



**Siemens Environmental Systems and  
Services**

**SIEMENS**

*A Division of Siemens Energy, Inc.*

## **INDUSTRIAL EMISSION CONTROLS**

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**PRESENTED TO**

**COUNCIL OF INDUSTRIAL BOILERS**

**OCTOBER 23, 2008**

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## Overview

**SIEMENS**

- ❑ **Founded in 1913 as American Foundry Equipment Company; introduced one of the first industrial Fabric Filter air pollution control devices.**
- ❑ **“Wheelabrator” is a shot blasting machine used to clean foundry castings. Evolved into environmental control technologies as a result of the need to collect dust from casting cleaning operations.**
- ❑ **Name changed to Wheelabrator Air Pollution Control Inc. (WAPC) in 1983.**
- ❑ **Head Office in Pittsburgh, PA; Branches in Milton, Ontario, Canada and Orlando, FL; employees have an average tenure of 20 years with Wheelabrator/Siemens.**
- ❑ **In-house engineering disciplines:**
  - Structural
  - Electrical
  - Mechanical
  - Environmental
  - Chemical
  - Civil
  - I & C
- ❑ **Acquired by Siemens Power Generation October 5, 2005 (now Siemens Energy, Inc.)**





# Customer Value is Created by Serving the Complete System

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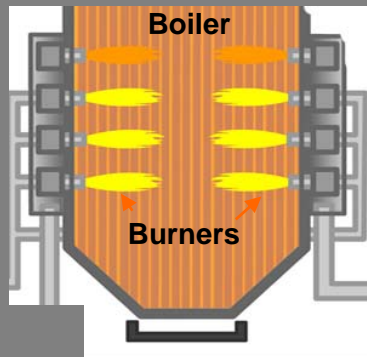
## Strategy:

**Provide one stop Combustion/Gas path Optimization, Equipment and Service**

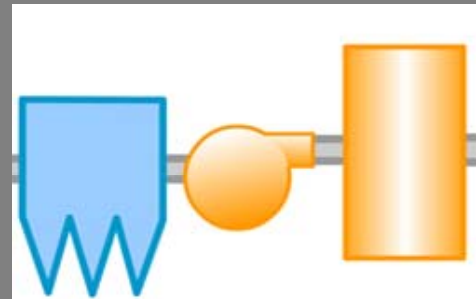
**A cleaner burn results in less clean-up**

**Combustion Performance**

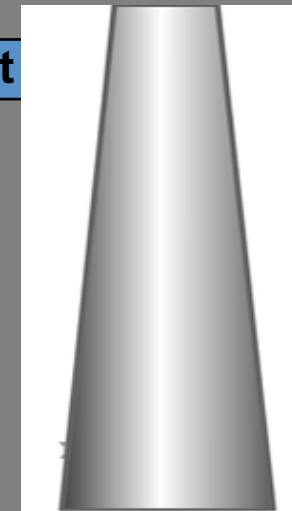
**Air Pollution Control Equipment**



+



=



**Emissions**

Combustion Process = BTS & ABT

▶ Lower NOx  
Increase Efficiency  
Enhance Reliability

Flue Gas Clean-up = Wheelabrator

▶ Full Range of Products  
Existing Fleet  
Experienced Team



# Products Overview

SIEMENS



- **Flue Gas Desulfurization (FGD)**

- Dry FGD
- Mercury Control
- Wet FGD
- Wet ESP



- **Fabric Filters (FF)**

- Pulse Jet
- Cartridge
- Reverse Air



- **Electrostatic Precipitators (ESP)**

- HaRDE
- VIGR

- **NOx and Ancillary Products**

- SNCR
- SCR Services
- Low NOx Combustion



- **Multi-Pollutant Technology**

- Powerspan



## Major Markets

**SIEMENS**

- Utility/Industrial Boilers
- Iron and Steel
- Pulp and Paper
- Cogeneration
- Foundry
- Petroleum/Chemical
- Rock Products
- Refuse-to-Energy

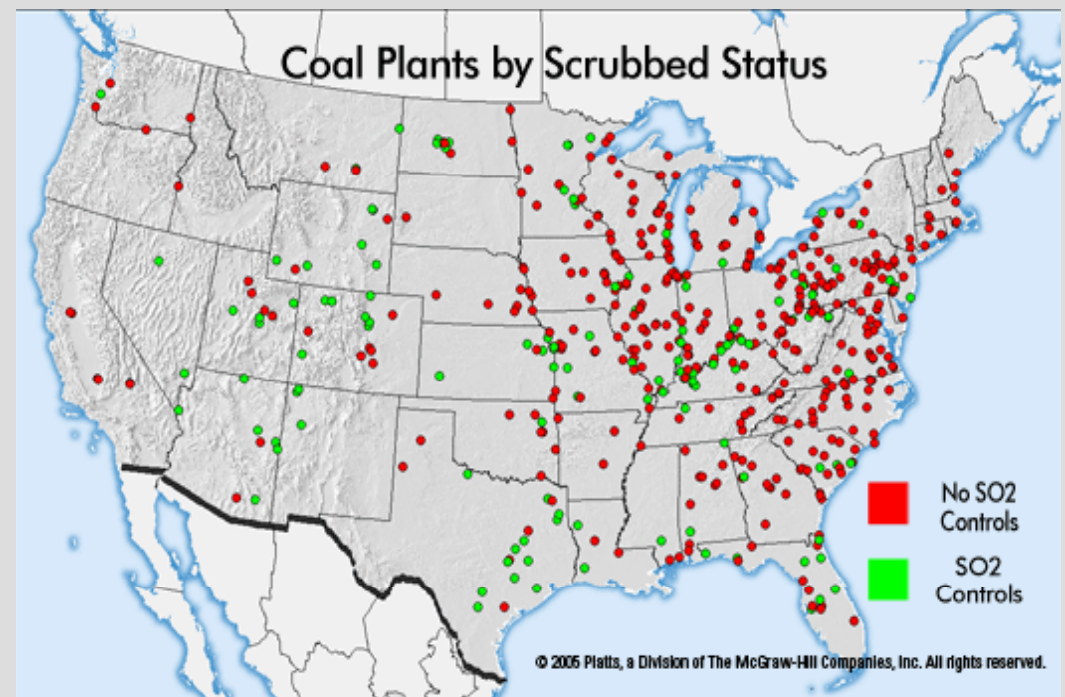


# Increasing Demand for Environmental Solutions

**SIEMENS**



- Flue Gas Desulfurization (FGD)
- Electrostatic Precipitators (ESP)  
(Wet and Dry)
- Fabric Filters (FF)
- NOx and Ancillary Products







Environmental Systems and Services

SIEMENS

# Air Pollution Control Systems

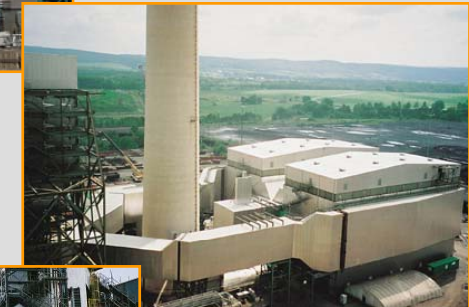




# Air Pollution Control Systems

**SIEMENS**

- **Wet & Dry FGD Systems**
- **Fabric Filters**
- **Wet & Dry Electrostatic Precipitators**
- **Mercury Control Technology**







## TYPICAL SULFUR DIOXIDE REMOVAL EFFICIENCIES FOR DIFFERENT TYPES OF SCRUBBERS

<b>DUCT INJECTION</b>	<b>30-50%</b>
<b>DRY SORBENT REACTOR</b>	<b>60-75%</b>
<b>WITH HUMIDIFICATION</b>	<b>70-85%</b>
<b>SPRAY DRYER / ABSORBER</b>	<b>80-95%</b>
<b>WET SCRUBBER</b>	<b>95-98%</b>

Since HCl is more reactive than SO<sub>2</sub>, all can achieve higher efficiencies for HCl.

