A Quick Guide to Opportunities for Co-Benefits from Plant Optimization and Existing Pollutants Control Measures

Minamata Convention on Mercury (COP3)

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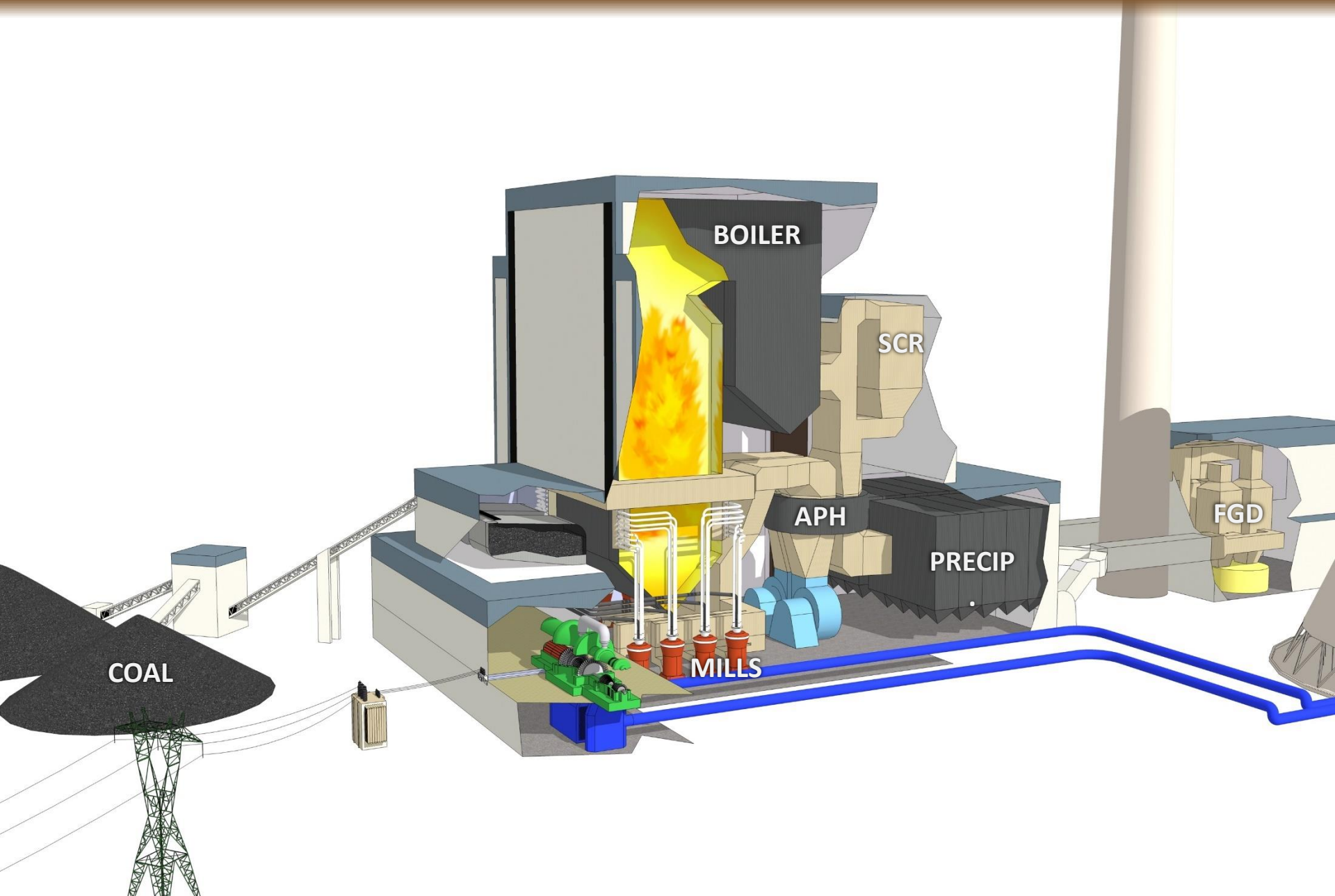
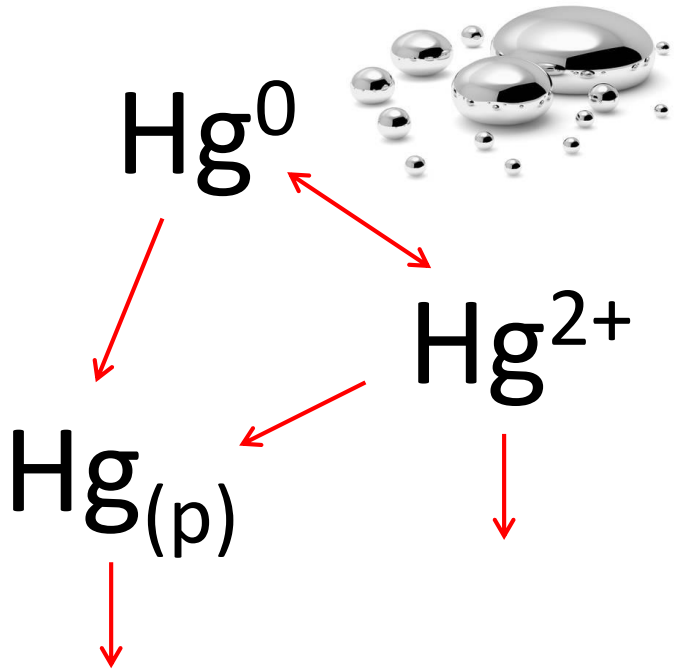
Coal-Boiler Boiler and Air Pollution Control Devices



