

Dry Sorbent Injection Systems for Acid Gas Control

Dry sorbent injection (DSI) systems have been in service for more than 20 years as an effective tool to reduce acid gas levels. With current and pending environmental regulations, interest in DSI has been renewed as a low capital cost, multi-pollutant control solution. DSI can be used to control acid gases, such as sulfur dioxide (SO_2), hydrogen chloride (HCl) and sulfuric acid (H_2SO_4).

SO_2 and HCl emissions are typically controlled together. In some industrial applications, HCl is controlled separately. DSI for SO_2 /HCl control can be used on units firing 100% Powder River Basin (PRB) coals, high PRB coal blends, small (<300 MW) low sulfur bituminous units, or biomass and waste-to-energy (WTE) plants. DSI is a viable alternative for units in which the investment for wet or dry flue gas desulfurization (FGD) systems is not cost effective.

DSI is also the technology of choice for controlling H_2SO_4 emissions from power plants. Depending on fuel characteristics, high stack opacity or blue plume from H_2SO_4 may occur at power plants that use wet FGD for SO_2 control. The issue is more acute when the system has a selective catalytic reduction (SCR) system for nitrogen oxides (NO_x) reduction because SO_3 can also be formed by the catalyst. In systems using powdered activated carbon (PAC) for mercury control, SO_3 will poison the PAC, rendering it less effective. Utilizing DSI can limit SO_3 levels so that less PAC is required to control mercury emissions.

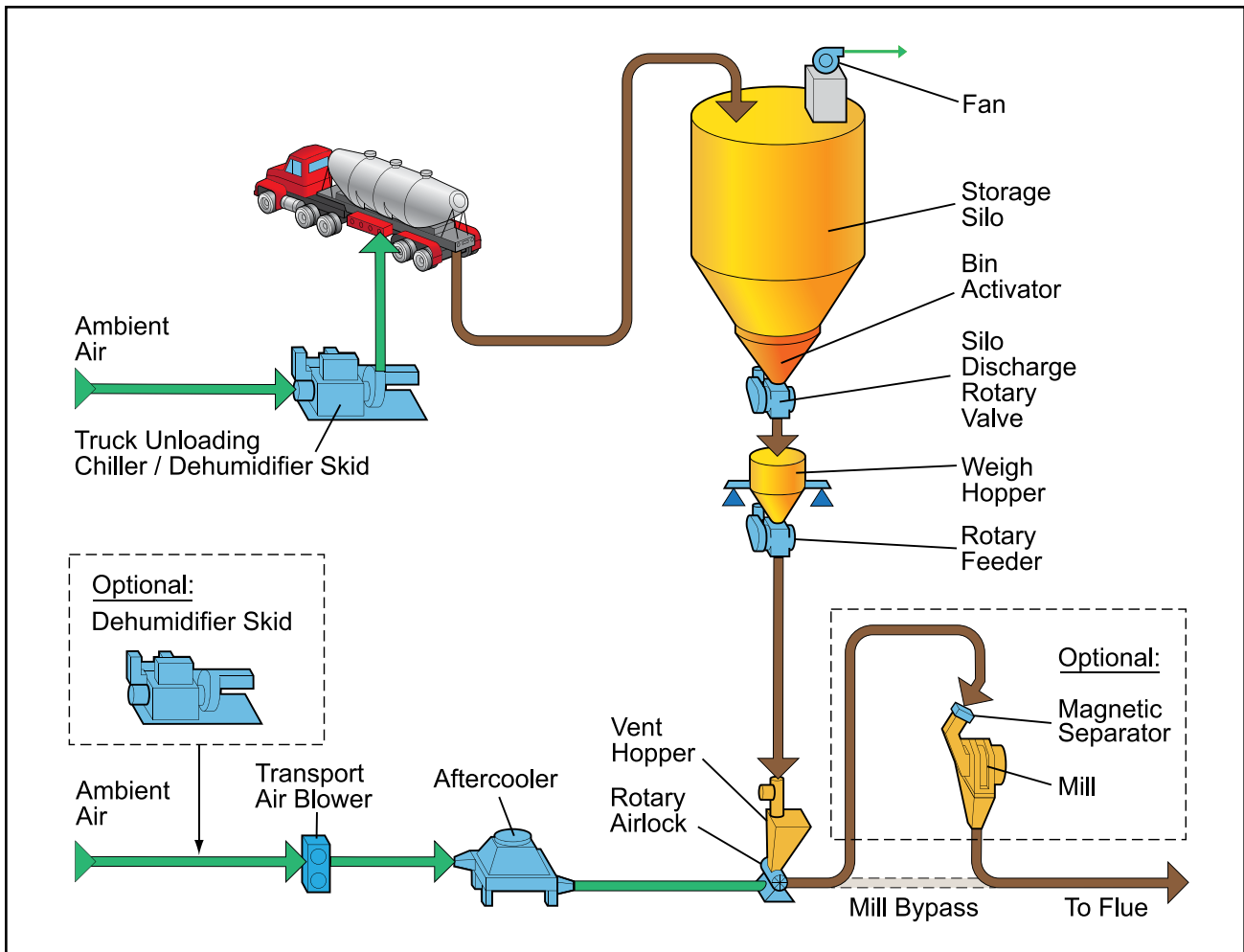
Additionally, H_2SO_4 mist is a condensable particulate matter (PM) which contributes to $\text{PM}_{2.5}$ emissions. DSI technology is a proven, cost-effective technology to mitigate condensable particulate, H_2SO_4 and the blue plume, and limit PAC poisoning from SO_3 .

