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

September 30, 2021

San Joaquin Valley Air Pollution Control District

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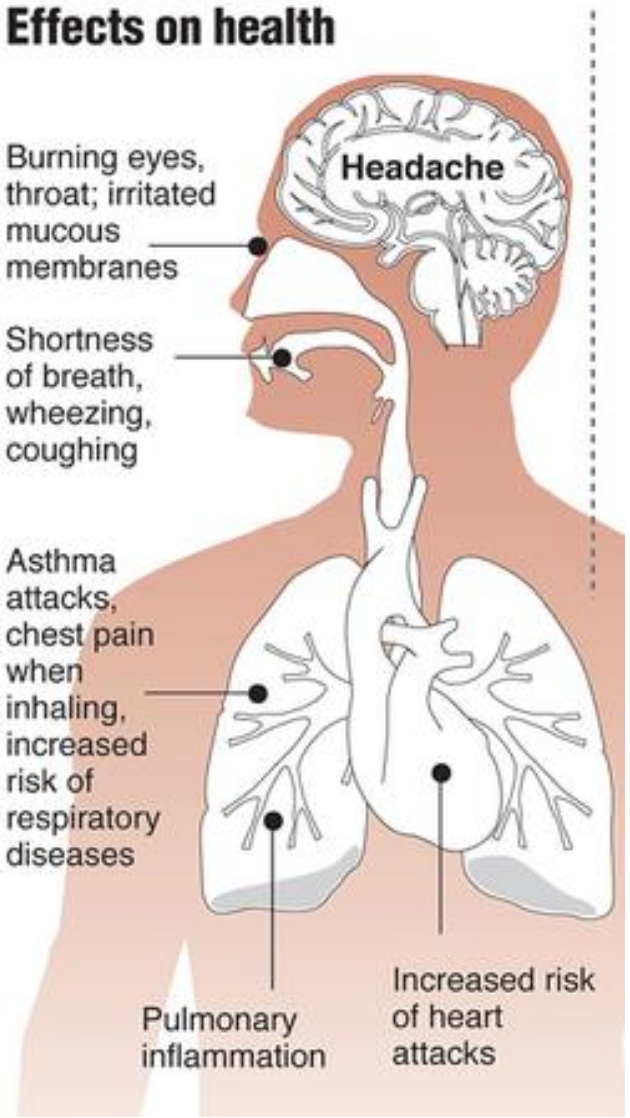
Valley's Air Quality Challenges

- 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 (PM2.5)
  - Substantial emission reductions needed to achieve federal standards – need to go beyond already strict control limits
- Combustion is a significant source of NOx emissions, primary precursor to ozone and PM2.5 formation
  - Comprehensive strategy in *2018 PM2.5 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 PM2.5 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
  - NOx emissions are key precursor to formation of ammonium nitrate, which is large portion of total PM2.5 during winter
  - NOx 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 PM2.5 and Ozone, and help to protect public 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.

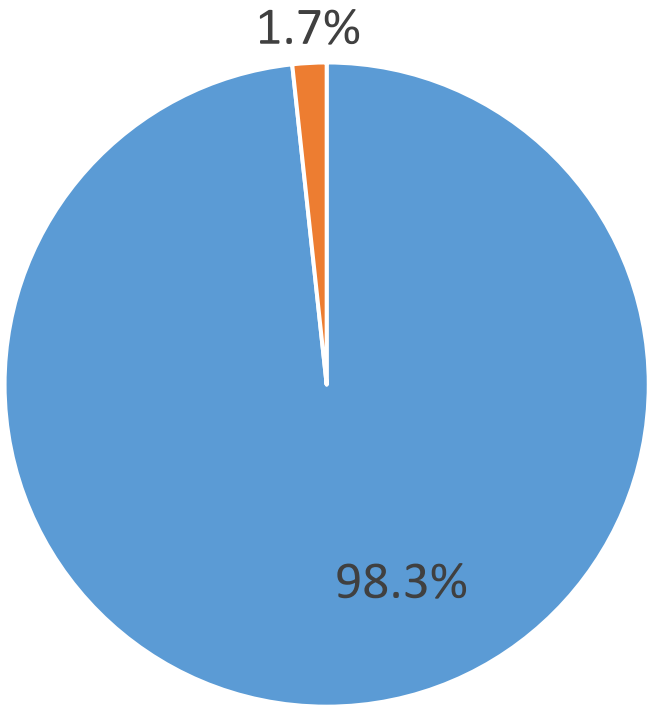
Where do Solid Fuel Fired Boilers, Steam Generators, and Process Heaters Operate?

