marketable ash byproduct.



Total-Project Scope Ensures Effective System Performance

Variety of Applications and Options to Fit Your Needs

B&W's SDA systems are ideal for new steam generation projects or retrofits to existing plants. We have a strong track record of integrating SDAs into existing plants with limited space. The systems can typically be connected and brought on-line during a brief tie-in outage, thus minimizing disruption to power generation.

Wide variety of fuels

- Powder River Basin (PRB) coal
- Lignite
- Bituminous coal
- Refuse derived fuel and municipal solid waste
- Biomass
- Oil

Combustion gas sources

- Pulverized coal and Cyclone™ boilers
- Circulating fluidized-bed boilers
- Waste and biomass stoker boilers
- Incinerators

Reagent slurry

- Solids recycle to minimize lime use
- Lime only to minimize capital cost

Flyash

- Pre-collection to generate an ash byproduct to market
- End collection only to minimize hardware and use ash alkalinity as reagent

Particulate collector integration

- Pulse jet fabric filters
- Reverse gas fabric filters
- Electrostatic precipitators



Adjacent SDAs share a common spare atomizer.

Integrated Particulate Control

Particulate and scrubber reaction byproducts downstream of the spray dryer absorber can be collected by either an electrostatic precipitator (ESP) or a fabric filter. The preferred method is typically a fabric filter because it serves as an efficient secondary acid gas reactor and provides excellent particulate removal.

B&W's fabric filter technology includes nearly 45 years of experience in supplying more than 100 installations with reverse gas cleaning or pulse jet cleaning systems. On electric utility coal-fired boilers alone, our fabric filter experience includes more than 8,000 MW of generation capacity in more than 50 installations. Our technology is installed on all types of coal-fired boilers and on a wide range of industrial processes, and includes some of the largest SDAs and fabric filters in the world.



Experienced field engineers and technology experts provide on-going technical support for service, upgrades and replacement parts.



B&W PGG's SDAs and fabric filter provide an integrated SO₂ and particulate removal process.



B&W's total-project scope includes design, procurement, construction and startup activities to facilitate the effective performance of the entire system and integration with existing or new emissions control equipment.

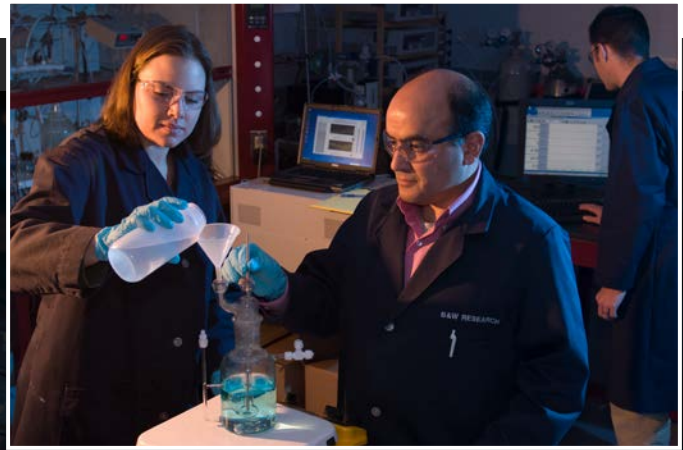
Count on B&W's Experience

The B&W SDA process effectively reduces emissions, meeting and exceeding air quality regulations. This FGD technology has proven successful on utility and industrial coal-fired boilers with more than 21,000 MW of installed capacity worldwide in power generation applications. Many additional installations are controlling emissions from industrial processes, district heating and waste-to-energy applications.

B&W sponsors a Users Group meeting to provide an open forum for sharing operating experiences and discussing new developments. We also participate in numerous other industry forums each year and visit SDA installations regularly, reflecting our continuing commitment to customer service and product innovation.

