

# Potential Amendments to District Rule 4352 (Solid Fuel Fired Boilers, Steam Generators, and Process Heaters)

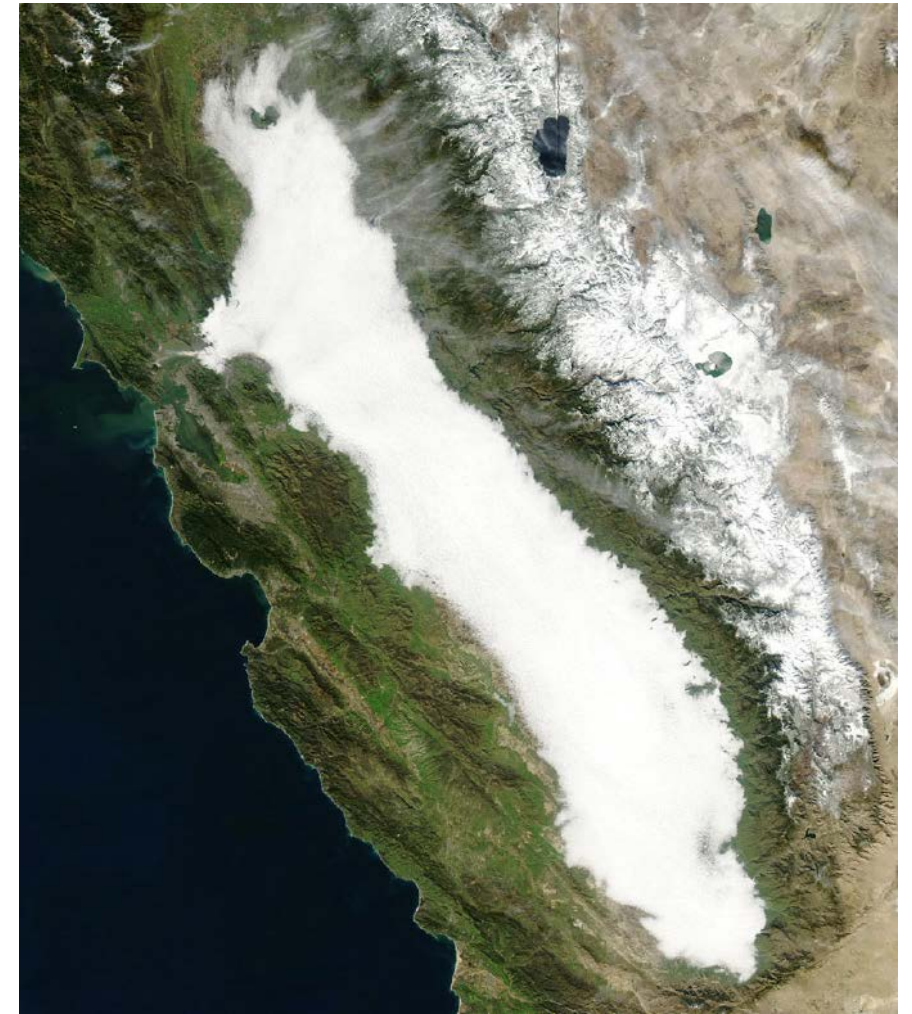
November 4, 2021

San Joaquin Valley Air Pollution Control District

[webcast@valleyair.org](mailto:webcast@valleyair.org)

# Valley's Air Quality Challenges

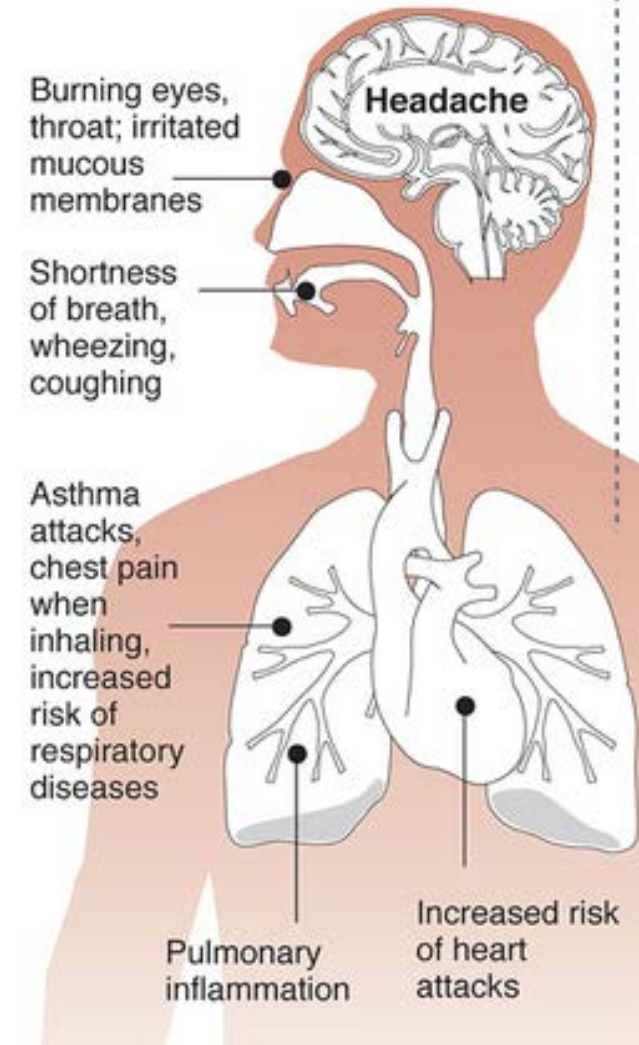
- Valley's challenges in meeting federal air quality standards unmatched due to unique geography, meteorology, and topography
- Valley designated as “Extreme” non-attainment of the 8-hour Ozone NAAQS; “Serious” non-attainment of federal standards for fine particulate matter (PM<sub>2.5</sub>)
  - Substantial emission reductions needed to achieve federal standards – need to go beyond already strict control limits
- Combustion is a significant source of NO<sub>x</sub> emissions, primary precursor to ozone and PM<sub>2.5</sub> formation
  - Comprehensive strategy in *2018 PM<sub>2.5</sub> Plan* includes commitment to reduce emissions from mobile sources and a number of stationary source categories, including solid fuel fired boilers, steam generators, & process heaters