PAC Injection for Mercury Control can be added to any of the above.

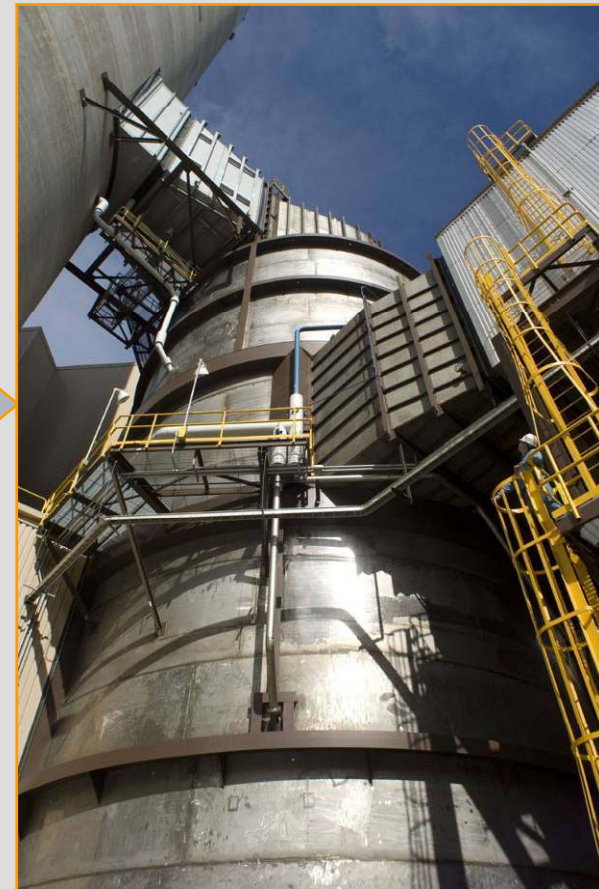


# Dry FGD Systems

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## Technologies

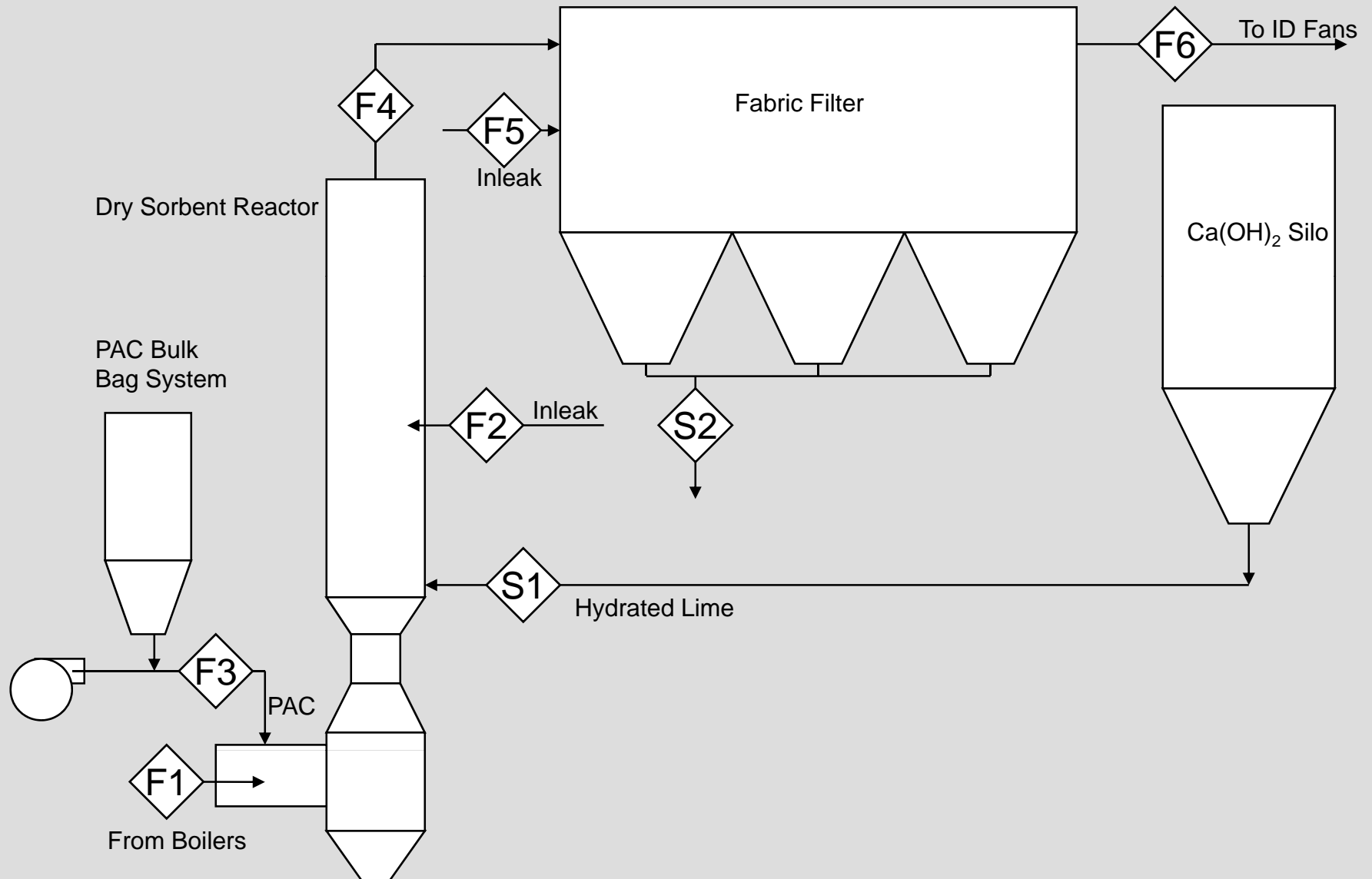
- **Duct Injection Systems**
- **Dry Sorbent Reactor Systems**
- **Spray Dryer Absorber Systems**





# Dry Sorbent Reactor – Process Flow

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# Dry Sorbent Reactor / Fabric Filter

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## **Coal Fired Boiler Illinois**

- Dry Sorbent Reactor
- JET VIP Pulse Jets
- 530,000 ACFM
- SO<sub>2</sub>, HCl, Particulate  
and Mercury Control







# Spray Dryer Absorber (SDA) Dry Scrubbing System

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**Lime Slurry Atomized into Fluegas**

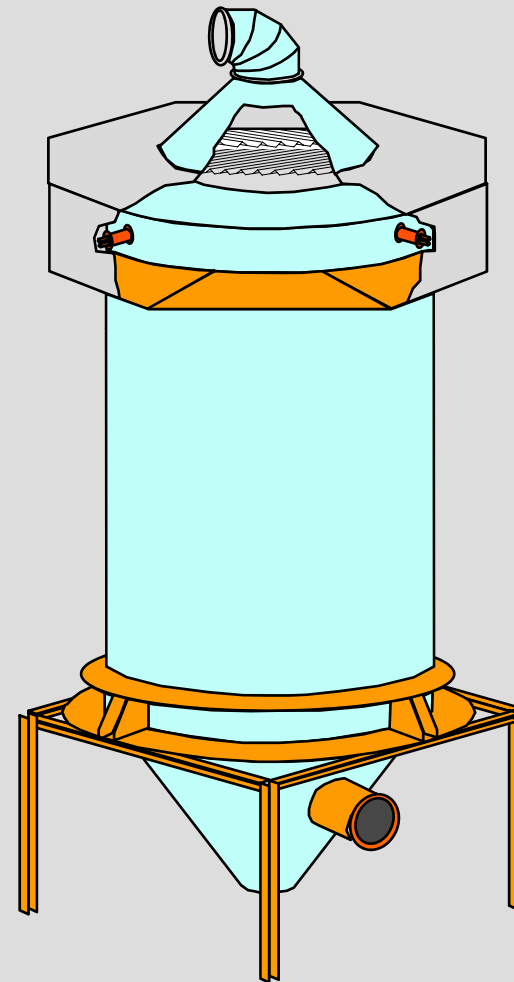
**SO<sub>2</sub>, Acid Gases Absorbed Into Droplet**