Factors Affecting Mercury Emissions

- **Coal**
  - Mercury and sulfur content
  - Halogen content
  - Coal cleaning processes
- **Boiler Operation**
  - Combustion conditions
  - Flue gas conditions
  - Other operating conditions
- **Boiler Design/Other Emissions Control Systems**
  - Back-pass arrangement
  - Air pollution control devices (APCDs)

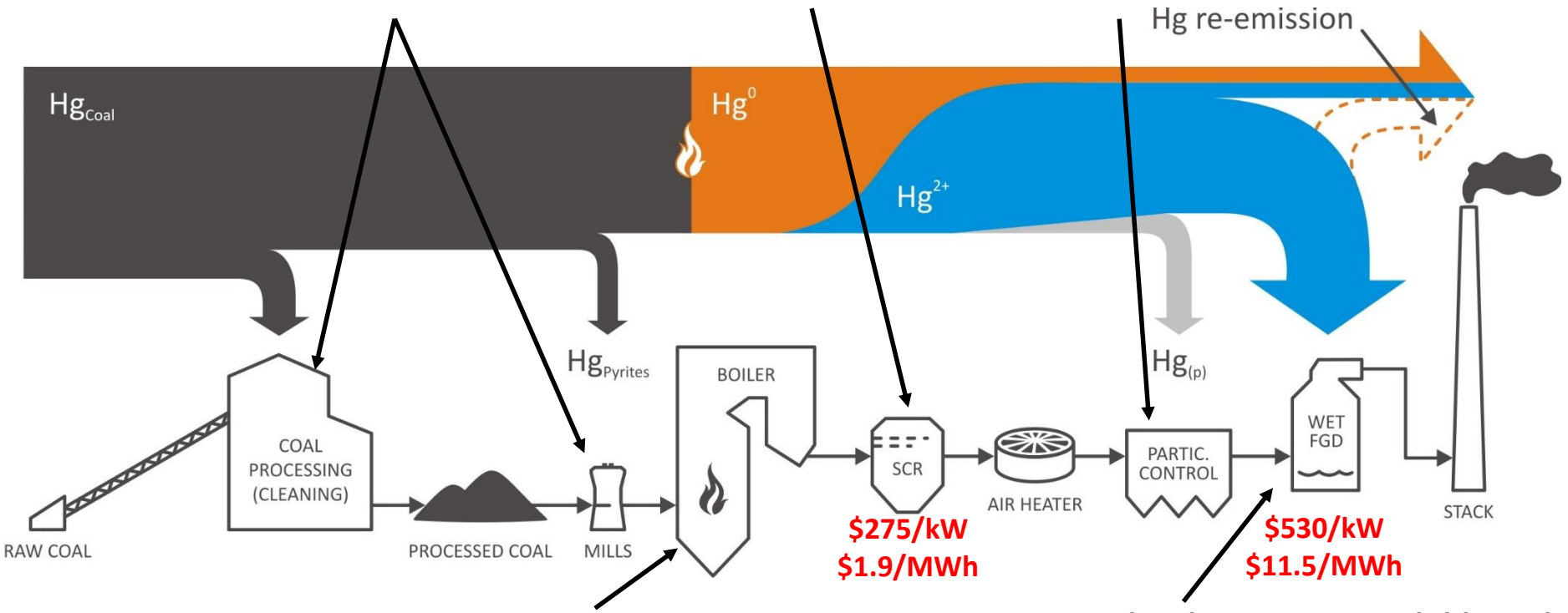


Fate of Mercury in Coal-Fired Boilers

Coal Hg can sometimes be selectively removed in the coal cleaning and milling processes.

Metal-oxide catalysts can oxidize a significant portion of Hg^0 and catalyst systems can reduce elemental mercury.

Oxidized Hg adsorbed by particulate matter in the flue gas can be collected in the particulate control device.