# Health Benefits of Reducing Emissions in the Valley

- Exposure to PM<sub>2.5</sub> and Ozone linked to a variety of health issues, including (but not limited to):
  - Asthma, chronic bronchitis, irregular heartbeat, and respiratory/cardiovascular hospitalizations
- District implements control measures to lower direct and precursor emissions throughout the Valley
  - NO<sub>x</sub> emissions are key precursor to formation of ammonium nitrate, which is large portion of total PM<sub>2.5</sub> during winter
  - NO<sub>x</sub> is also chemical precursor to formation of Ozone
- Proposed rule amendment will support goal of attaining health-based federal ambient air quality standards for both PM<sub>2.5</sub> and Ozone, and help to protect public health

## Effects on health



# Rule 4352 Overview

- Rule 4352 applies to any boiler, steam generator, or process heater fired on solid fuel
  - *Boilers* are external combustion equipment used to produce hot water or steam
  - *Process heaters* are combustion equipment that transfer heat from combustion gases to liquid or gas process streams
  - *Steam generators* are external combustion equipment that convert water to steam



Image credit: Prime Boiler Services Ltd.



# Where do Solid Fuel Fired Boilers, Steam Generators, and Process Heaters Operate?

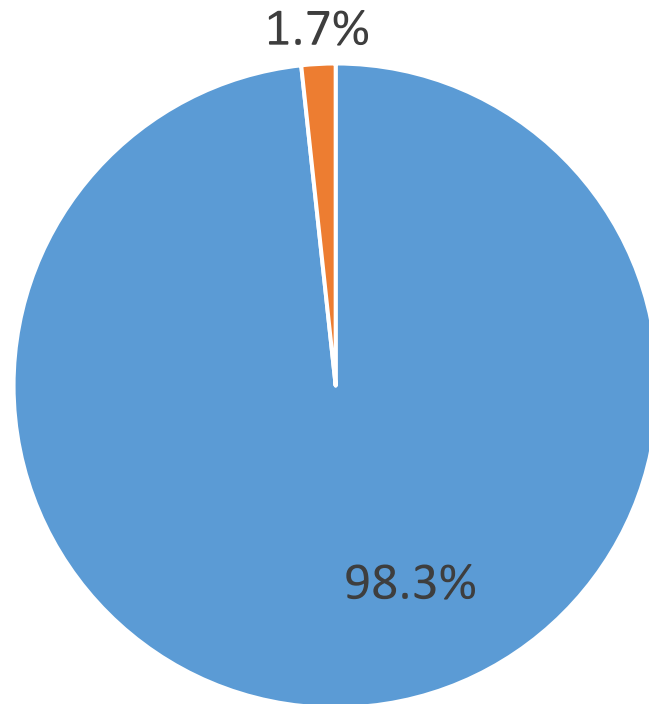
- Solid fuel fired boilers, steam generators, and process heaters are primarily used for power generation
- Units subject to Rule 4352 may be fired on a variety of solid fuels:
  - Municipal solid waste
  - Biomass
  - Coal
  - Petroleum coke
- Units currently operating in the Valley are fired on municipal solid waste or biomass



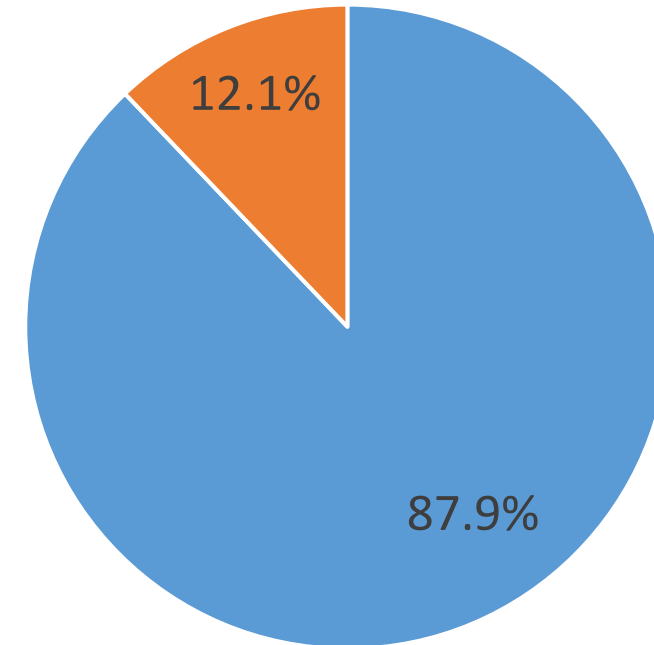
*Image credit: Covanta Holding Corporation*