**Heat of fluegas Evaporates Slurry Water**

**Small Droplets / High Surface Area  
Promotes Evaporation**

**Cooled Flue Gas with Dried Reaction  
Products Ducted to Fabric Filter**

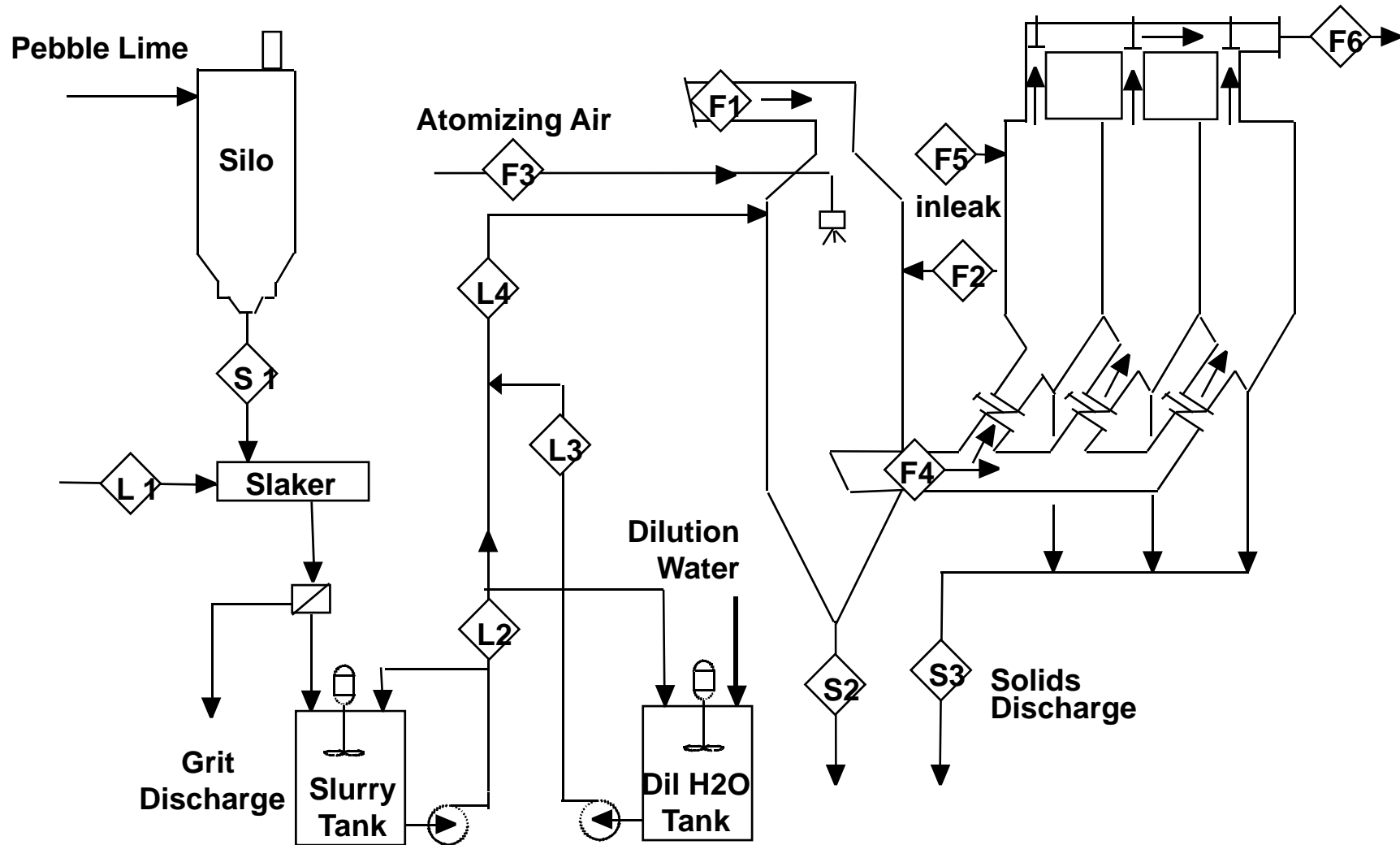
**Additional SO<sub>2</sub>/Acid Gas is Adsorbed in  
Filter Cake on Bags**





# SDA/FF Dry Scrubbing Process

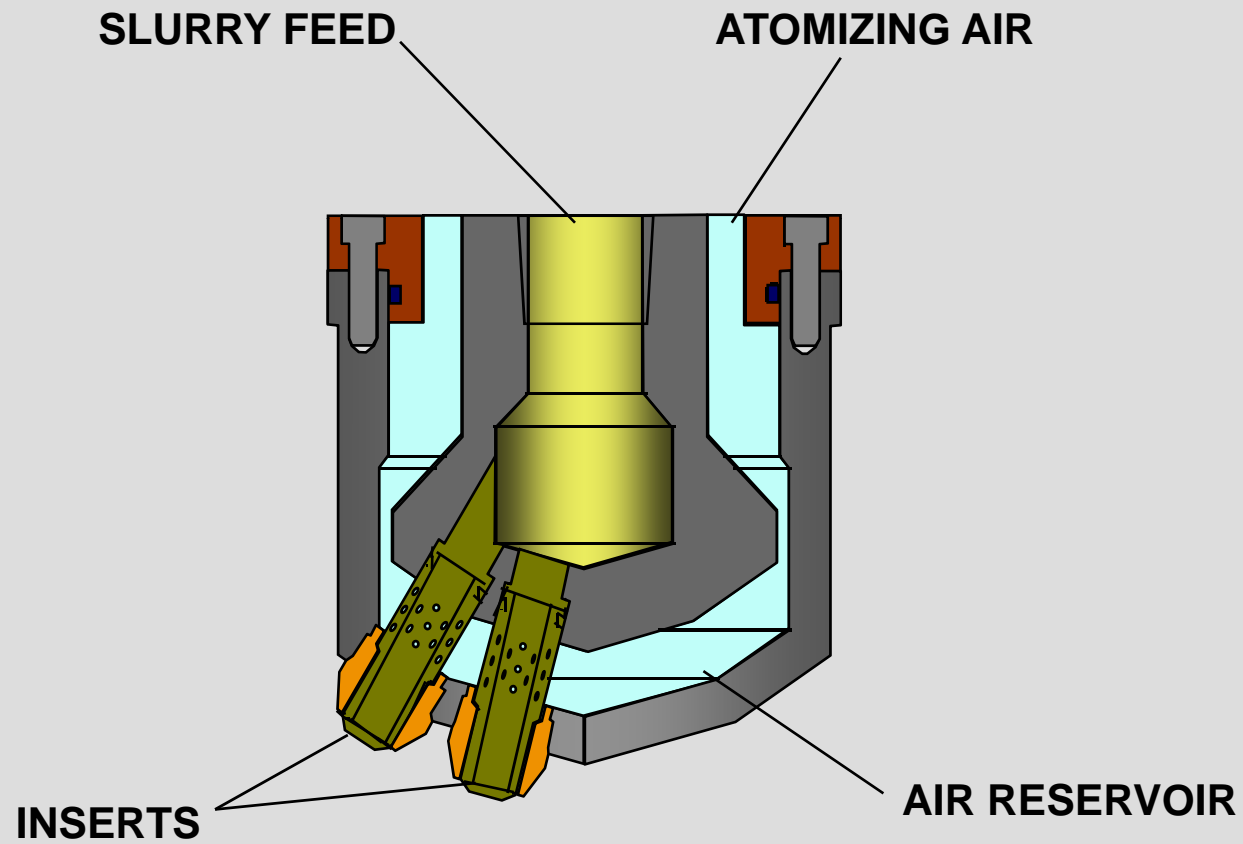
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# Two Fluid Nozzle