- 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

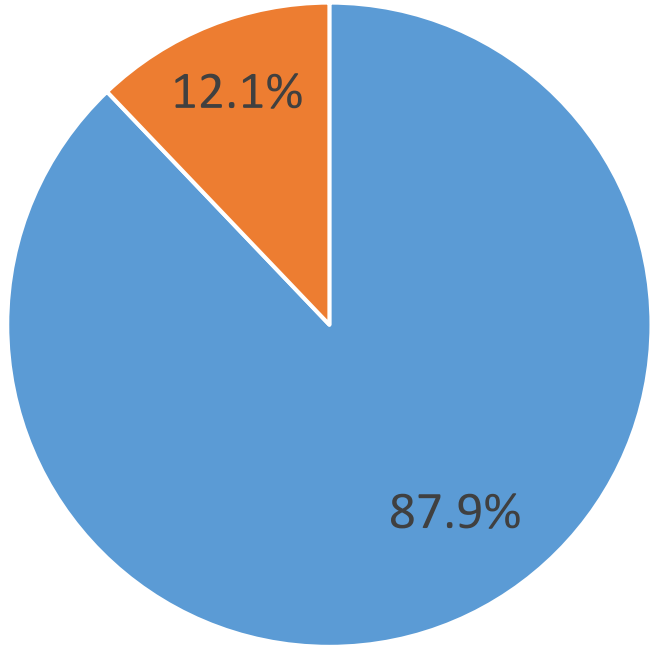
Image credit: Covanta Holding Corporation

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



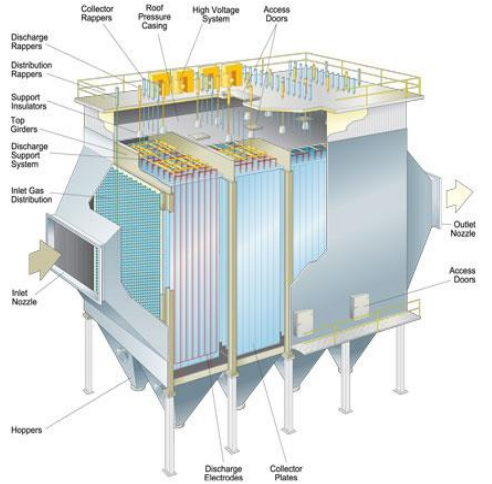
Current Rule 4352 Requirements

- 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 NOx and CO limits for categories of solid fuel fired boiler/steam generator/process heater units
  - Municipal Solid Waste (165 ppmv NOx at 12% CO_2, 400 ppmv CO at 3% O_2)
  - Biomass (90 ppmv NOx at 3% O_2, 400 ppmv CO at 3% O_2)
  - NOx and CO emission limits are based on a block 24-hour average
  - Monitoring and recordkeeping requirements
- NOx 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