# NOx from Solid Fuel Fired Boilers, Process Heaters and Steam Generators in the Valley

All NOx Sources in the Valley  
(Mobile, Stationary, & Area Sources)



NOx Emissions from Stationary Sources



■ Other NOx Sources   ■ Solid Fuel Fired Boilers

■ Other Stationary Sources   ■ Solid Fuel Fired Boilers

# Current Rule 4352 Requirements

- District Rule 4352 adopted September 14, 1994, and amended in 1996, 2006, and 2011
- Rule requirements approved as meeting Most Stringent Measures (MSM) by U.S. EPA in July, 2020
- Rule 4352 establishes specific NO<sub>x</sub> and CO limits for categories of solid fuel fired boiler/steam generator/process heater units
  - Municipal Solid Waste (165 ppmv NO<sub>x</sub> at 12% CO<sub>2</sub>, 400 ppmv CO at 3% O<sub>2</sub>)
  - Biomass (90 ppmv NO<sub>x</sub> at 3% O<sub>2</sub>, 400 ppmv CO at 3% O<sub>2</sub>)
  - NO<sub>x</sub> and CO emission limits are based on a block 24-hour average
  - Monitoring and recordkeeping requirements
- NO<sub>x</sub> from solid fuel fired boilers controlled by up to ~75% through current rule requirements

# Current Controls In Use on Valley Solid Fuel Fired Boilers

## Particulate Matter Control Technologies

- Electrostatic Precipitators (ESP)
  - Removes particulates from a gas stream by using electrical energy to charge particles either positively or negatively and attracted to collector plates
- Baghouses
  - Removes particulates from a gas stream by using fabric filters to collect and separate particles from industrial exhaust streams

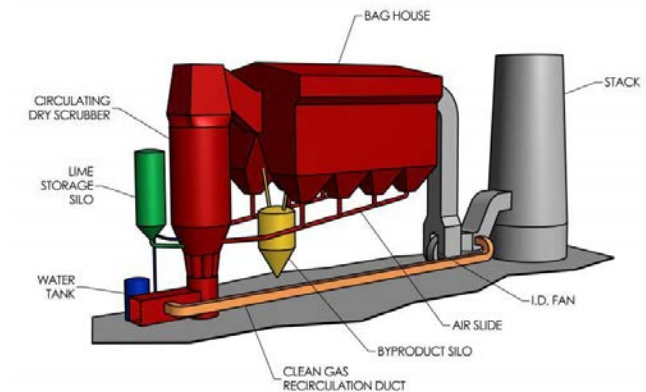
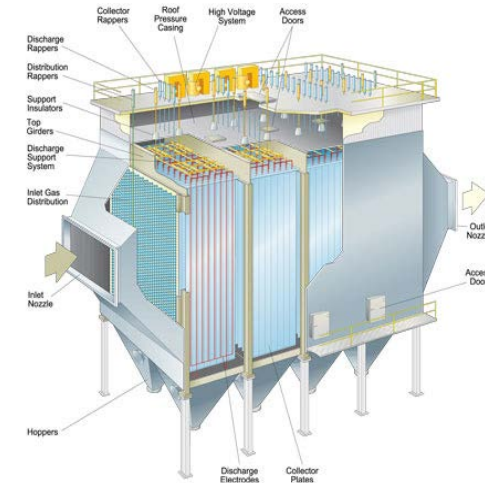


Image credit:  
Babcock & Wilcox,  
2016



# Current Controls In Use on Valley Solid Fuel Fired Boilers (cont'd)

## NOx Control Technologies

- Selective Non-Catalytic Reduction (SNCR) Systems
  - Reduces NOx emissions through injection of ammonia type reagent into furnace/exhaust stream
- Selective Catalytic Reduction (SCR) Systems
  - Targeted to reduce NOx emissions through injection of ammonia type reagent into furnace in the presence of a catalyst

## SOx Control Technologies

- Dry Sorbent Injection Systems
  - Powdered alkaline sorbent, such as hydrated lime, is injected into exhaust duct and reacts with acid gases to reduce SOx
- Wet Scrubber Systems
  - Wet solution containing a reagent, chemical reactions reduce emissions of SOx

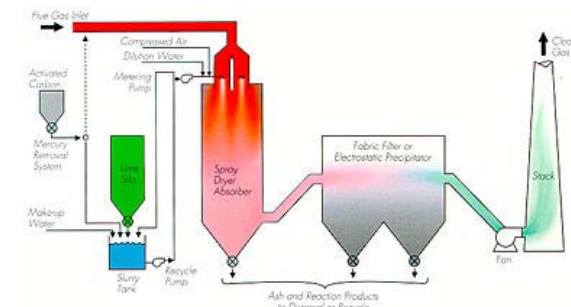
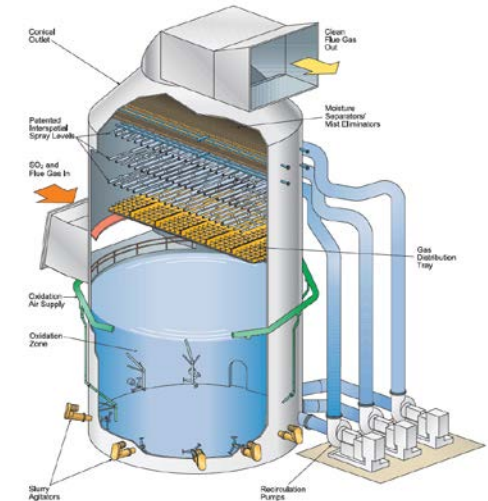