Boiler operating conditions can be adjusted to promote Hg oxidation and sorption onto the fly ash.

Oxidized Hg is water-soluble and conventional acid gas scrubbers can dispose oxidized Hg.

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Co-Benefit of Existing Pollutants Control Measures

❑Co-Benefit Methods of Control

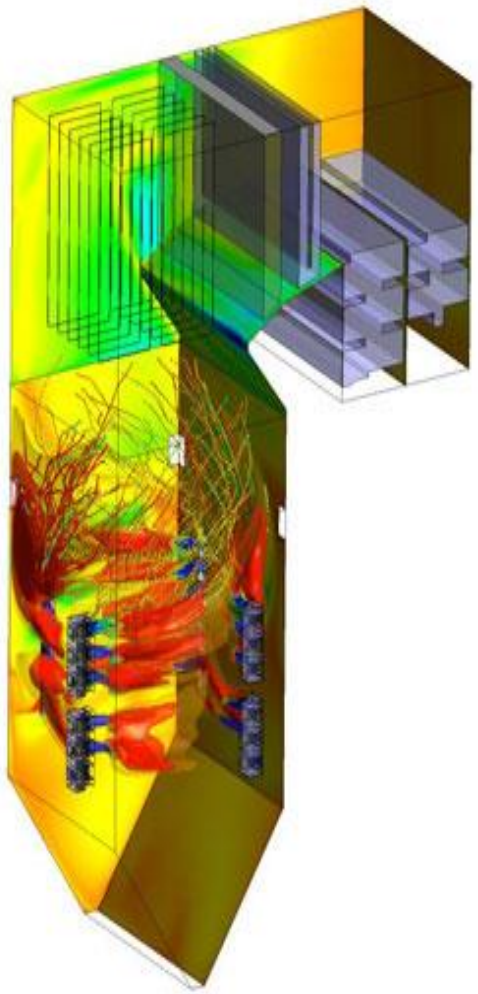
- Selective Catalytic Reduction (SCR) Systems – Increase mercury oxidation.
- Electrostatic Precipitators (ESP) and Baghouse Systems – Capture particle-bound mercury
- Wet Flue Gas Desulfurization (WFGD) Systems – Capture oxidized Hg. Mercury re-entrainment needs to be minimized.
- Dry Sorbent Injection Systems – Improves mercury capture by sorbent acting on SO_3 removal.