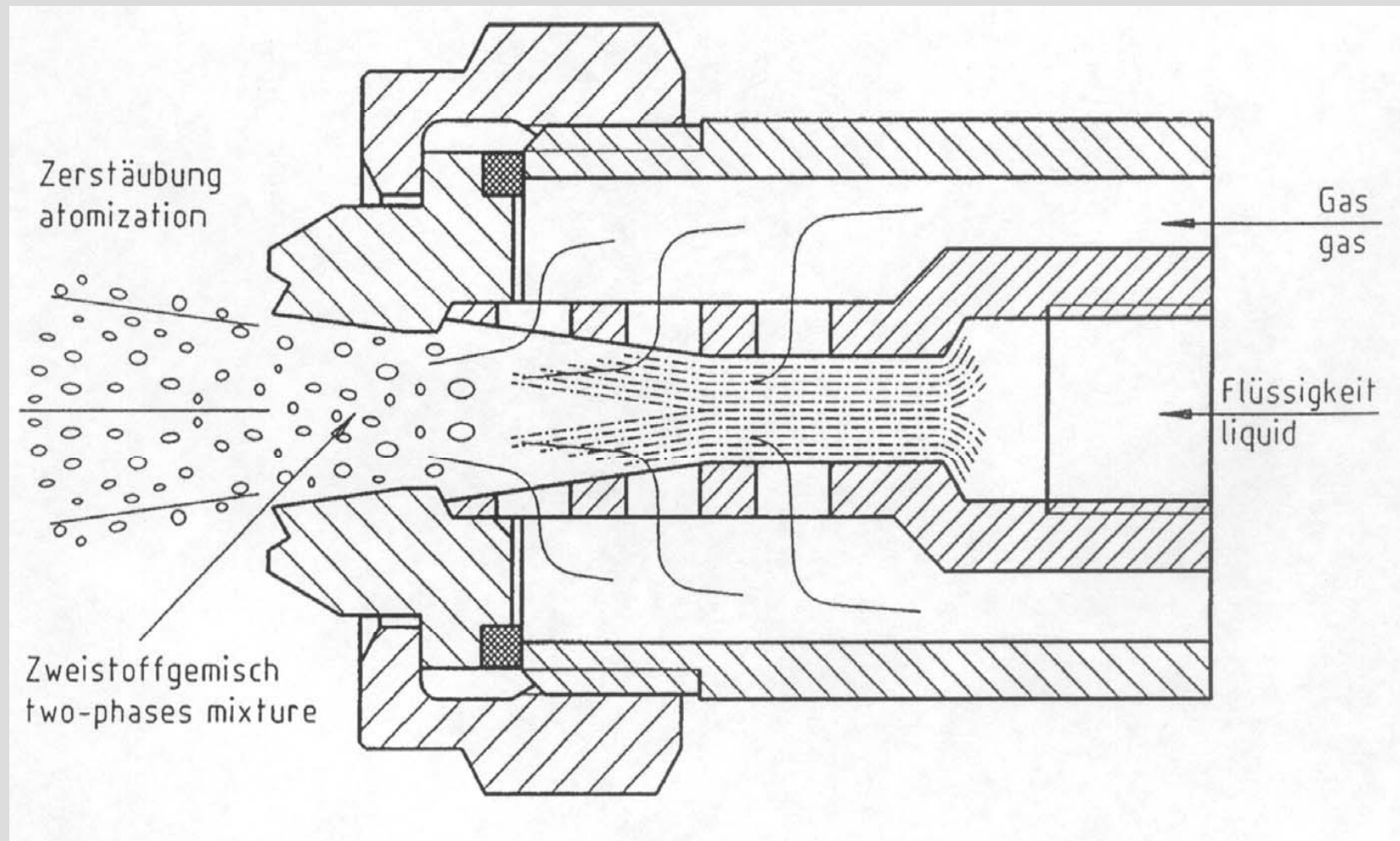
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# Two Fluid Nozzle – Internal Mixing

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# SDA Dry Scrubbing Advantages

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Fine Particulate/Aerosol Control

Sulfur Trioxide/Sulfuric Acid Mist

Mercury Control

Particulate Collection After Gas Cooling

Water Consumption/Disposal

No Chloride Purge

Utilize Cooling Tower Blowdown



## SDA On-Line Maintenance

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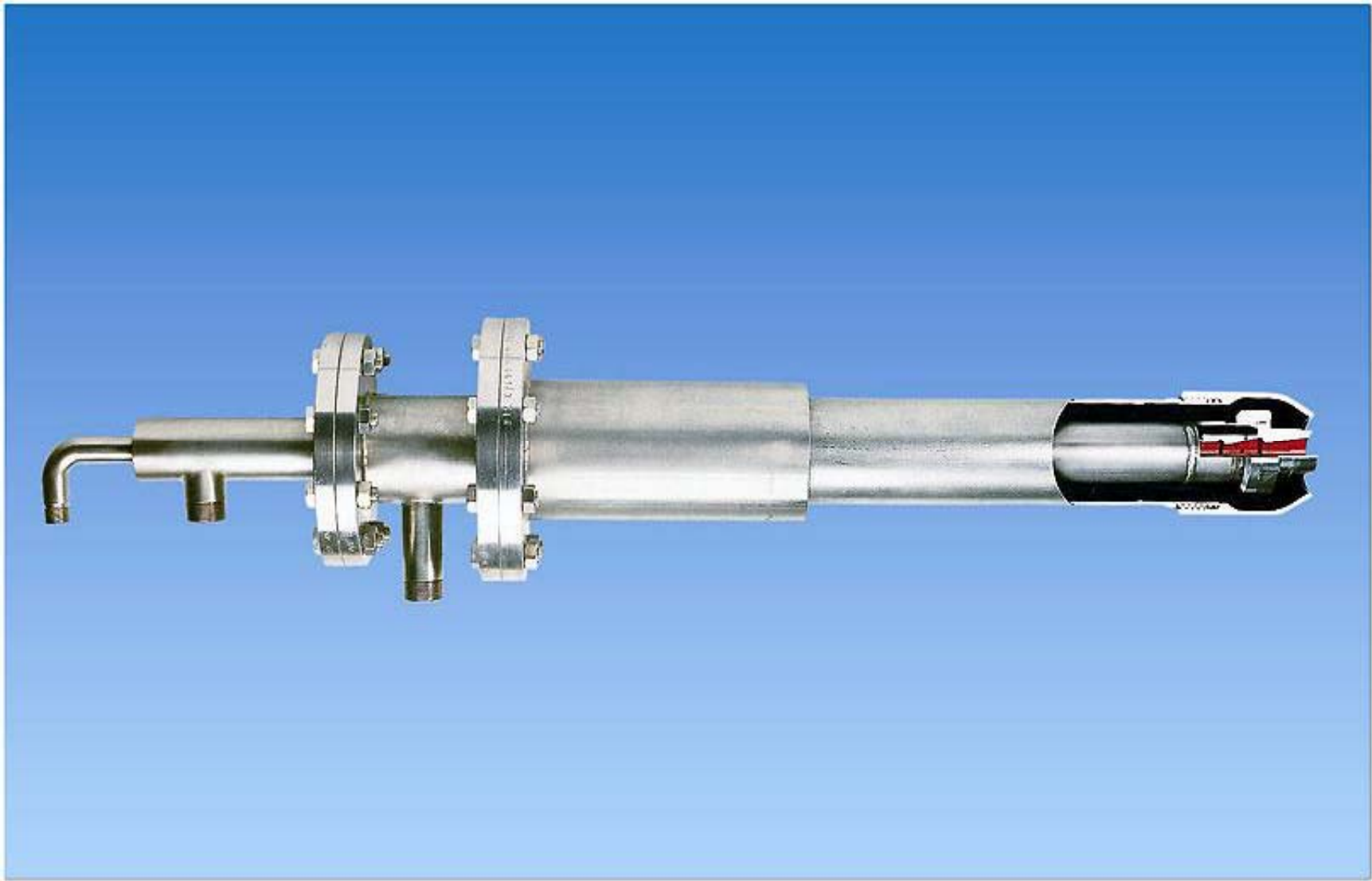


