REINHOLD ENVIRONMENTAL Ltd.

2012 APC Round Table
& Expo Presentation

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Low-Cost Solutions for HCl, SO_X, NO_X, Hg, PM, Heavy Metals, and DewPoint Corrosion Mitigation

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Reinhold PCUG 2012 - Baltimore, MD

BoldEco Environment

BoldEco Low-Cost Solutions

- Address SO_X, HCl, NO_X, Hg, PM_{10} And $PM_{2.5}$ Individually OR Comprehensively
- Fully Retrofit and Add-on Technologies
- Small Footprint - Require Little Space for Installation
- High Performance - Require Shorter Residence Times
- Cut Into Existing Ductwork; Short Tie-in Time
- Leverage Inherent Process Chemistries to Achieve Minimal Operating Cost
- Low Capital and Operating Costs

BoldEco Low-Cost Solutions

- Scrubbing (Multi-phase Reaction) Optimization Solutions
  - Acid Gas Scrubbing and Neutralization
    - Sorbent Efficiency and Utilization
  - Elemental Hg Conversion and Adsorption
    - Oxidation and Particulate Formation
- Particulate Control Solutions
  - PM Capture Optimization For ESPs
    - Resistivity and Humidity Control
  - Condensables And Ionic Hg Capture
    - Nucleation by Gas Cooling

BoldEco Low-Cost Solutions

- Acid Gas Scrubbing Optimization
  - DSI Enhancement
    - Spray Cooling
  - SNCR Enhancement
    - Vaporized SNCR
  - SCR Enhancement
    - Hybrid SNCR/SCR

BoldEco Low-Cost Solutions

- Hg and Particulate Control Enhancement
  - FF Enhancement
    - Reverse Gas Duct Standing Shockwave Generator
  - ESP Enhancement
    - Spray Cooling
  - Condensables Enhancement
    - Spray Cooling
  - ACI Enhancement
    - Spray Cooling

BoldEco Family of Technical Solutions

Eco|SprayTech Systems

- Gas cooling and reaction chambers, patented injection systems for gas cooling, humidification, emergency dilution and chemical reactions

Eco|SorbTech Systems

- Low-cost BACT and MACT level acid gas and combined PM removal

Eco|PulseTech Systems

- Low-cost MACT level high efficiency Fabric Filters for PM removal, controls and add-on systems for FF optimization

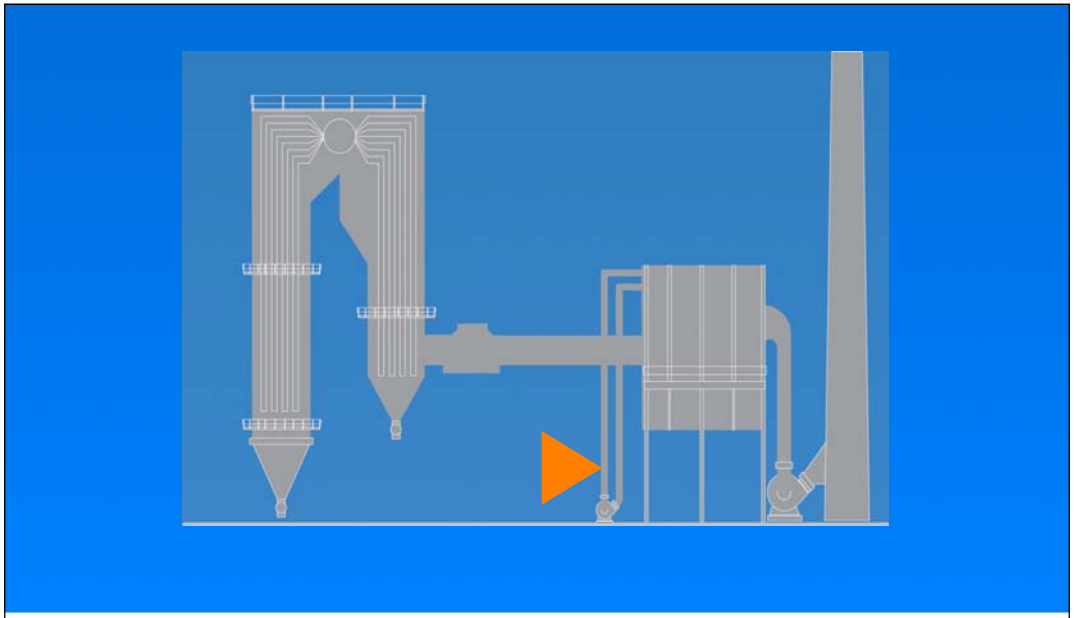
Eco|SelecTech Systems

- Low-cost MACT level, low temperature SCR and SNCR NO_X removal, hybrid SNCR/SCR systems, innovative, low-cost soot blowing systems

