

TECHNOLOGIES for SO₂ and ACID GAS CONTROL

As the uncertainties of environmental regulations continue, power plant owners and operators are faced with many challenges. They must consider a range of air quality control technologies to manage acid gas emissions, including sulfur oxides (SO₂ and SO₃), hydrogen chloride (HCl), hydrogen fluoride (HF) and other hazardous air pollutants (HAPs). Choosing from the various options of both time-tested technologies and the myriad number of new technologies can often be confusing.

As a leading supplier of multi-pollutant air quality control equipment, Babcock & Wilcox (B&W) remains at the technological forefront in providing cost-effective solutions to meet these increasingly stringent environmental regulations. Through research and development, strategic growth, and license agreements, we continue to advance our proven line of acid gas control technologies.



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A COMPLETE PORTFOLIO OF SOLUTIONS

Our experience and expertise provides a solid foundation to help customers make the right choice from among a wide range of available options to respond to environmental compliance requirements.

Spray Dryer Absorber Systems

Spray dryer absorber (SDA) systems are designed for utility boilers typically burning low to medium sulfur coals, smaller utility and industrial applications, and combined HCl and SO₂ control on waste-to-energy units. We are the exclusive North American licensee of GEA Process Engineering A/S for the GEA Niro SDA process.

- ▶ Greater than 98% SO₂, SO₃, HCl and HF removal efficiency
- ▶ Creates a dry solid byproduct and does not require a wastewater treatment facility
- ▶ Low water consumption
- ▶ Industry leading, high slurry atomizer capacity reduces maintenance and improves reliability
- ▶ Efficient flue gas dispersion system optimizes mixing of flue gas and reagent for the most effective emissions reduction
- ▶ Applied to high sulfur applications with hydrated lime injection
- ▶ Accommodates boiler load variations and boiler cycling
- ▶ Inherent oxidized mercury emissions reduction
- ▶ Effectively integrated with fabric filter and dry sorbent injection for a packaged approach to particulate, mercury and acid gas control



Circulating Dry Scrubber Systems

Circulating fluidized bed flue gas desulfurization technology (more commonly referred to as a circulating dry scrubber or CDS) is typically designed for units that are firing medium to high sulfur coals but may also be applied to low sulfur units. Because of its smaller footprint, CDS systems are ideal for plant locations with limited space or site-specific needs. We are the exclusive North American licensee for Hamon Enviroserv GmbH's CDS technology.

- ▶ Greater than 98% SO₂, SO₃, HCl and HF removal efficiency
- ▶ Creates a dry solid byproduct and does not require a wastewater treatment facility
- ▶ Effectively integrated with fabric filter and dry sorbent injection for a packaged approach to particulate, mercury and acid gas control
- ▶ Low water consumption





Dry Sorbent Injection Systems

Our dry sorbent injection (DSI) systems provide a low-cost solution to capture acid gases, either separately or combined. When used solely for SO₂ control, DSI systems are ideal for coal-fired boilers (typically less than 300 MW), biomass boilers and industrial applications. On larger units, DSI systems also can be used for HCl or SO₃ control when combined with other air emissions control technologies.

- ▶ Provides up to 80% SO₂ removal efficiency, and high HCl and SO₃ removal efficiencies
- ▶ Flexible design
- ▶ Designed to handle a variety of reagents
- ▶ Effectively integrated with an SDA and fabric filter for a packaged approach to particulate, mercury and acid gas control
- ▶ Multiple injection location options to suit the application
- ▶ Available for new plant installations or retrofit into existing plants
- ▶ Mobile test unit for demonstrations



Wet Scrubber Systems

Our wet flue gas desulfurization (FGD) systems achieve high SO₂ and HCl removal and system availability on utility boilers burning fuels with any sulfur level. A variety of configurations are available to meet plant requirements.