- **Isolate and Remove Nozzle Assembly - Flow is Distributed to Remaining Nozzles**
- **Install Spare Nozzle**
- **Clean/Inspect/Refurbish Nozzle**



# Nozzle Lance Assembly

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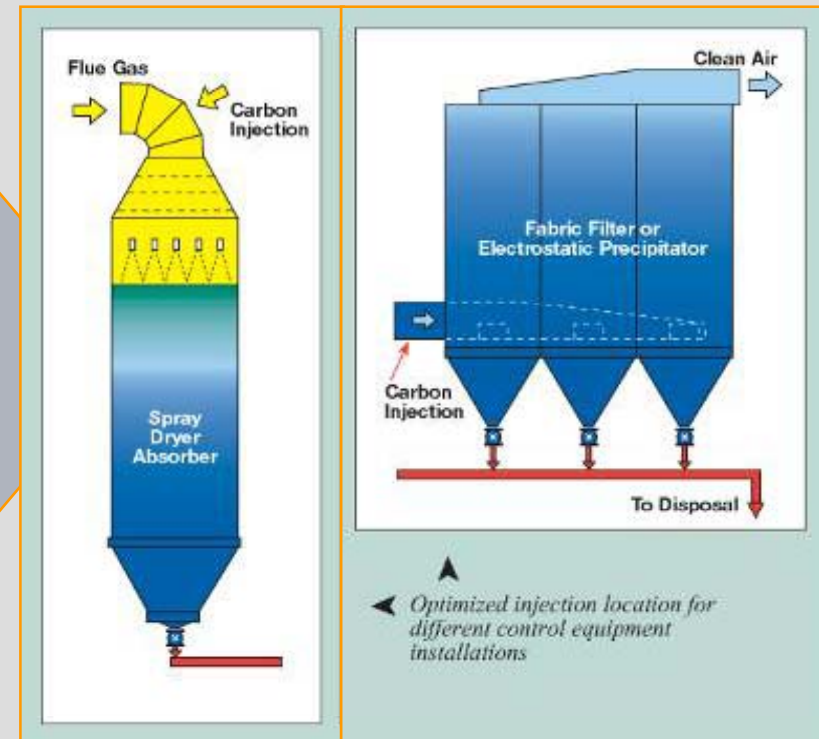




# Mercury Control Powdered Activated Carbon (PAC) Injection

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- Injected upstream of particulate control device
- Mercury binds with PAC in flue gas
- 80 to 95% removal with PAC







# Fabric Filters

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## Technology

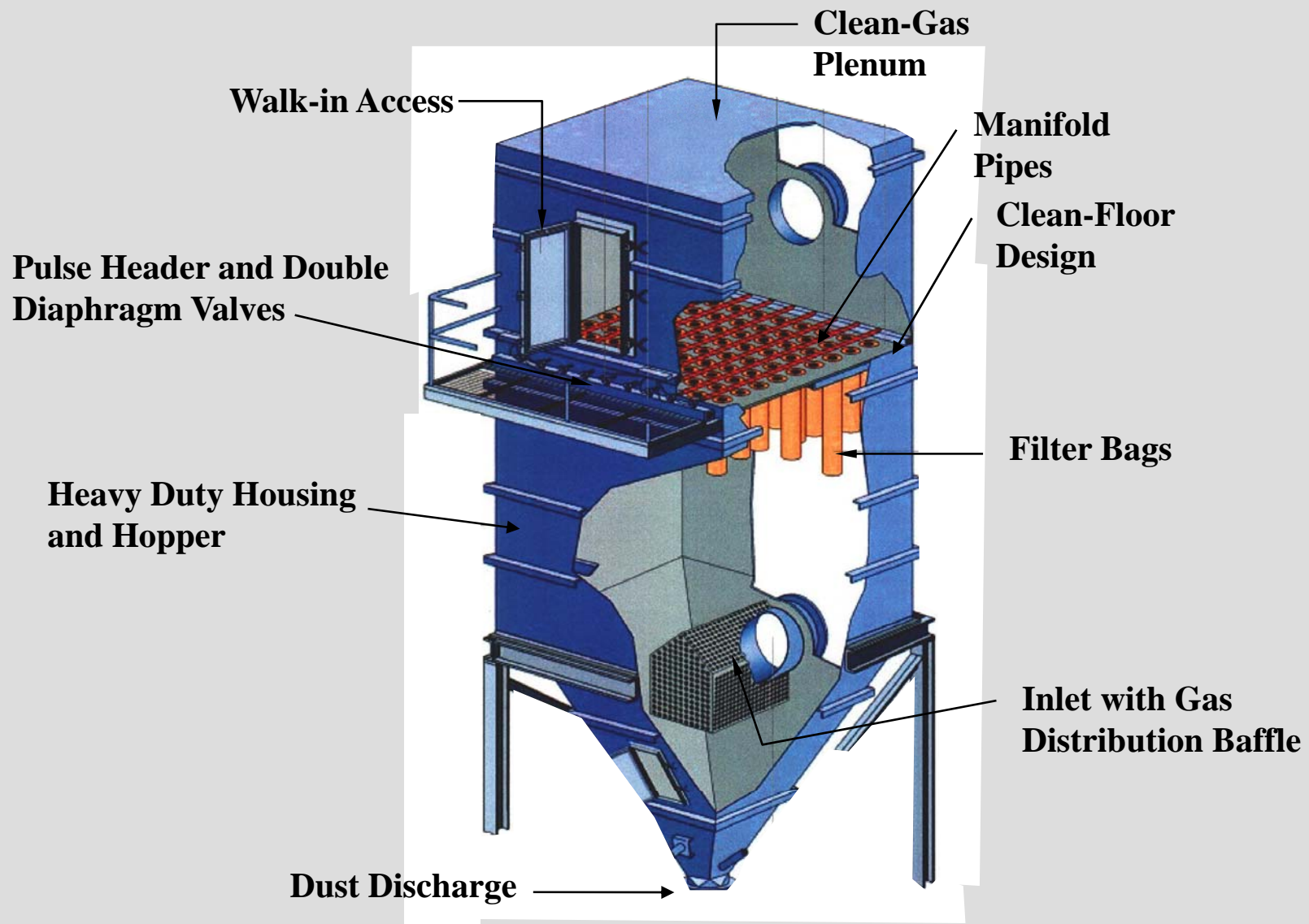
- **JET III™ Pulse System**
- **JET VIP™ Pulse System**
- **Reverse Air System**
- **Cartridge Collectors**
- **Shakers**