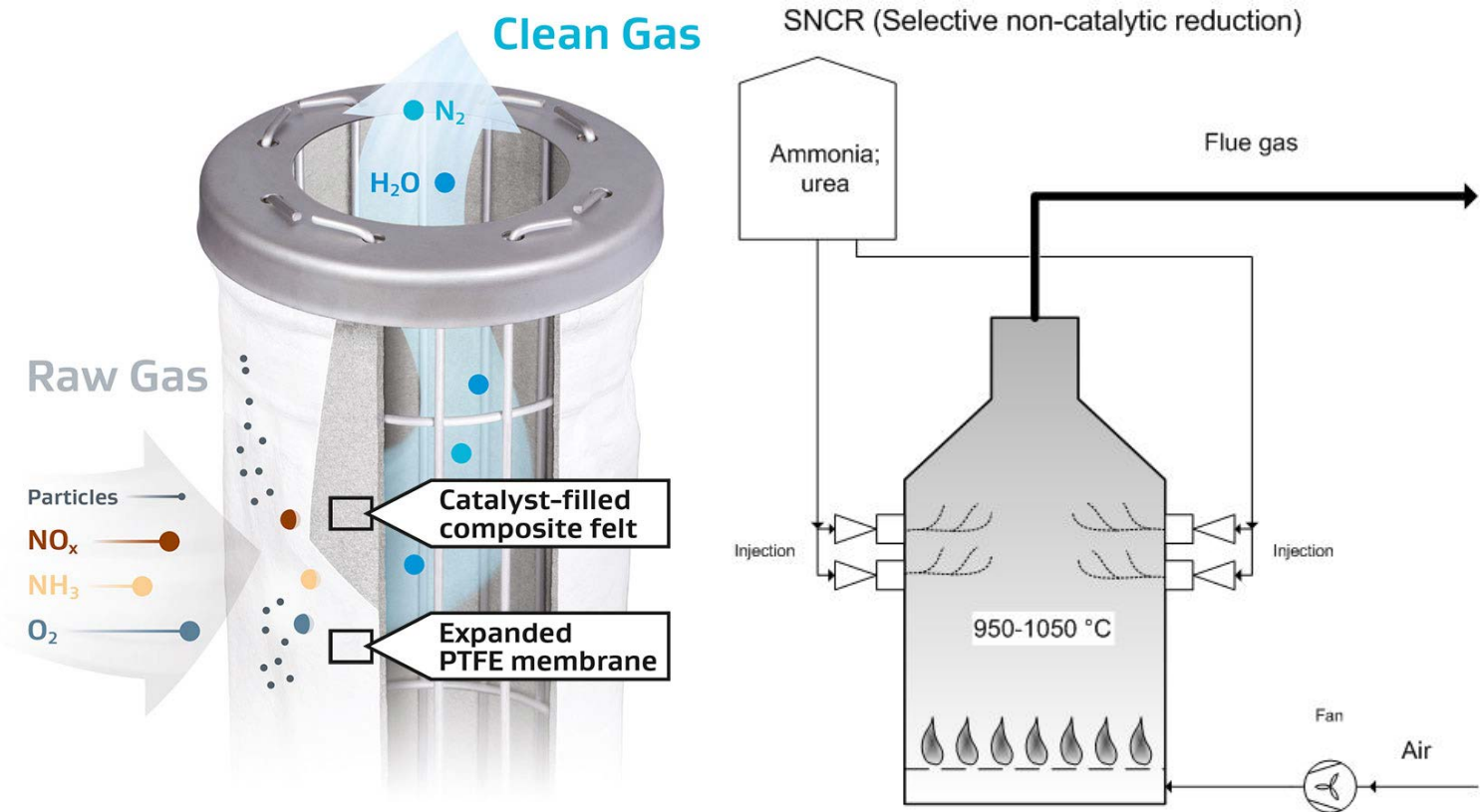
Image credit:  
Babcock & Wilcox,  
2016

# Evaluation of Additional Emission Reduction Opportunities

- Per *2018 PM<sub>2.5</sub> Plan*, District pursuing the following potential opportunities to reduce NO<sub>x</sub> emissions for municipal waste-fired units to the extent that additional NO<sub>x</sub> controls are technologically and economically feasible:
  - Lowering NO<sub>x</sub> limit for units fired on Municipal Solid Waste from 165 ppmv @ 12% CO<sub>2</sub> to 110 ppmv @ 12% CO<sub>2</sub> over 24-hr period and 90 ppmv @ 12% CO<sub>2</sub> over annual period
  - Evaluating feasibility of even lower NO<sub>x</sub> limits
- District also evaluating feasibility of lower NO<sub>x</sub> emission limits for other solid fuel fired units and establishing PM<sub>10</sub> and SO<sub>x</sub> limits