- ▶ Greater than 99% SO₂ and HCl removal efficiency
- ▶ Multiple reagent choices include limestone, lime, magnesium-enriched lime and sodium carbonate
- ▶ Inhibited or forced oxidation
- ▶ Absorber tray system for improved gas-liquid contact and uniform flue gas distribution, thus lowering the liquid-to-gas ratio which minimizes absorber pump and piping requirements, and lowers the recirculation tank size
- ▶ Patented interspatial headers allow for shorter absorber tower, reduced pump power, lower building height, less external recirculation piping, and easier nozzle inspection and maintenance
- ▶ Patented inlet awning prevents buildup of deposits in absorber inlet flue, improving reliability and reducing maintenance costs



Seawater Scrubber Systems

Seawater wet FGD technology can be used for coastal plant locations. To remove sulfur oxides and other acid gases, flue gas is brought into contact with seawater in the absorption zone. During the last phase of the process, the seawater is oxidized and returned to the sea. We are an exclusive licensee of Hamon EnviroServ's seawater FGD systems.

- ▶ Greater than 98% removal efficiencies
- ▶ Does not require a wastewater treatment facility
- ▶ No solids handling
- ▶ Unlimited partial load operation
- ▶ Low pressure drop

PROVEN TECHNOLOGIES — CUSTOMIZED SOLUTIONS

New air quality control technologies are constantly being developed, while more mature technologies are being improved for enhanced operation. The information presented in this table represents our proven solutions based on overall capital and O&M life cycle costs. Environmental experts will thoroughly evaluate each application and provide the optimum equipment package for your plant.

Technology	Typical Application Summary	Unit Size		
		<~300 MW	~250 to 400 MW	>~300 MW
SDA	<ul style="list-style-type: none"> - Any size unit - Typically low to medium sulfur fuels - High sulfur fuels with hydrated lime injection - Disposable byproduct 			
CDS	<ul style="list-style-type: none"> - Any size unit - All sulfur fuels - Disposable byproduct 			
DSI	<ul style="list-style-type: none"> - Smaller units for SO₂ removal (less than approximately 300 MW) - Any size unit for SO₃ or HCl control - Low to medium sulfur fuels - ESP or new FF required 			
Wet FGD w/LFO	<ul style="list-style-type: none"> - Larger units - All sulfur fuels - Gypsum byproduct 			
Wet FGD w/LIO	<ul style="list-style-type: none"> - Larger units - All sulfur fuels - Fixated and stabilized disposable byproduct 			
Wet FGD w/mag lime	<ul style="list-style-type: none"> - Larger units - Medium to high sulfur fuels - Fixated and stabilized disposable byproduct 			
Seawater Scrubber	<ul style="list-style-type: none"> - Any size unit - Low sulfur fuels - Located on an ocean with warm seawater - No solid byproduct 			

▶ KEY

SDA: spray dryer absorber

CDS: circulating dry scrubber

DSI: dry sorbent injection

ESP: electrostatic precipitator

FF: fabric filter

Wet FGD w/LFO: wet flue gas desulfurization with limestone forced oxidation

Wet FGD w/LIO: wet flue gas desulfurization with limestone inhibited oxidation

Wet FGD w/mag lime: wet flue gas desulfurization with magnesium-enriched lime

Sulfur in Fuel			Byproduct			Water Consumption	
Low	Medium	High	Marketable Gypsum	Fixated and Stabilized for Disposal	Disposable	Lower	Higher
✓	✓	✓			✓	✓	
✓	✓	✓			✓	✓	
✓	✓				✓		
✓	✓	✓	✓*				✓
✓	✓	✓		✓	✓		✓
	✓	✓		✓	✓		✓
✓							✓

* Market demand for byproduct may be reduced

Single-Source Solutions

As a single-source supplier, B&W can provide complete air quality control systems, combining design, engineering, procurement, supply and construction into one, seamless and integrated package.

Aftermarket Parts and Services

B&W provides quality upgrades, services and replacement parts for all manufacturers' environmental equipment. Our knowledgeable Environmental Field specialists are available to assess the condition of your equipment, identify potential problems and provide system recommendations. Benefits include improved emissions removal efficiencies, increased reliability and simplified maintenance processes. We also provide a complete line of emissions monitoring services and systems.



The Babcock & Wilcox Company

1200 E Market Street, Suite 650
Akron, Ohio, U.S.A. 44305
Phone: +1 330.753.4511

www.babcock.com    

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