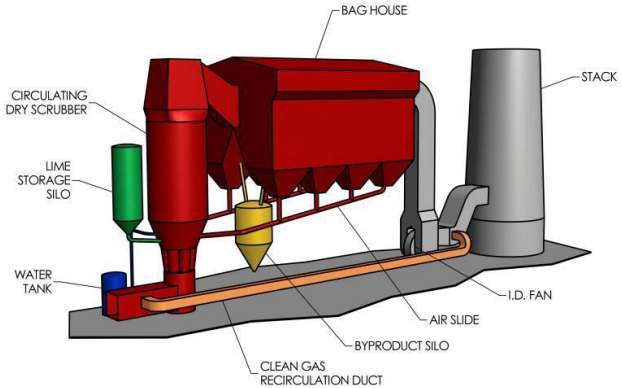
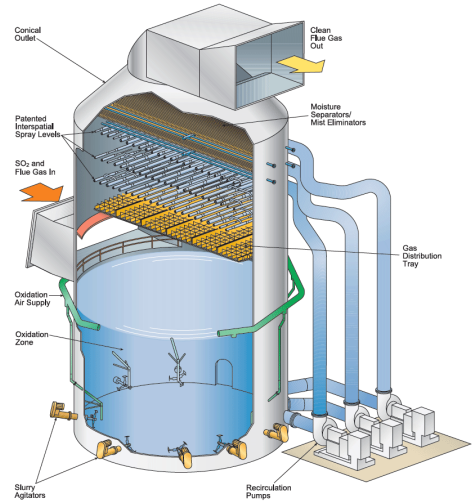


Image credit: Babcock & Wilcox, 2016

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

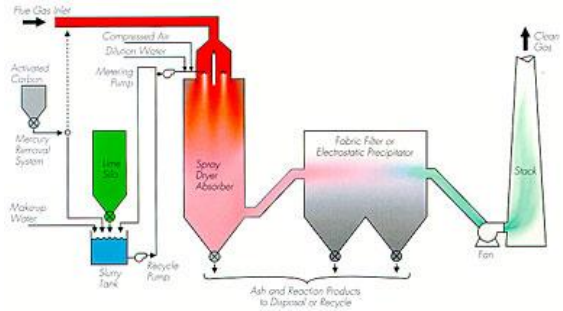


Image credit: Babcock & Wilcox, 2016

Evaluation of Additional Emission Reduction Opportunities

- Per *2018 PM2.5 Plan*, District pursuing the following potential opportunities to reduce NOx emissions for municipal waste-fired units to the extent that additional NOx controls are technologically and economically feasible:
  - Lowering NOx limit for units fired on Municipal Solid Waste from 165 ppmv @ 12% CO_2 to 110 ppmv @ 12% CO_2 over 24-hr period and 90 ppmv @ 12% CO_2 over annual period
  - Evaluating feasibility of even lower NOx limits
- District also evaluating feasibility of lower NOx emission limits for other solid fuel fired units

Control Technologies Under Evaluation

- Selective Non-Catalytic Reduction
- Selective Catalytic Reduction
- Gore De-NOx Filter Bags
- Covanta LN™
- Combination of controls