# Control Technologies Under Evaluation

- Selective Non-Catalytic Reduction
- Selective Catalytic Reduction
- Gore De-NO<sub>x</sub> Filter Bags
- Covanta LN™
- Combination of controls

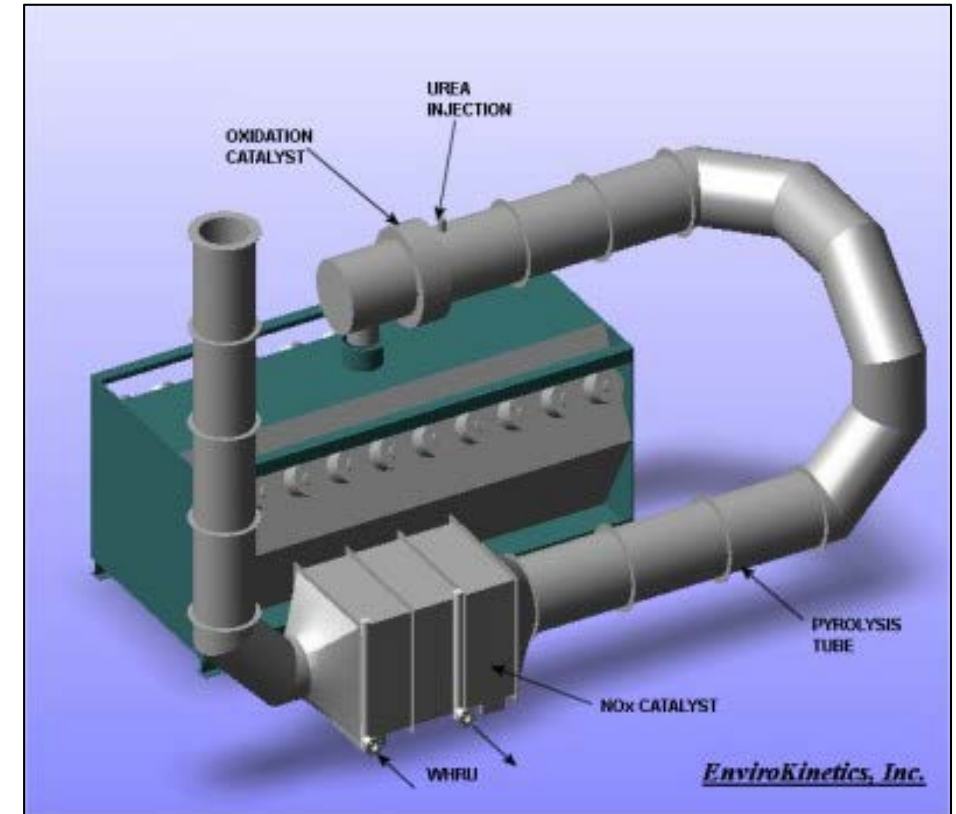


# Cost Assessment of Further Control Technology

- Sources for cost
  - Actual costs provided by facilities, engineering estimates, and control technology vendors & manufacturers
  - Various sources for the cost of electricity, fuel, and replacement parts
  - Cost factors from EPA's Office of Air Quality Planning and Standards
- Staff held virtual meetings with facilities, vendors, manufacturers, and other stakeholders to gather cost figures

# Selective Catalytic Reduction

- Selective Catalytic Reduction (SCR)
  - Reduces NO<sub>x</sub> emissions through injection of ammonia type reagent
  - Total Capital Cost: \$10M - \$34M
  - Operation & Maintenance Cost: \$1.7M - \$2M annually





# Gore De-NOx Filtration System

- Gore De-NOx Filtration System
  - Reduces NOx emissions through use of filter bags with ammonia catalyst
  - Total Capital Cost: \$5.5M - \$7.8M
  - Operation & Maintenance Cost: \$900K - \$6.6M annually