Particulate Control Solutions

Low-Cost RAFF Enhancement

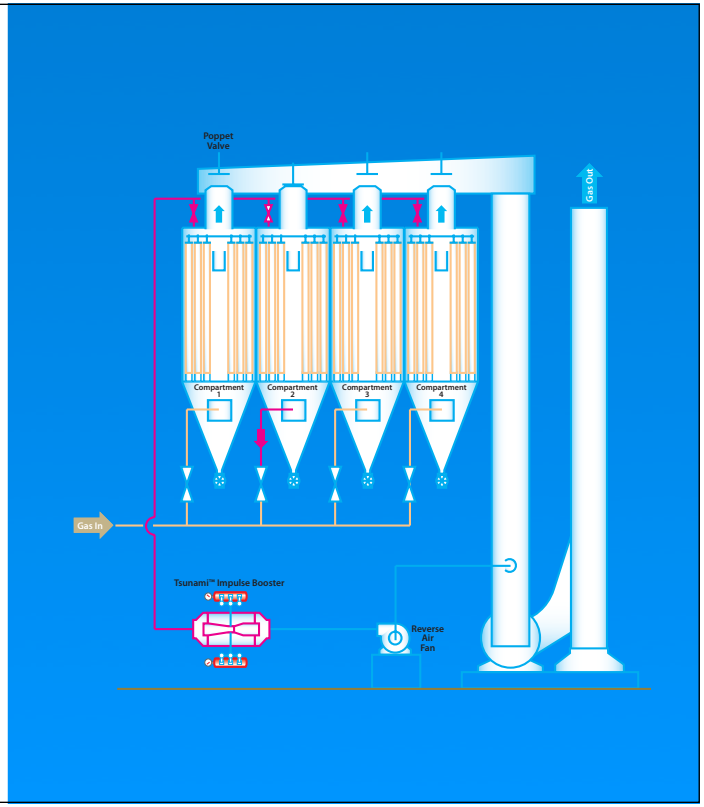
- Tsunami Standing Shockwave Generator
  - Works with Existing RAFF Systems
  - Installs on the RAFF Reverse Gas Ducting System
  - Works by Generating a Standing Shockwave in the RA Duct to Improve Cleaning and Pressure Drop



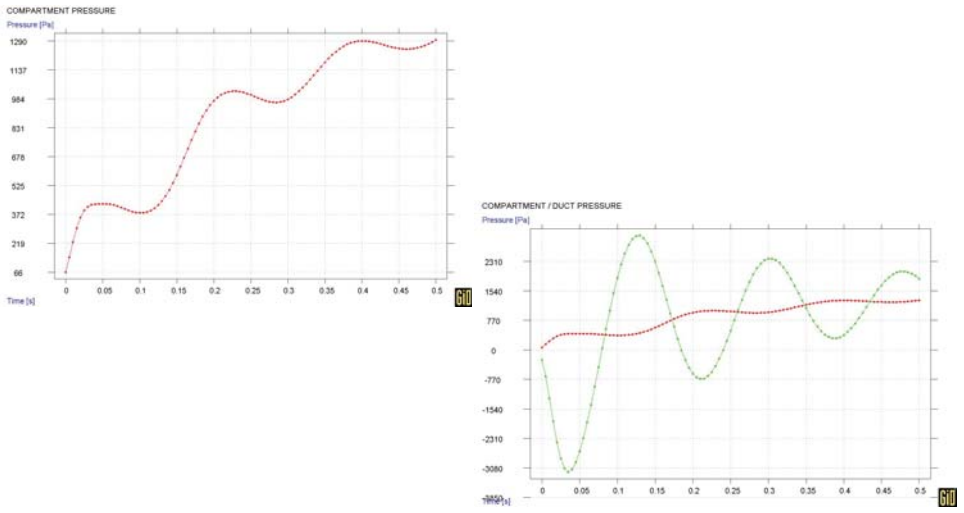
Solution Element -
RAFF Standing Shockwave Generator