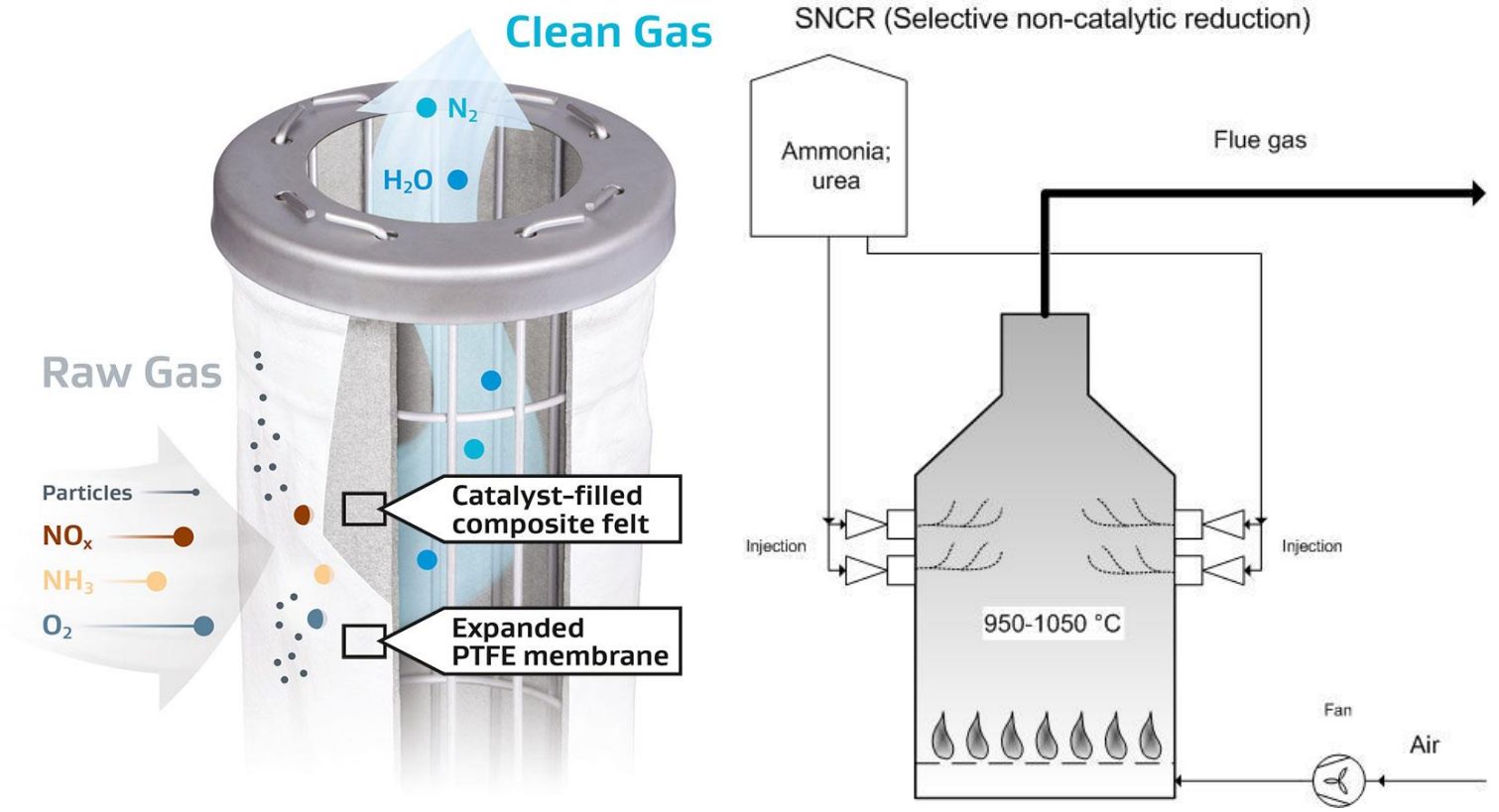


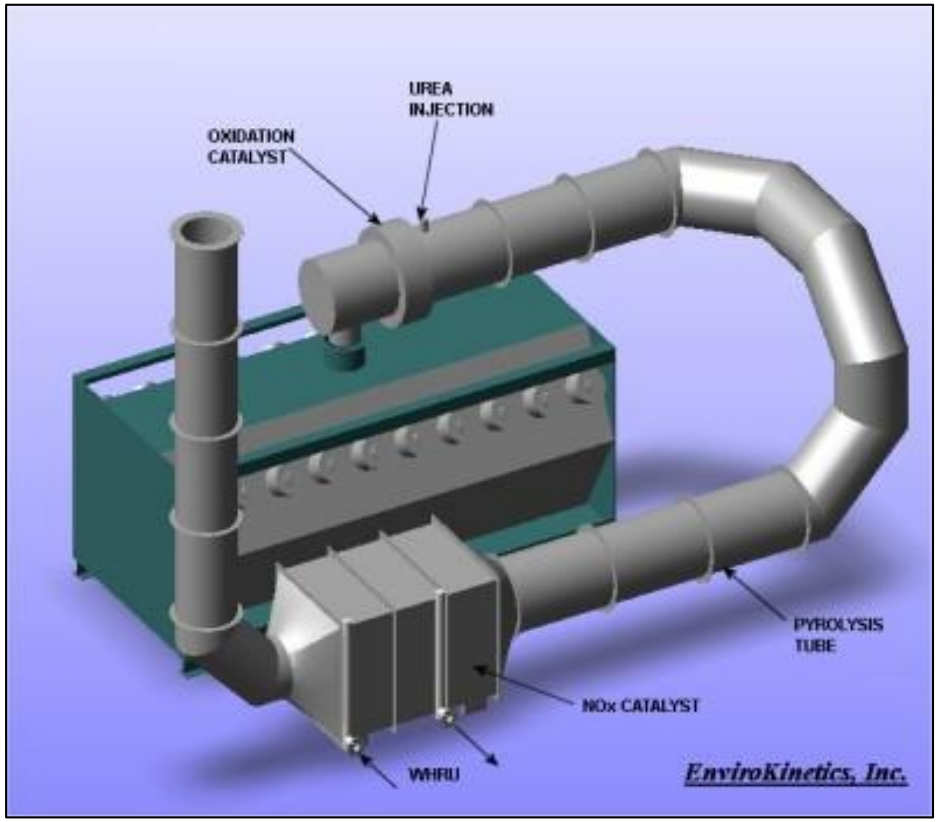
Image credit: W. L. Gore & Associates, Inc., Flemish Institute for Technological Research