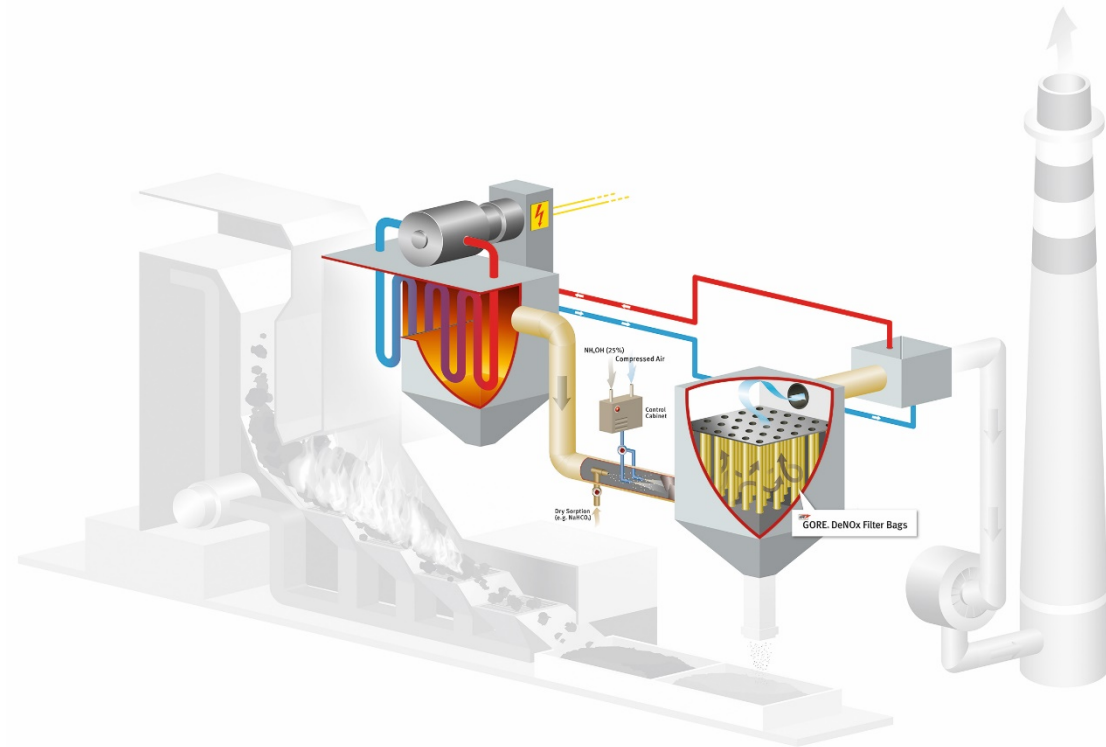


Image credit: W. L. Gore & Associates, Inc.

# Covanta LN™

- Covanta LN™
  - Proprietary staged combustion air system for municipal waste combustors
  - Achieves further NOx control
  - Total Capital Cost: ~\$12M
  - Operation & Maintenance Cost: ~\$840K

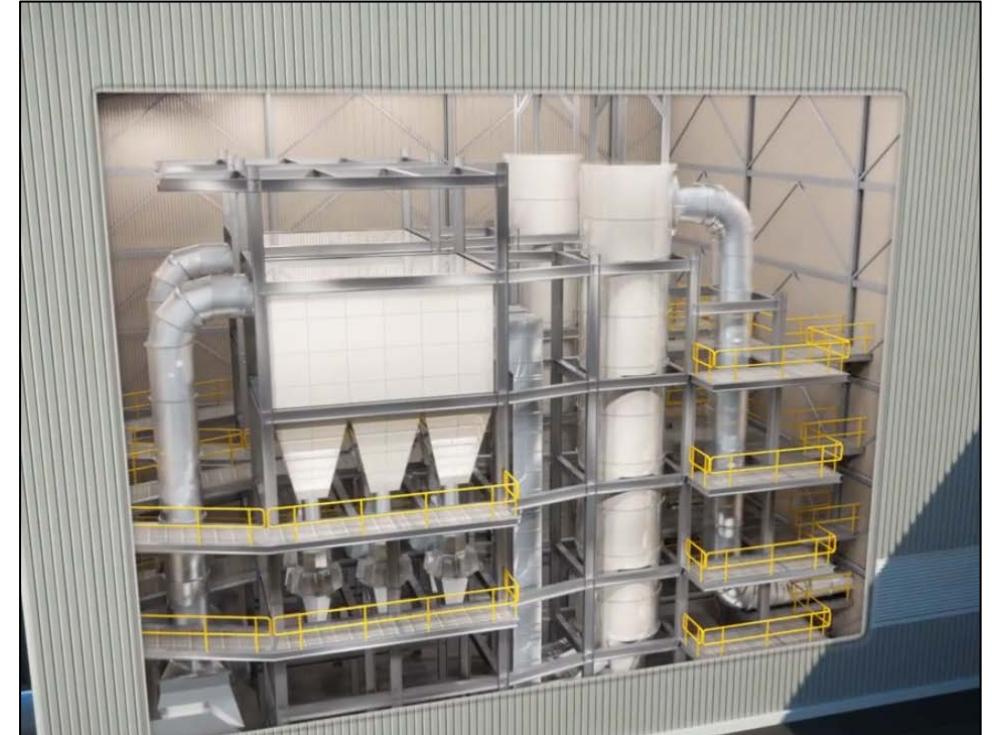
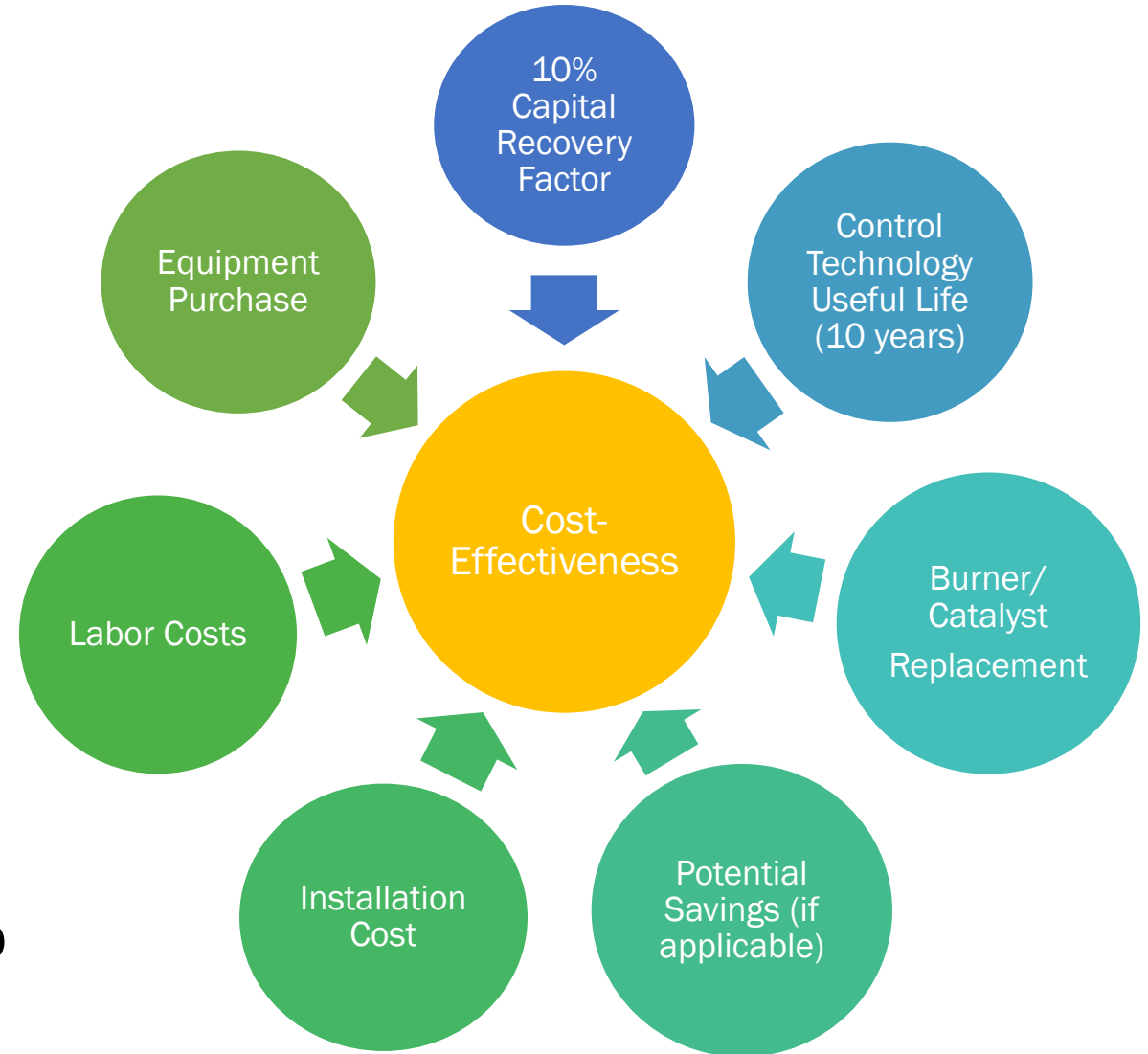