Direct Methods of Mercury Removal

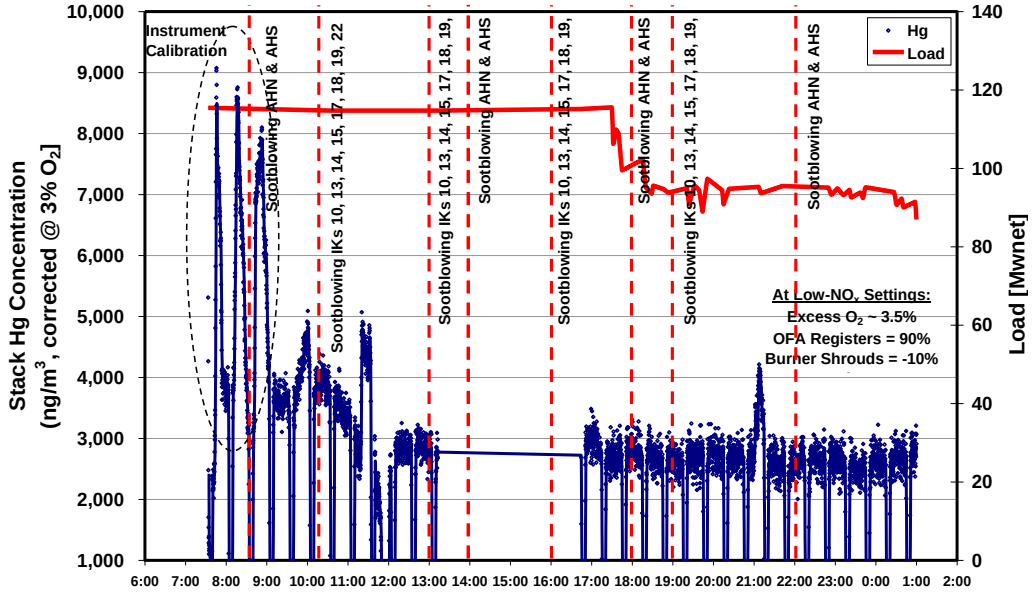
❑ Direct Methods of Control

- Activated Carbon Injection (ACI) – Uses Powdered Activated Carbon (PAC). Particulate control needed. Can be used in the WFGD.
- Halogen Addition – Injected with the coal. Promotes mercury oxidation for fly ash and WFGD capture.
- WFGD Additive – Proprietary and sulfide based reagents prevent mercury re-entraintment.

Mercury Optimization in Boilers



- Boiler controllable parameters impact combustion in the furnace
- Those parameters impact gas temperatures and fly ash characteristics
- Fly ash with higher unburned carbon, smaller size and larger porosity works better for mercury reduction
- Mercury can be reduced 50% in average by boiler tuning. Heat rate trade-off?