Cost Assessment of Further Control Technology

- Sources for cost assessments
  - 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 NOx 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

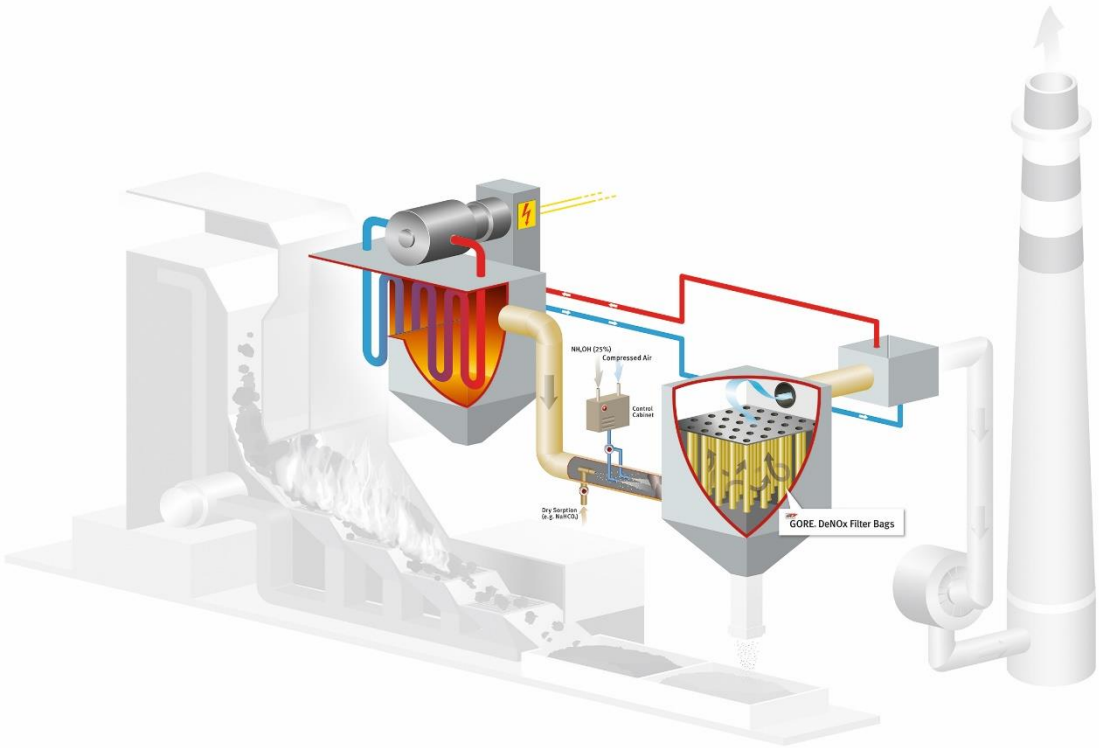


Image credit: W. L. Gore & Associates, Inc.