# JET III™ Pulse Collector

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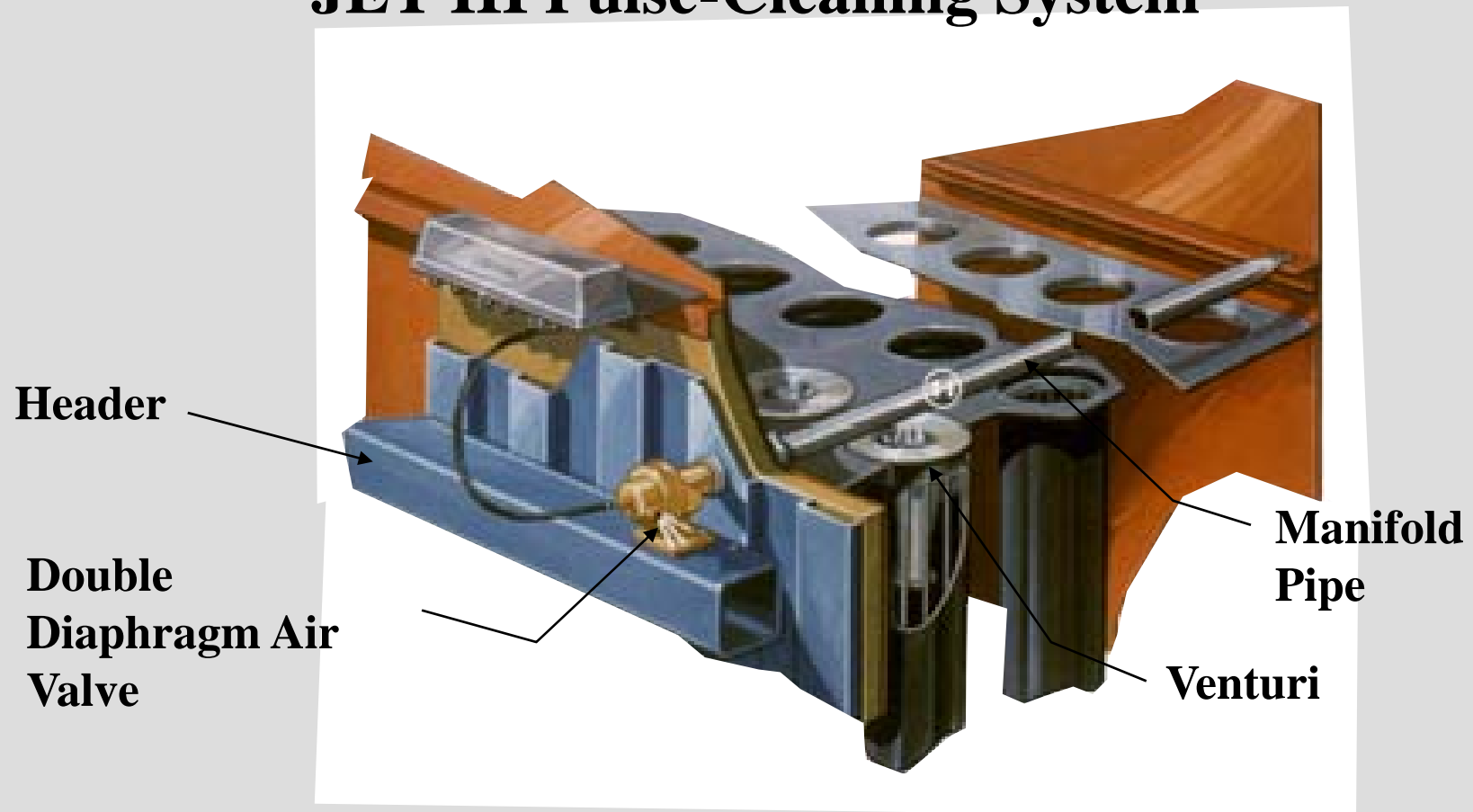




# JET III™ Pulse Collector

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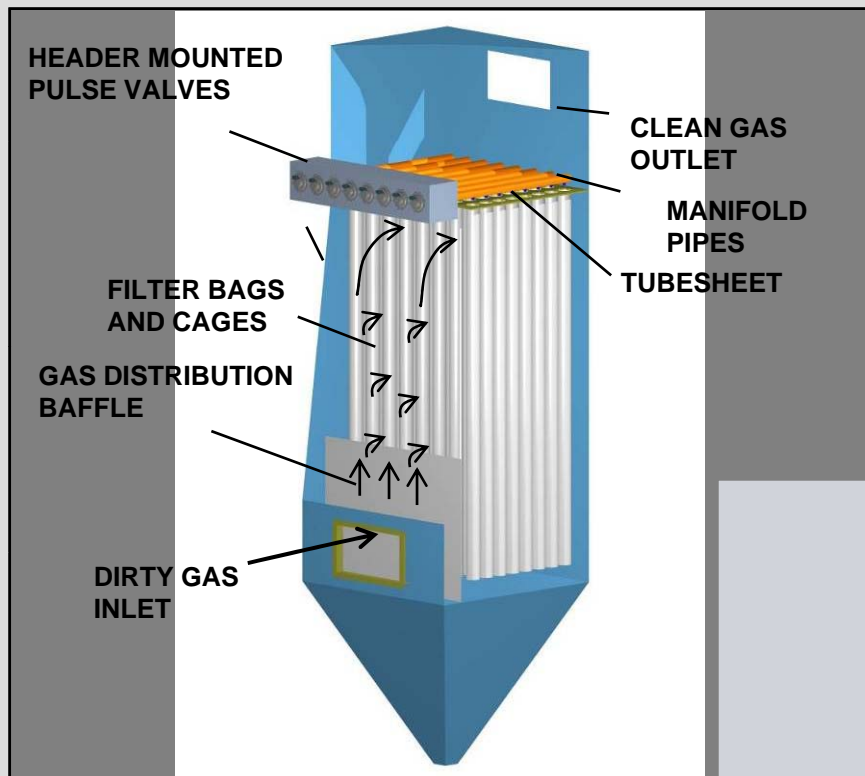
## JET III Pulse-Cleaning System





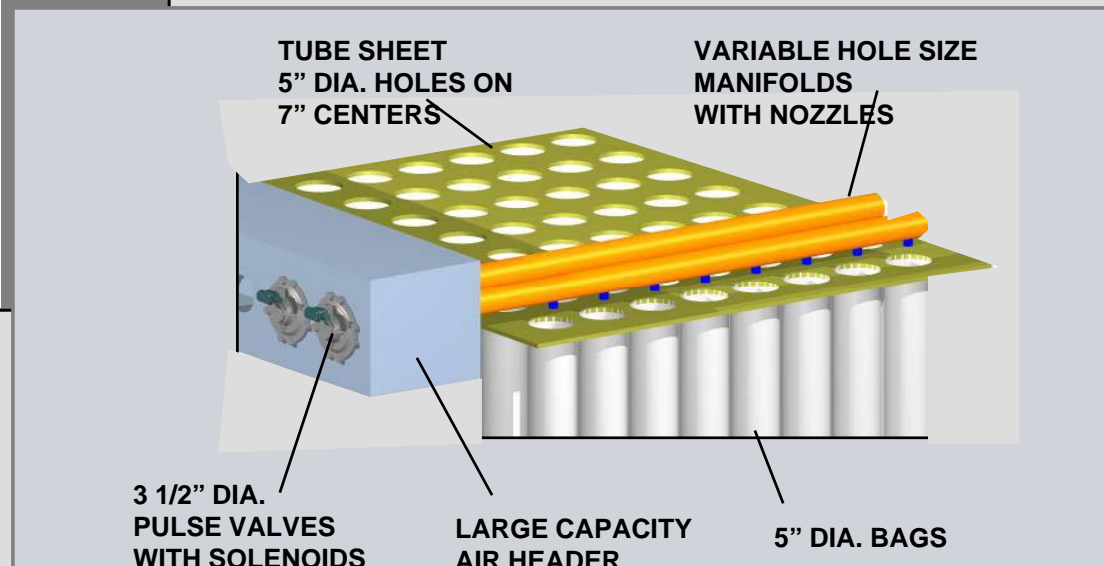
# Fabric Filter Technology JET VIP™ Pulse Systems