Babcock & Wilcox Power Generation Group, Inc. (B&W PGG) provides a total system approach to identify and study the potential

impact that existing emissions control equipment would have on a DSI system. Performance guarantees offered are a result of our field experiences coupled with pilot plant studies to understand the complex reactions of competing acid gases. As part of our complete line of multi-pollutant control technologies, our dry sorbent injection systems provide a low-cost solution to address all acid gas emissions.



B&W PGG's dry sorbent injection systems provide a low-cost solution to address all acid gas emissions.

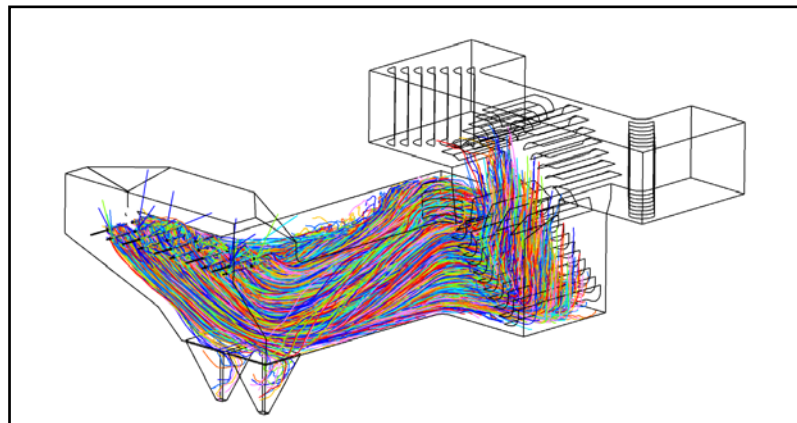


Typical dry sorbent injection system flow diagram.

Technology and system features

- Applications for:
 - SO₂
 - SO₃
 - HCl and HF
 - PAC protection
 - Electrostatic precipitator (ESP) conditioning
- A variety of reagent options are available based on the specific application, existing air quality control equipment, reagent economics, waste disposal, and the pollutants to be controlled:
 - Trona for SO₂, SO₃/condensable PM and HCl
 - Sodium bicarbonate for SO₂ and HCl

- Hydrated lime for SO₃/condensable PM and HCl
- Hydrated lime plus humidification for SO₂ and HCl
- Flexible designs
 - The material storage, handling and transport system is designed to handle multiple reagents to take advantage of reagent market pricing.
- A variety of injection location options to suit the application.



B&W PGG uses advanced CFD modeling to optimize overall system design.

- Available for new plant installations or retrofit into existing plants.
- Computational fluid dynamics (CFD) modeling is used to optimize system design including sorbent injection location, lance arrangement, flow, sorbent distribution, contact time, velocity and temperature distribution.
- Particulate control device impact studies are available to determine the effects of sorbent on the entire system, including waste generation and composition prediction.
- Proven technology that has been used for SO₂ removal since the late 1980s.
- In high sulfur coal applications, DSI can aid in mercury capture while optimizing PAC consumption.
- Mobile test unit is available for demonstrations.
- Major system components include:
 - Truck/rail unloading
 - Silo and reclaim system



B&W PGG's total system approach examines the effects of sorbent injection on the entire air quality control system.



Field demonstrations are available with B&W PGG's mobile test unit.

- Weigh hopper and feeder
- Transport air blowers
- Proprietary injection lance design
- Reagent milling (optional)

Technology benefits

- Low capital cost
- Low operation and maintenance costs
- Easy to operate
- Proven performance
- Easily integrated into the existing air quality control system (AQCS)

Why B&W PGG

Few can match B&W PGG's experience in:

- Boiler and steam generator technology
- Overall power plant process emissions control
- Providing an integrated environmental system solution
- Expert project execution

B&W PGG's environmental professionals are experts at recognizing opportunities to apply proven technology to existing equipment that provide tangible benefits. As a

Dry Sorbent Injection Technology Highlights

	<i>Anticipated Results (1)</i>	<i>Reagent Milling Required</i>	<i>Application</i>
SO ₂ Control	Up to 80% removal	Milled reagent is recommended to optimize reagent consumption	<ul style="list-style-type: none"> • 100% or high PRB coal blends • Coal-fired boilers, typically < 300 MW • Biomass • Industrial (WTE, cement, etc.)
HCl Control	Up to 95% removal <ul style="list-style-type: none"> • Higher removals achieved when combined with SO₂ control 	Milled or unmilled reagent is effective	<ul style="list-style-type: none"> • Coal-fired boilers with SO₂ control • Biomass • Industrial (WTE, cement, etc.)
H ₂ SO ₄ / Condensable PM Control	Up to 98% removal <ul style="list-style-type: none"> • Stack opacity reduction • Reduced flue corrosion risk • Condensable reduction 	Unmilled reagent is typical	<ul style="list-style-type: none"> • Coal-fired boilers with wet FGD and/or SCR • Industrial (WTE, cement, etc.)

Note 1: Depending upon inlet pollutant loading, system particulate control device (ESP or fabric filter), residence time, flue gas temperature, sorbent coverage and reagent particle size and reactivity

single-point contact, our complete package of environmental upgrade and aftermarket services includes:

- Engineering assessment
- Complete system engineering
- Engineered equipment upgrades
- Project management
- Installation and construction services

- Startup and commissioning
- Performance testing and monitoring
- Performance and reliability guarantees
- Field engineering services
- Replacement parts

Integrated solutions

Providing solutions backed by experience and aggressive

research, B&W PGG continues to develop new products and technologies to add to its wide range of emissions control equipment and systems solutions. Our total integrated system approach to pollutant mitigation can provide you with the greatest flexibility, accountability, optimized performance and certainty of outcome, while minimizing both capital and operating costs.

delivering
proven results

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