Covanta LN™

- Covanta LN™
  - Proprietary staged combustion air system for municipal waste combustors
  - Achieves further NOx control
  - Total Capital Cost: ~$5.5M
  - Operation & Maintenance Cost: ~$190K

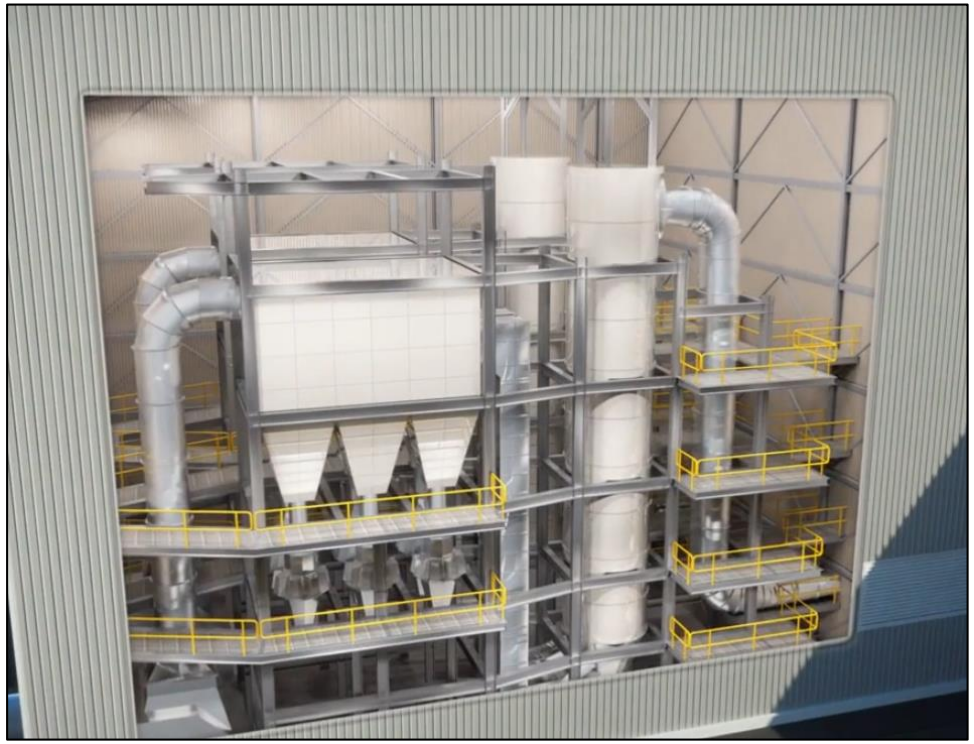
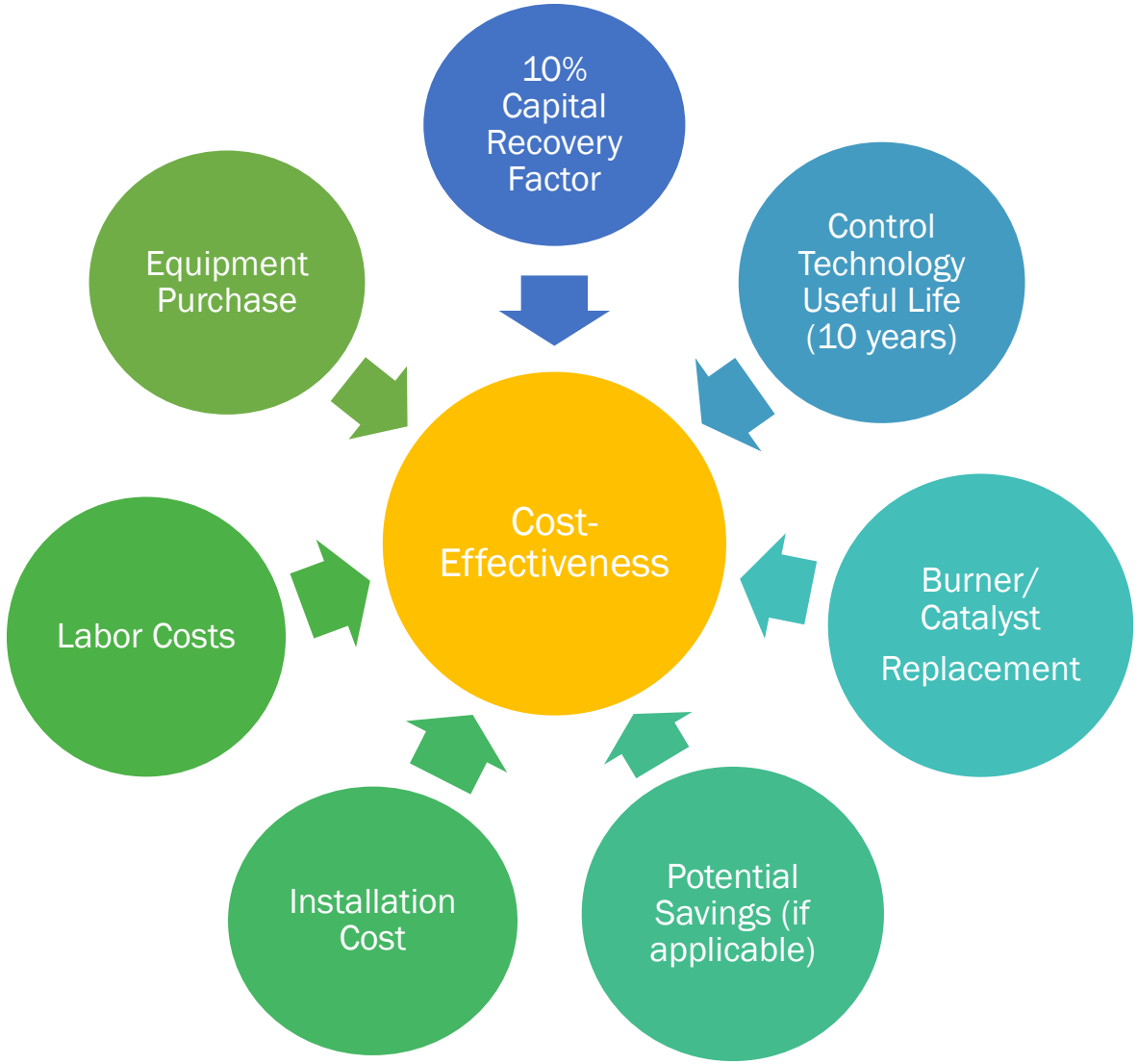