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## Advantages

- ▶ On-line Cleaning
- ▶ Smaller Footprint
- ▶ Gentler Pulsing =  
**Longer Bag Life**







# JET VIP™ Fabric Filter

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## Power Plant Michigan

- JET VIP Pulse Jets
- Units 5, 6 – 462,000 ACFM each
- Units 7, 8, 9 – 1,200,000 ACFM
- 90 MW / Unit





# JET VIP™ Fabric Filter

SIEMENS

## Biomass Wood Waste Fired Boiler Quebec, Canada

- JET VIP Pulse Jets
- 240,000 ACFM
- 0.010 lb/mmBTU  
particulate guarantee





# JET VIP™ Fabric Filter

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## Coal Fired Boiler Nebraska

- JET VIP Pulse Jets
- 146,000 ACFM
- PAC injected into FF inlet ductwork for Mercury Control







# JET VIP™ Fabric Filter

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## **Steel Melt Shop Florida**

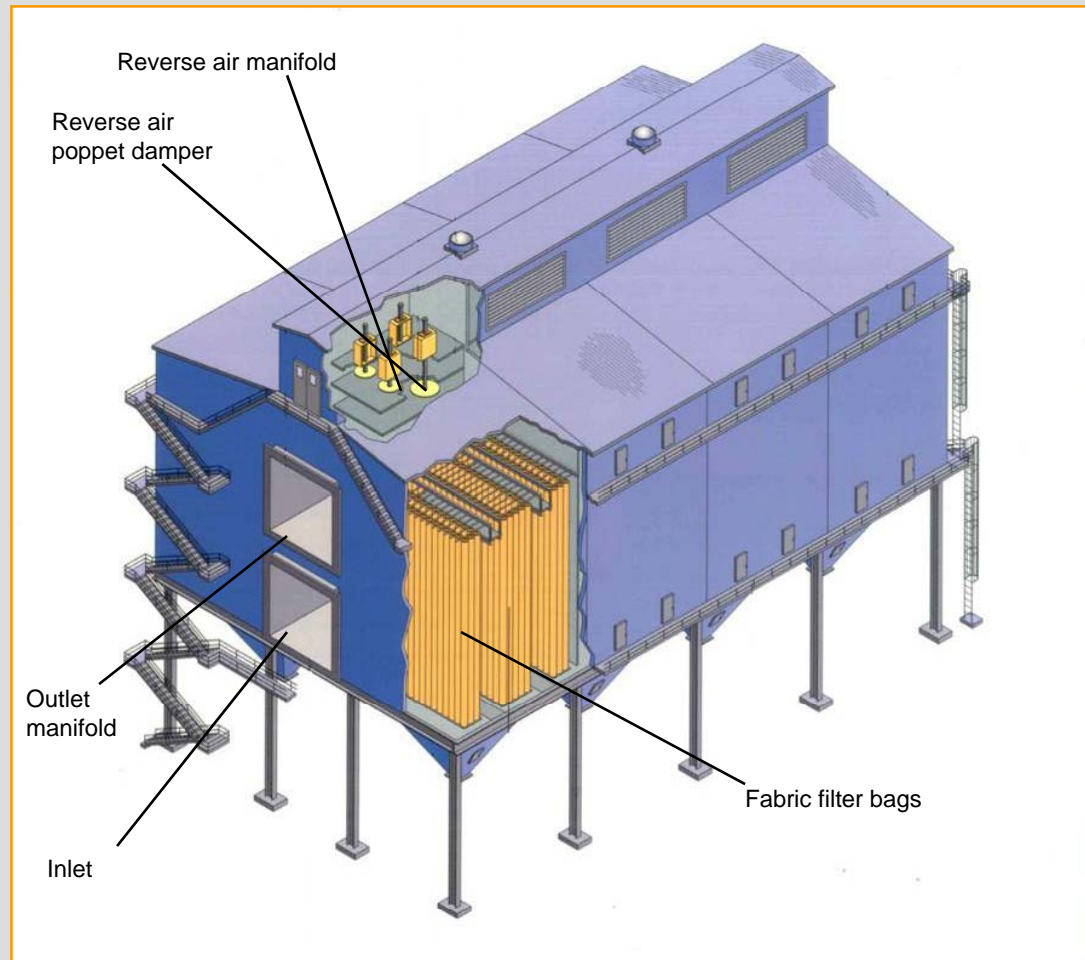
- JET VIP Pulse Jets
- 1,000,000 ACFM
- Siemens supplied FF, ID Fans, Ductwork, Stack, Controls





# Reverse Air Fabric Filter

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# Reverse Air Fabric Filter

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## Coal-Fired Boilers Nebraska

- Largest Reverse Air Fabric Filter System in U.S.
- 715 MW / 745 MW





# Electrostatic Precipitators

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## Technology

- **HaRDE® Electrostatic Precipitator**
  - Rigid Discharge Electrodes with tumbling hammer rapping
- **VIGR™ Electrostatic Precipitator**
  - Rigid Discharge Electrodes with magnetic impulse rapping
- **Wet Electrostatic Precipitators**
  - Designed to be a final polishing device to collect sub-micron particulate and mists





# Circulating Fluidized Bed Boilers Florida

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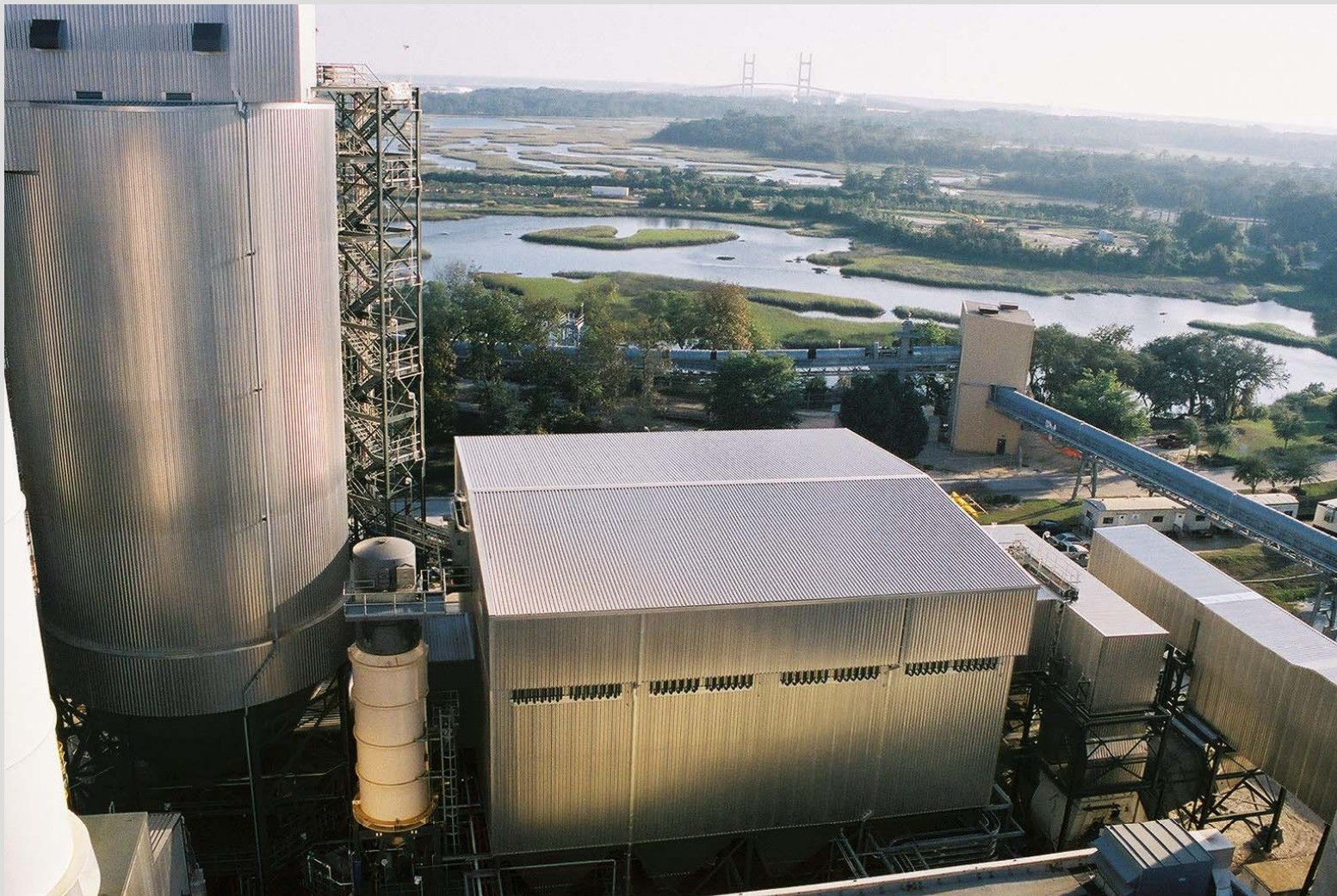
- 48' DIA. SDA and JET VIP™ Pulse-Jet Fabric Filter
- Circulating Fluidized Bed Boilers
- 2 x 300 MW
- 836,700 ACFM