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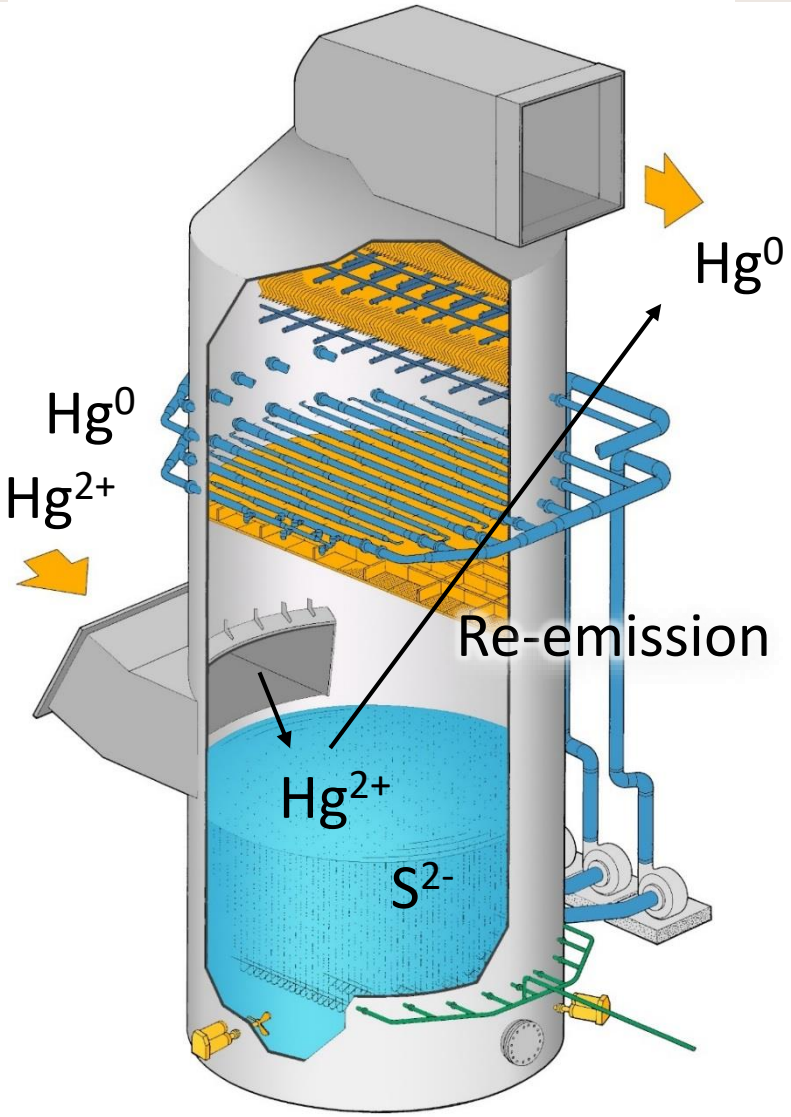
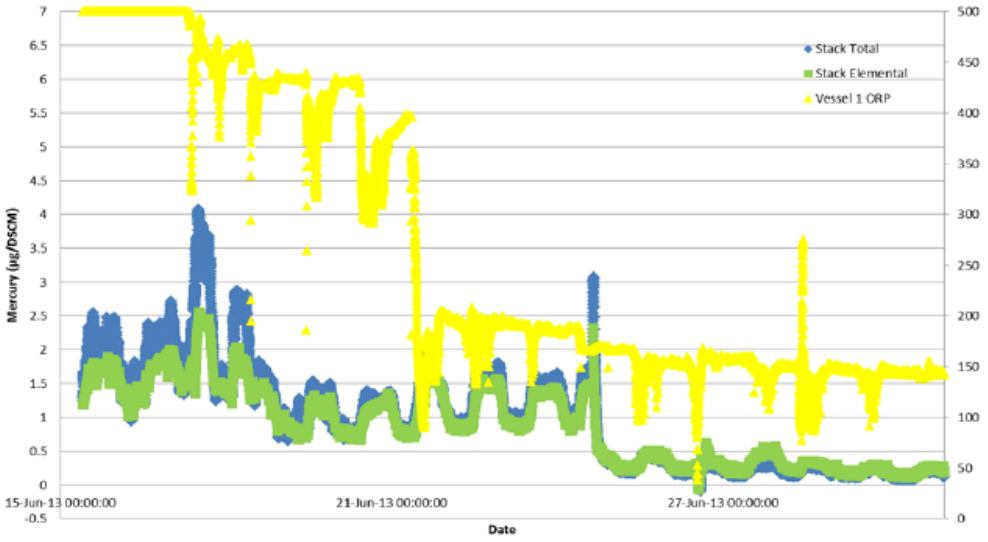
Mercury Optimization in Wet FGDs



- Wet FGD's in combination with SCR control devices can achieve mercury removals up to 95%.
- Hg^{2+} is absorbed in the FGD liquid slurry and reacts with sulfides from the flue gas.
- More sulfides reduce Hg^{2+} to Hg^0 (re-emission).
- ORP is used as an indicator of mercury control in Wet FGD.