Image credit: Covanta Holding Corporation

# Cost-Effectiveness (CE) Analysis

- Cost-Effectiveness is cost (capital and annual) over emission reductions for the life of the equipment (\$/ton)
- Two major cost elements
  - Capital Costs (Equipment, Infrastructure, Engineering, Installation, Tax, Freight)
  - Annual Costs (Operation & Maintenance)
- Emission reductions based on current emission levels (baseline) to proposed emission limit



# Proposed Amendments to Rule 4352: Requirements for Municipal Solid Waste Facilities

- Proposing to lower existing NO<sub>x</sub> limits
  - Current NO<sub>x</sub> limit 165 ppm with SNCR as current control technology
  - Proposed lower NO<sub>x</sub> limit: 90 ppmv @ 12% CO<sub>2</sub> on a 12-month rolling average and 110 ppmv @ 12% CO<sub>2</sub> on a block 24-hour average
- Proposing to establish PM<sub>10</sub> emission limits
  - Permit limits at 0.053 lbs/MMBtu
  - Proposed limit of 0.04 lbs/MMBtu or 0.02 gr/dscf @ 12% CO<sub>2</sub>
- Proposing to establish SO<sub>x</sub> emission limits
  - Permit limits at 0.09 lbs/MMBtu
  - Proposed limit of 0.03 lbs/MMBtu or 12 ppmv @ 12% CO<sub>2</sub> on a 12-month rolling average and 0.064 lbs/MMBtu or 25 ppmv @ 12% CO<sub>2</sub> on a block 24-hour avg
- Full compliance to be required by January 1, 2024

# Proposed Amendments to Rule 4352: Further Requirements for Biomass Facilities

- Proposing to lower existing NO<sub>x</sub> limits
  - Current NO<sub>x</sub> rule limits for Biomass: 90 ppmv NO<sub>x</sub>
  - Proposed lower NO<sub>x</sub> limit: 65 ppmv @ 3% O<sub>2</sub> on a block 24-hour average
- Proposing to establish PM<sub>10</sub> limits
  - Proposed PM<sub>10</sub> limit: 0.03 lbs/MMBtu
- Proposing to establish SO<sub>x</sub> limits
  - Proposed SO<sub>x</sub> limit: 0.02 lbs/MMBtu on a rolling 30-day average, and 0.035 lbs/MMBtu on a block 24-hour average
- Full compliance to be required by January 1, 2024