Solution Element - RAFF Standing Shockwave Generator

- Generates a standing shockwave in the reverse gas duct that vibrates the bags clean
- Simple in-duct installation
- May be fired multiple times as needed to clean filter media

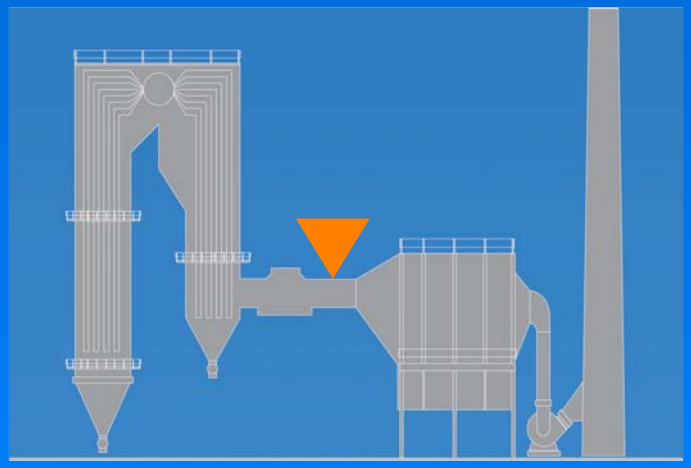


Low-Cost RAFF Enhancement



Low-Cost ESP Enhancements

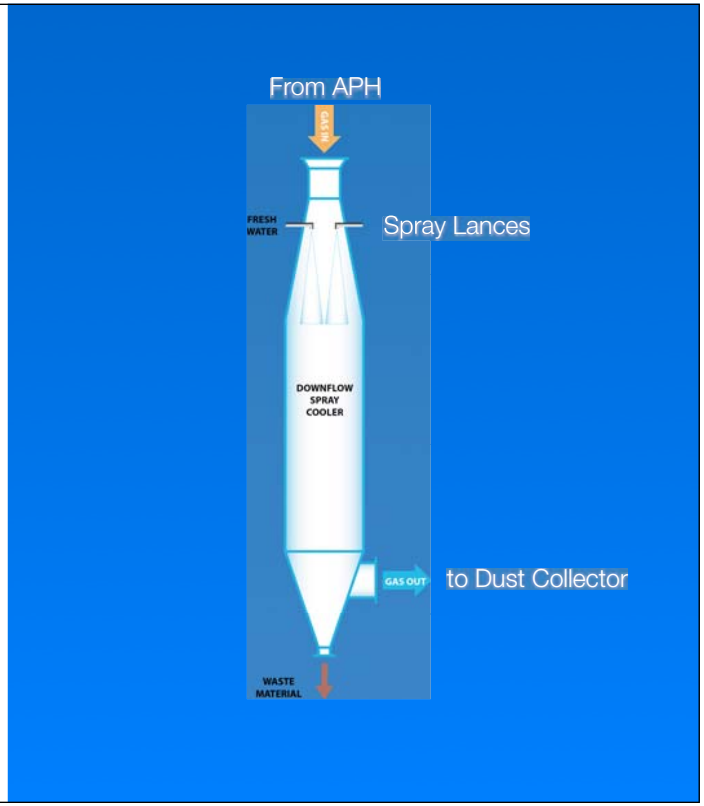
- ID-side - Evaporative Gas Cooling Tower
- FD-side - Fan Inlet Cooling



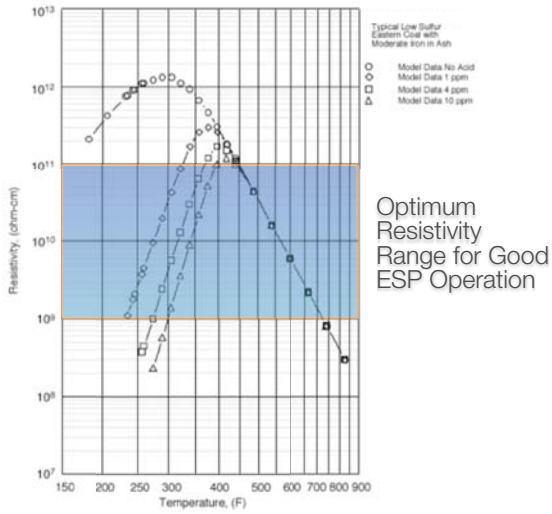
Solution Element -
EGC Spray Cooling Tower