Research for Future Technology Development

To help our customers prepare for future compliance regulations, respond to changes in fuel availability, and to improve our existing technologies, B&W conducts research at our world-class facility that features state-of-the-art analytical equipment. An SDA pilot is included in the environmental train of a small boiler simulator that replicates a commercial boiler. We routinely work with host plants to demonstrate enhancements to our existing technologies to reduce operating costs and drive performance beyond the initial design requirements.



SDA systems can be effectively retrofitted into sites with limited space and typically are brought on-line during a brief tie-in outage, thus minimizing disruption to power generation.



Ease of maintenance is a key benefit of the B&W SDA process design.



From Concept to Startup to Aftermarket Support, B&W Delivers

B&W takes pride in our total-scope capabilities. Working with us is easy. Our dedicated team of experienced engineers will offer the best solutions to your emission control needs.

B&W provides conceptual design, detail engineering, equipment supply, construction (through our subsidiary, Babcock & Wilcox Construction Co., Inc.), startup, commissioning and support services. We have supplied SDA systems in a variety of contracting arrangements. Expert project managers oversee project execution.

Replacement parts, service and upgrades are also available for all B&W SDA systems and atomizers. A well-stocked, domestic parts center provides efficient delivery of key replacement parts when needed. Experienced service engineers and technology specialists provide on-going technical support.

As air emission regulations become tougher, we are committed to provide the best available technology to enhance the longevity and competitiveness of coal-fired power plants for many years to come.

Count on us to provide the total-scope solution for your next emissions control project.



Selected B&W SDA Projects



Kansas City Power & Light, Hawthorn Unit 5

Boiler capacity	550 MW
Scrubber capacity (acfm)	1,904,000
Inlet SO ₂ concentration (ppm)	330
SO ₂ emissions rate (lb/MBtu)	0.10
Commercial operation	2001
Fuel	PRB subbituminous coal



Newmont Nevada Energy, TS Power Plant

Boiler capacity	220 MW
Scrubber capacity (acfm)	855,800
Inlet SO ₂ concentration (ppm)	355
SO ₂ emissions rate (lb/MBtu)	0.05
Commercial operation	2008
Fuel	PRB subbituminous coal



Wisconsin Public Service, Weston 4

Boiler capacity	595 MW
Scrubber capacity (acfm)	1,925,000
Inlet SO ₂ concentration (ppm)	550
SO ₂ emissions rate (lb/MBtu)	0.08
Commercial operation	2008
Fuel	PRB subbituminous coal



Xcel Energy, Hayden

	Unit 1	Unit 2
Boiler capacity	184 MW	262 MW
Scrubber capacity (acfm)	974,000	1,216,250
Inlet SO ₂ concentration (ppm)	445	455
SO ₂ emissions rate (lb/MBtu)	0.13	0.13
Commercial operation	1998	1999
Fuel	Bituminous coal	Bituminous coal



Xcel Energy, Comanche

	Unit 1	Unit 2	Unit 3
Boiler capacity (gross)	360 MW	365 MW	830 MW
Scrubber capacity (acfm)	1,535,000	1,531,000	3,620,000
Inlet SO ₂ concentration (ppm)	580	580	580
SO ₂ emissions rate (lb/MBtu)	0.08	0.08	0.08
Commercial operation	2008	2008	2009
Fuel	PRB subbituminous coal	PRB subbituminous coal	PRB subbituminous coal



Black Hills Generation, Wygen

	Unit 1	Unit 2	Unit 3
Boiler capacity	90 MW	90 MW	100 MW
Scrubber capacity (acfm)	397,391	466,941	466,781
Inlet SO ₂ concentration (ppm)	850	985	985
SO ₂ emissions rate (lb/MBtu)	0.153	0.09	0.081
Commercial operation	2003	2008	2010
Fuel	PRB subbituminous coal	PRB subbituminous coal	PRB subbituminous coal

B&W's SDA system provides cost-effective emissions reduction solutions for the existing fleet of both base-loaded and peaking coal-fired power plants.

Selection of our SDA technology for new generating capacity projects continues to demonstrate the viability of the technology to meet even the most stringent air quality standards.

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