Image credit: Covanta Holding Corporation

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 NOx limits
  - Current NOx limit 165 ppm with SNCR as current control technology
  - Proposed lower NOx limit: 90 ppmv
- Proposing to establish PM10 emission limits within Rule 4352
  - Permit limits at 0.053 lbs/MMBtu
  - Considering limit of 0.04 lbs/MMBtu with baghouse as control system
- Proposing to establish SOx emission limits within Rule 4352
  - Permit limits at 0.09 lbs/MMBtu
  - Considering limit of 0.05 lbs/MMBtu with dry sorbent injection system as control
- Full compliance proposed to be required by January 1, 2024

Proposed Amendments to Rule 4352: Further Requirements for Biomass Facilities

- Proposing to lower existing NOx limits
  - Current NOx rule limits for Biomass: 90 ppmv NOx
  - Proposed lower NOx limit: 65 ppmv NOx
- Current PM10 limits for Biomass facilities established on facility permits
  - Considering establishing new PM10 limits within Rule 4352, under evaluation
- Current SOx limits for Biomass facilities established on facility permits
  - Considering establishing new SOx limits within Rule 4352, under evaluation

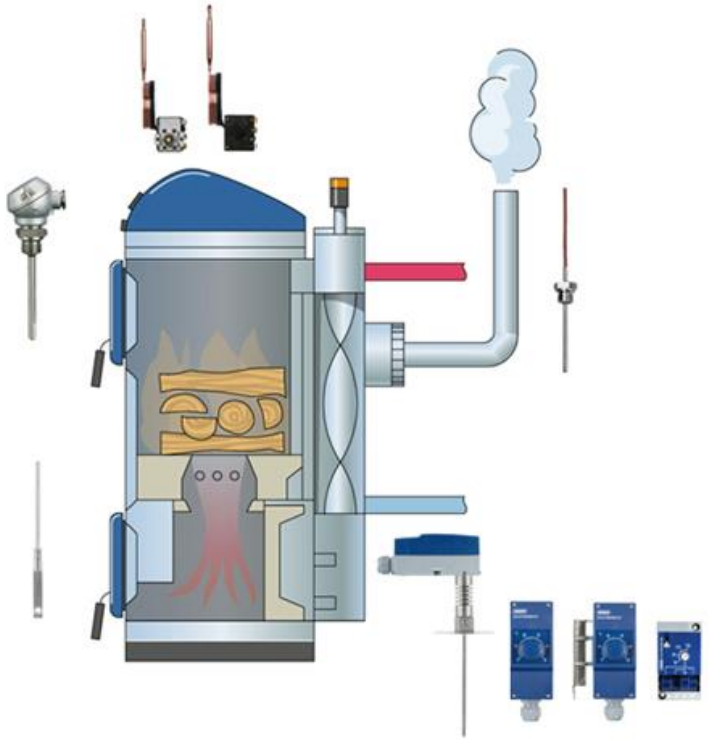
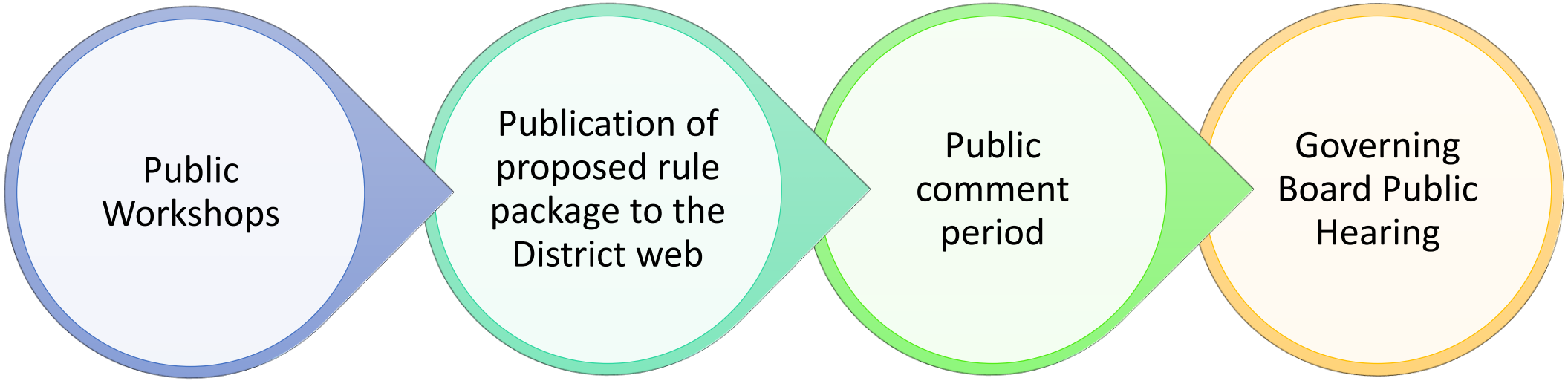


Image credit: Jumo, 2021

Next Steps

- Requesting comment on rule concepts by October 14, 2021
  - Draft rule to be published in coming weeks, with associated comment period
- Continued analysis of costs, cost-effectiveness of various controls, and feasibility of control requirements
- Socioeconomic Impact Analysis underway by third-party consultant to evaluate economic impacts of proposed amendments
  - Characterization of the Valley's economic climate
  - Evaluation of economic impacts
  - Socioeconomic Impact Analysis report
  - Results of analysis will be included with proposed rule packages
- Ongoing public engagement process

Public Engagement Process for Rule 4352 Amendment



Public Participation and Comment Invited throughout Process

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