Solution Element - EGC Spray Cooling Tower

- Downflow EGC Tower in installed after APH where finely atomized water is evaporated to cool gases to lower resistivity
- EGC tower eliminates danger of build-up in ductwork and provides engineered evaporation times

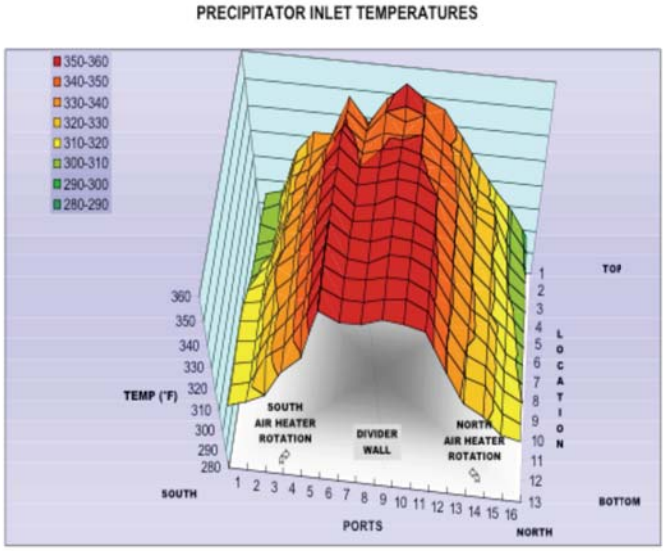


Flyash Resistivity

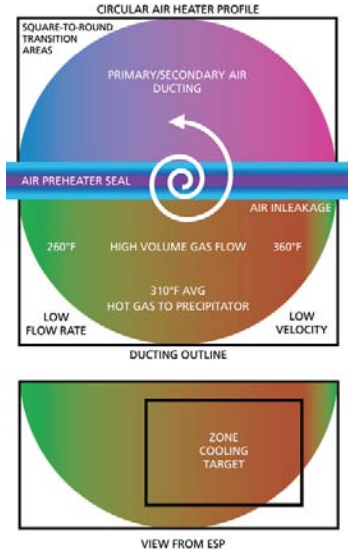


Optimum Resistivity Range for Good ESP Operation

Air Preheater Outlet Temperature Profile



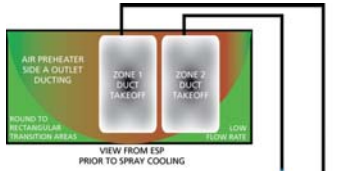
Zone Cooling Approach



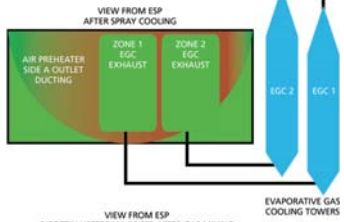
Spray Cooling Target

Zone Cooling Implementation with EGC

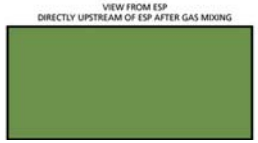
Duct Temperature Profile
Upstream of EGC



Duct Temperature Profile
Downstream of EGC



ESP Inlet Temperature Profile
280-300°F Average



Additional Benefits of Cooling Technology

- Enhancement of DSI
- Enhancement of ACI
- Enhanced Collection of Condensable Fraction
- More Stable ESP Electrical Operation