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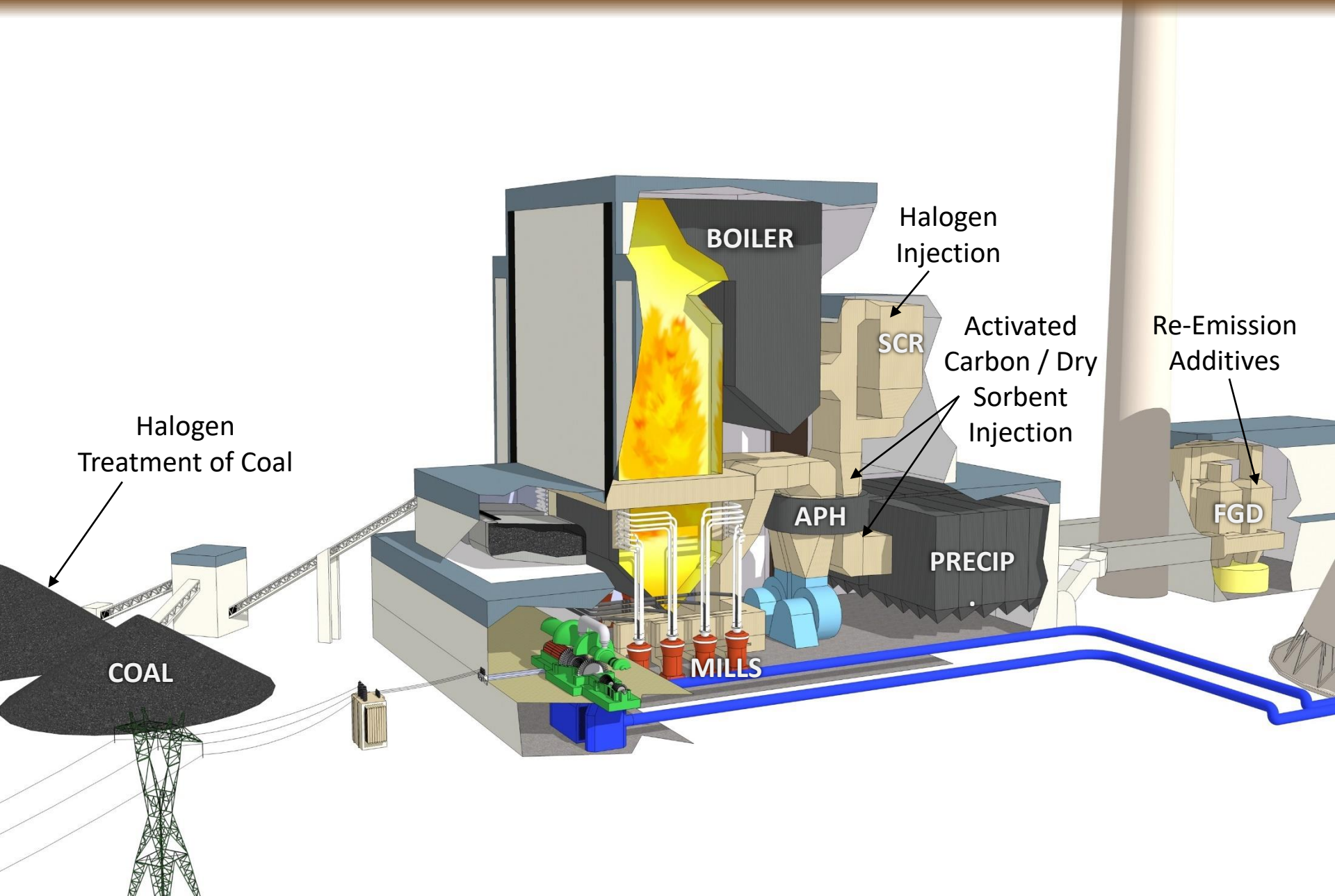
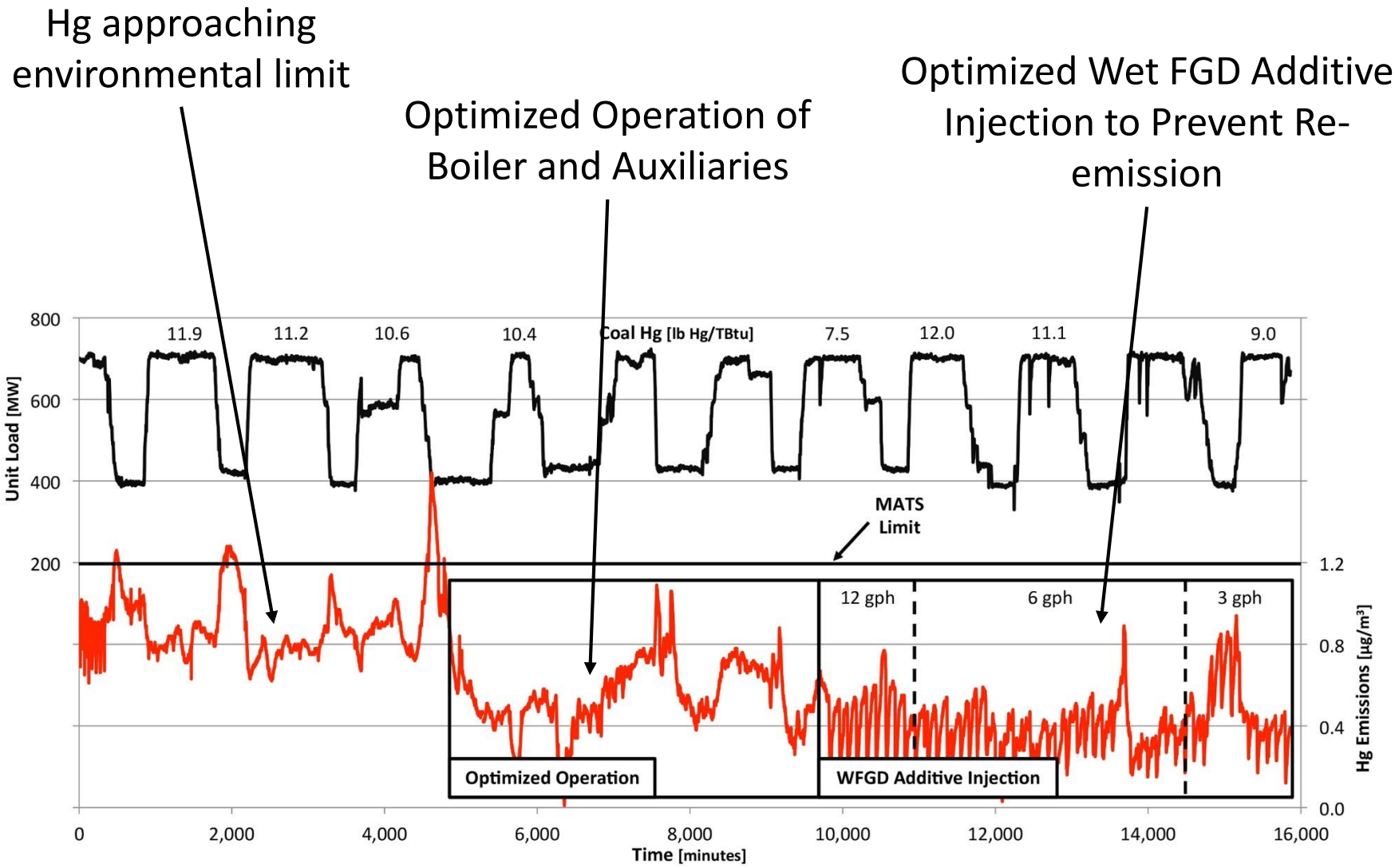
Direct Methods of Mercury Removal



Example of Optimized Operation



A Holistic Approach to Mercury Emissions Control Can Result in $ Millions Annual Savings

- ❑ Optimization of Current Boiler Operation
- ❑ Installation of Co-Benefit Equipment*
- ❑ Optimization of APCD Operation
- ❑ Installation of Mercury Control Technology
- ❑ Optimization of Mercury Control System

**As required by regulation on other pollutants*

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Thank You!!!

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