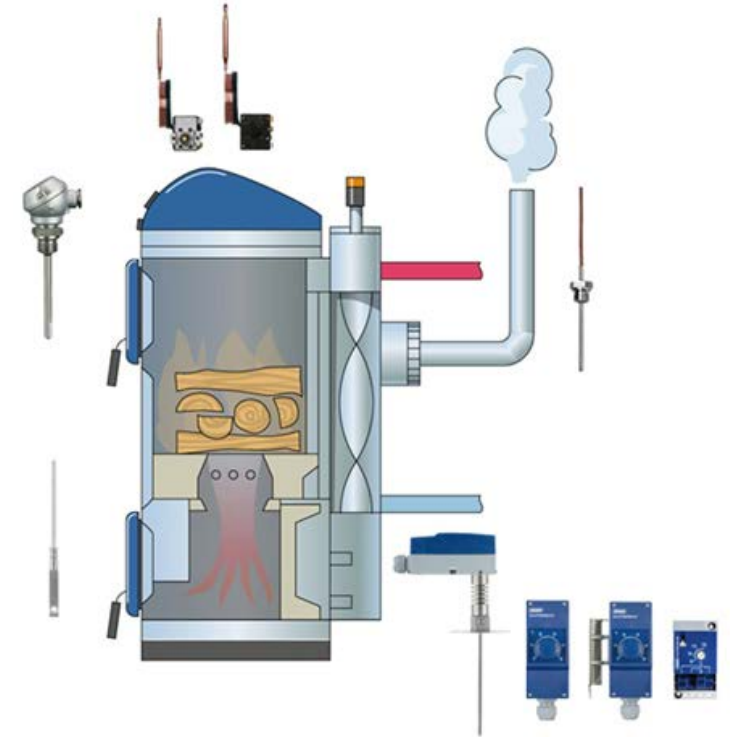


Image credit: Jumo, 2021



# Proposed Amendments to Rule 4352: Exemptions

- Currently facilities with potential to emit less than 10 tons of NO<sub>x</sub> or VOC are exempt from Rule 4352 requirements
- District is evaluating potential changes to current exemption provisions



# Estimated Emission Reductions

Fuel Type	NOx Emission Reductions (tons/day)
Municipal Solid Waste	0.395
Biomass	0.316
<b>TOTAL</b>	<b>0.711</b>

Fuel Type	PM10 Emission Reductions (tons/day)
Municipal Solid Waste	0.018
Biomass	0.262
<b>TOTAL</b>	<b>0.280</b>

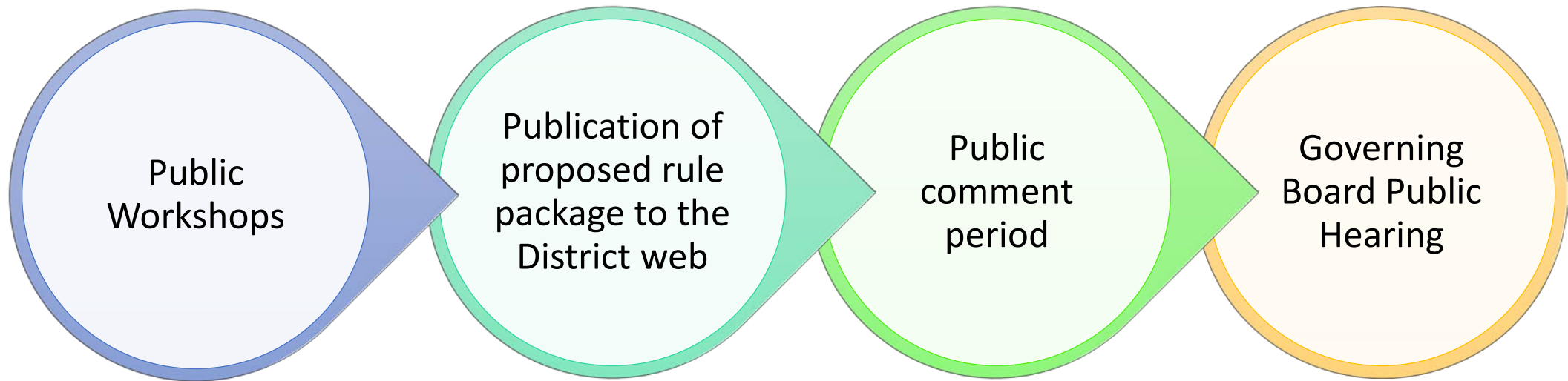
  

Fuel Type	SOx Emission Reductions (tons/day)
Municipal Solid Waste	0.057
Biomass	0.213
<b>TOTAL</b>	<b>0.270</b>

# Next Steps

- Requesting comments on rule concepts by November 11, 2021 for incorporation into final draft rule
  - Comments welcomed through public hearing date
  - Governing Board Meeting anticipated December 16, 2021
- Continued analysis of costs, cost-effectiveness of various controls, and feasibility of control requirements
- Socioeconomic Impact Analysis being finalized by third-party consultant to evaluate the regional economic impacts of proposed amendments
- Ongoing public engagement process

# Next Steps: Public Engagement Process for Rule 4352 Amendment



Public Participation and Comment Invited throughout Process

# Contact

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# Comments/Questions

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