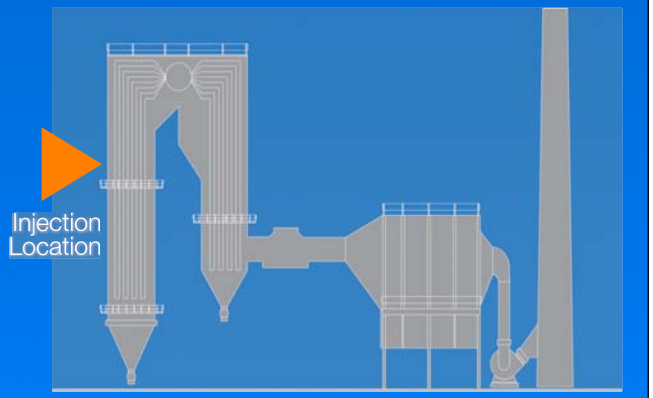
NO_X Control Solutions

Low-Cost NO_X Solutions

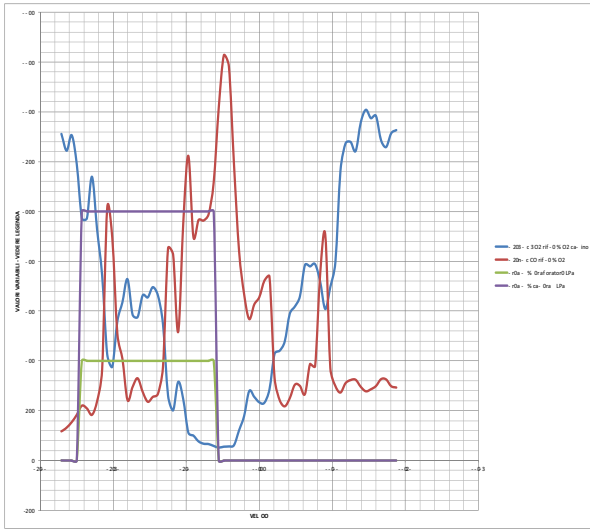
- SNCR with Catalytic Urea Conversion
- Hybrid SNCR/SCR with Single-layer Catalyst Bed
- Oxidizer with Activator Optimization
- Two-step SNCR/Oxidizer

Solution Element - Catalytic Urea Conversion SNCR System

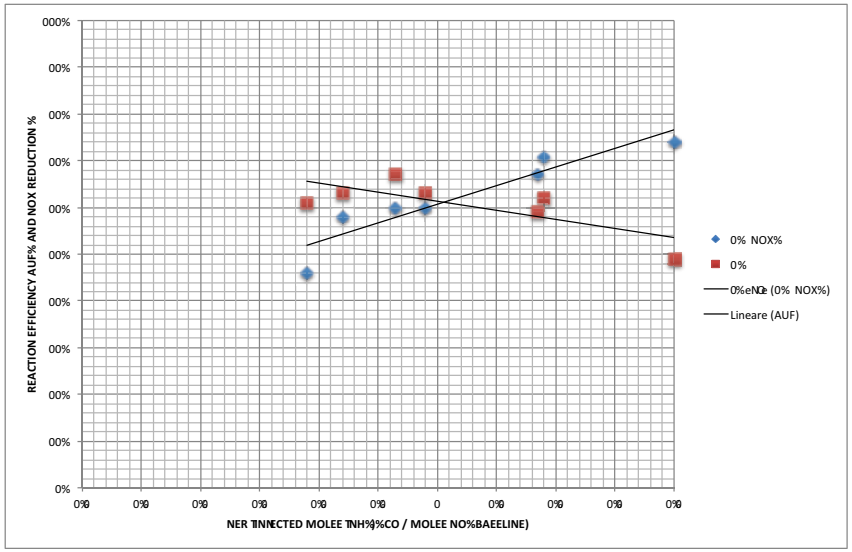
- Patented urea conversion process
- High-temperature, vaporized injection of catalyzed urea
- Full-scale results show greater than 85% NO_X reduction
- Reduces urea consumption by >50%