# Circulating Fluidized Bed Boilers Florida

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Waste to Energy Plant  
SDA / FF 's



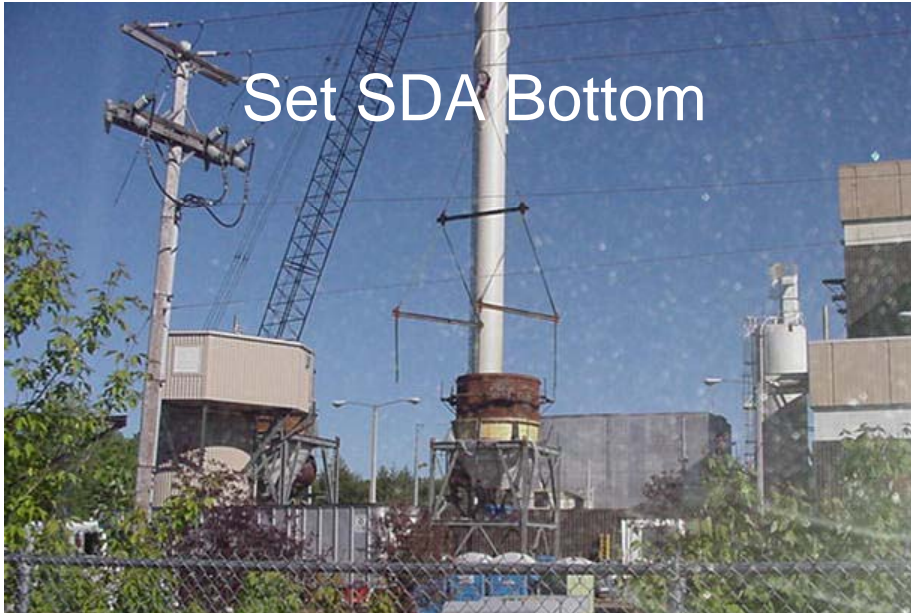


# SDA Ground Assembly





Set SDA Bottom





Set SDA Top







# Waste to Energy Plant New England

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# Waste to Energy Plant New England

**SIEMENS**







# Coal Fired Boilers in MA 2 Trains – 1,000,000 ACFM Each

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# Coal Fired Boilers in MA JET VIP Fabric Filters

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# Coal Fired Boilers in MA 1,000,000 ACFM Ductwork

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# Barging Capabilities

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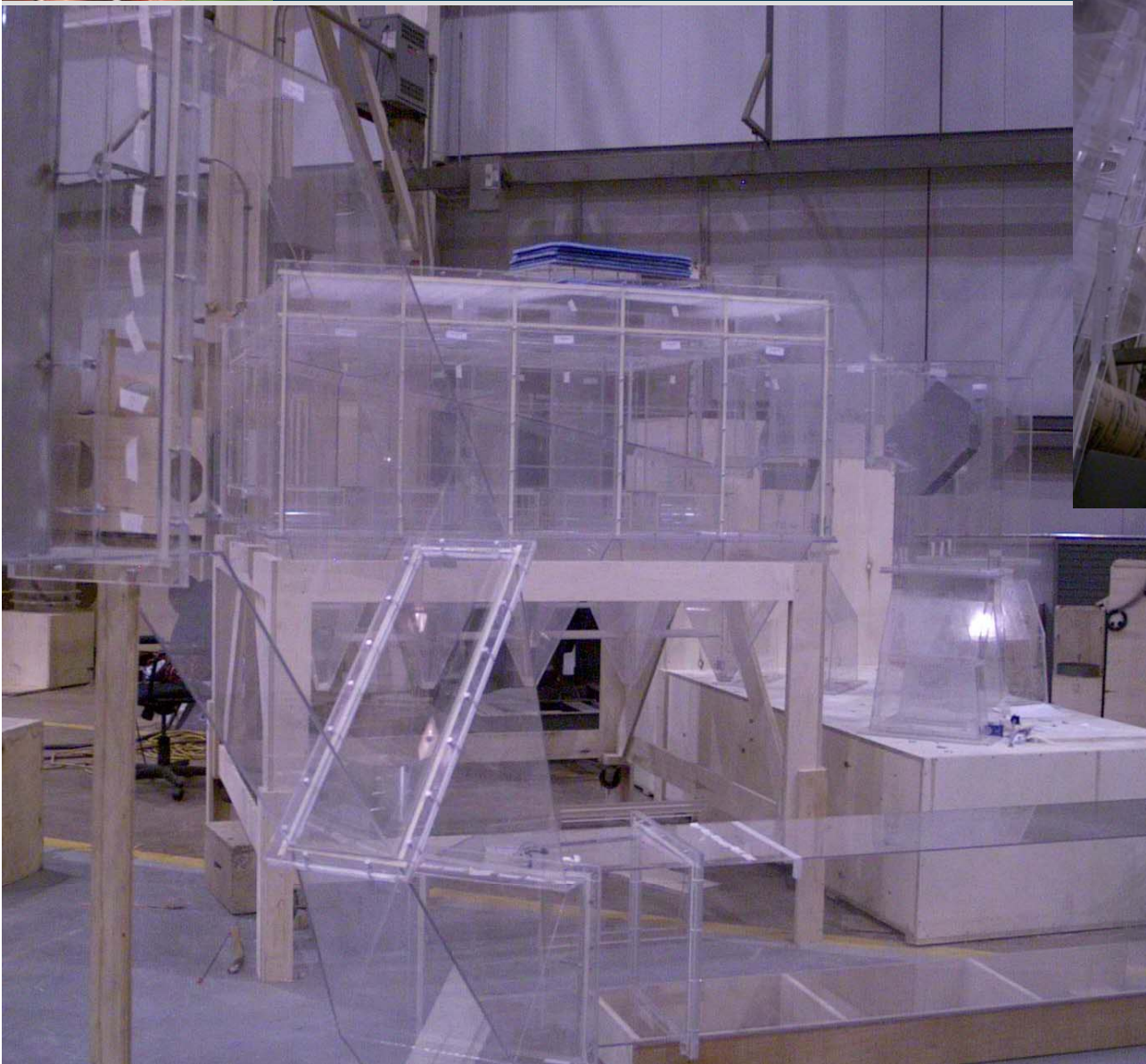






# Model Testing or CFD

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**Thank you**

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**QUESTIONS ?**