Enhanced SNCR Test Results



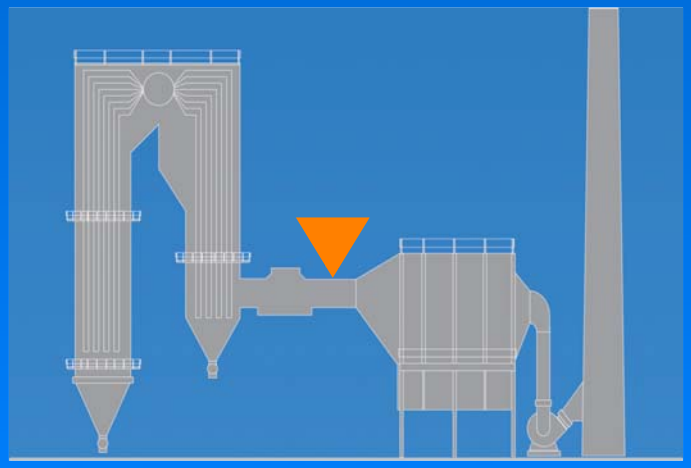
Enhanced SNCR Test Results



Acid Gas Control Solutions

Low-Cost Acid Gas Solutions

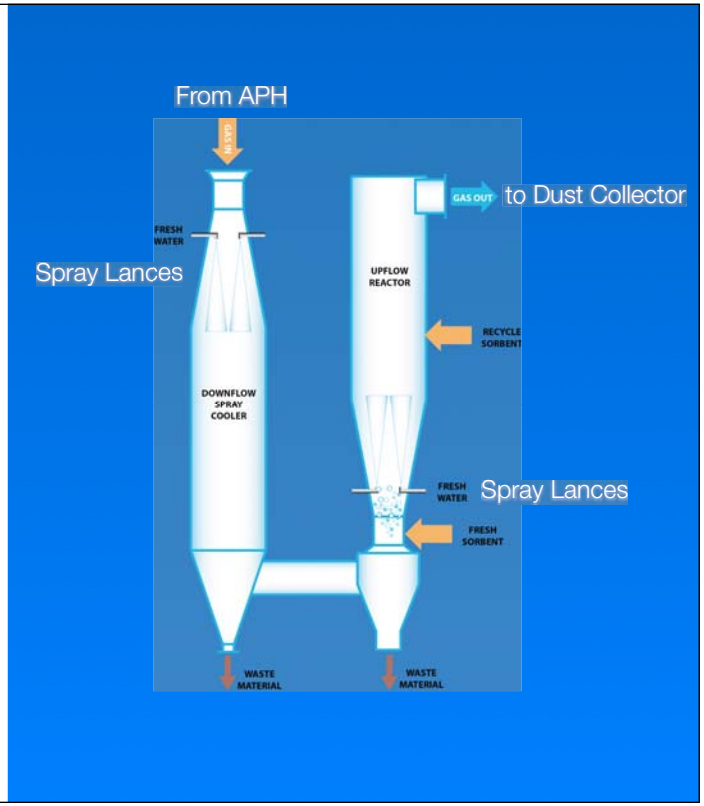
- DSI Enhancement
  - Evaporative Gas Cooling Tower (EGC) Temperature Control
    - Enhances Acid Gas Removal by Approach to Saturation
    - Enhances HCl, H_2SO_4 and SO_2 Capture
  - EGC Combined with Turbulent Fluid Bed Reactor
    - Increases Utilization of Sorbent
    - EGC establishes Optimum Temperature to Optimize Reaction
    - Provides Increased Turbulence
    - Increases Gas Contact Time
    - Eliminates Sorbent Build-up



Solution Element -
TFB Reaction Chamber

Solution Element - TFB Reaction Chamber

- Upflow reactor close-coupled to an EGC Tower
- Sorbent is injected downstream of pre-cooled gases to maximize reaction
- Upflow reactor greatly increases turbulence, mixing and residence time



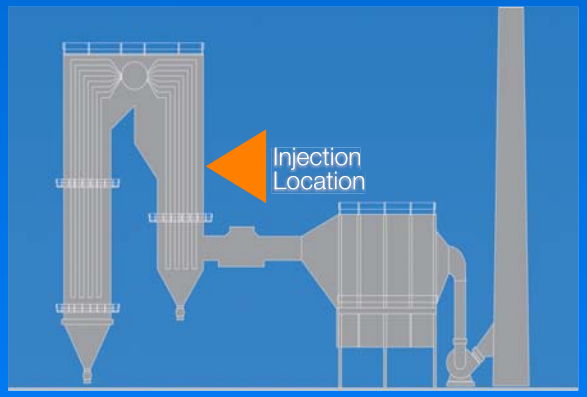
Hg Control Solutions

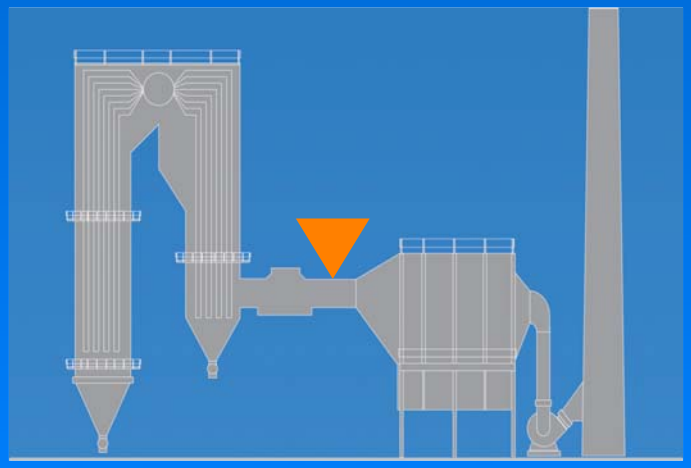
Low-Cost Hg Control Solutions

- ACI Enhancement
  - Installation of EGC
    - Decreases Gas Temperature for enhanced elemental Hg adsorption
- Oxidizer Injection
  - Installation of Oxidizer System
    - Converts elemental Hg to ionic Hg upstream of dust collector
    - Captured in dust collector as a particulate

Solution Element - Hg Oxidizer System

- Oxidizer alone or in conjunction with activator
- Can be engineered to provide >50% NO_X reduction
- Can be used in conjunction with SNCR to provide higher NO_X reduction

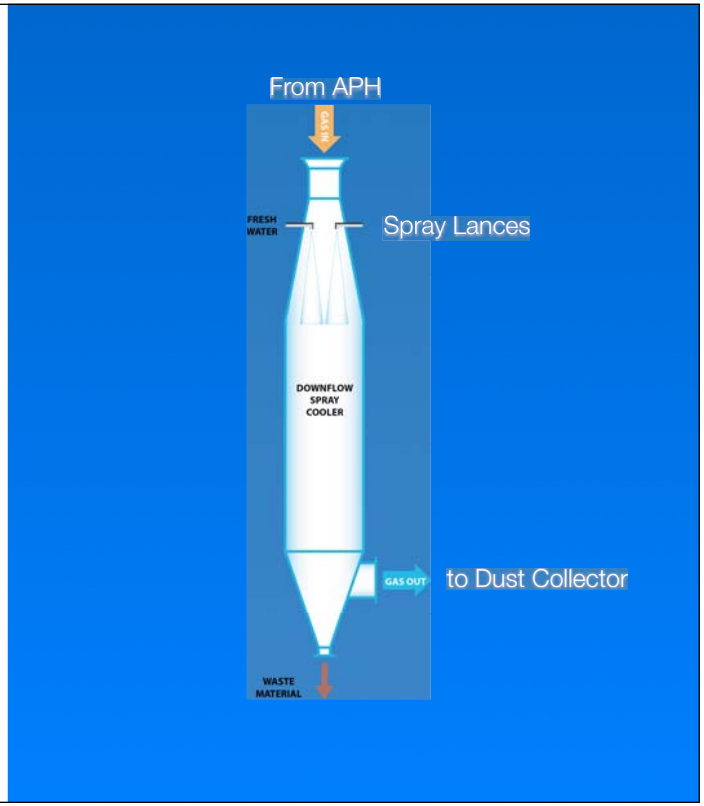




Solution Element -
EGC Spray Tower for Improved ACI Performance

Solution Element - EGC for Hg Control

- Cooling gases has been proven to improve ACI performance on elemental Hg



Multi-Pollutant Control Solutions

BoldEco Technology Benefits

- Single Reactor Units Can Be Installed in Parallel
- Multiple Reactor Units Consist of Identical Subsystems in Parallel
- Can Be Started-up and Shut-down Independently of Plant Processes
- Subsystems Can Be Individually Operated or Turned Down to:
  - Accommodate Different Operating Modes
  - Low Load Conditions at the Lowest Possible Operating Cost
  - Allow for Off-line Cleaning Mode for Maximum Performance
- Designed to Be Phased in with Compliance Deadlines

Solution Element - VersaMAPS Multi-pollutant Control

- Address SO_X, HCl, NO_X, Hg, PM_{10} And $PM_{2.5}$
- Small Footprint
- Designed To Have Single Or Multiple Reactor Arrangement
- High Sorbent Utilization