Interactions Between SO_3, HCl, HBr, PM and Trona Injection in DSI

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McIlvaine Company Hot Topic Hour on
"SO_3 Measurement and Control"
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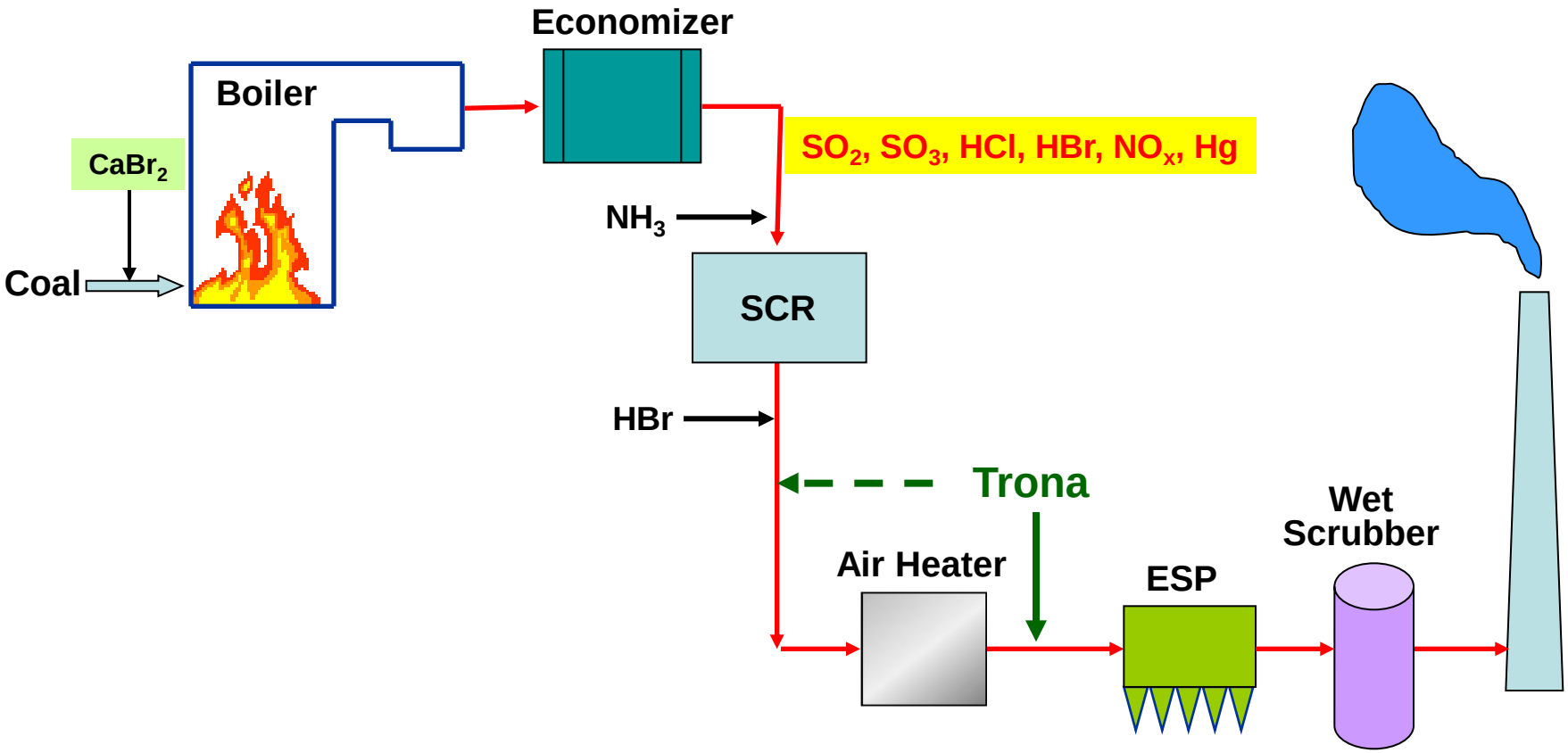
Regulations

- **MATS - coal-fired boilers**
  - HCl: 0.002 lb/mmBTU
  - Mercury: 1.2 lb/TBTU
  - PM: 0.03 lb/mmBTU

- **Proposed Industrial Boiler MACT – solid fuel**
  - HCl: 0.022 lb/mmBTU

Trona Injection to Mitigate Acid Gases



Chemical Reactions in Flue Gas

Trona Calcination

$$2(Na_2CO_3 \cdot NaHCO_3 \cdot 2H_2O)\ (s) \rightarrow 3Na_2CO_3(s) + 5H_2O(g) + CO_2(g)$$

Acid Gas Neutralization Reactions

$$Na_2CO_3 + SO_2 + 1/2O_2 \rightarrow Na_2SO_4 + CO_2$$

$$Na_2CO_3 + SO_3 \rightarrow Na_2SO_4 + CO_2$$

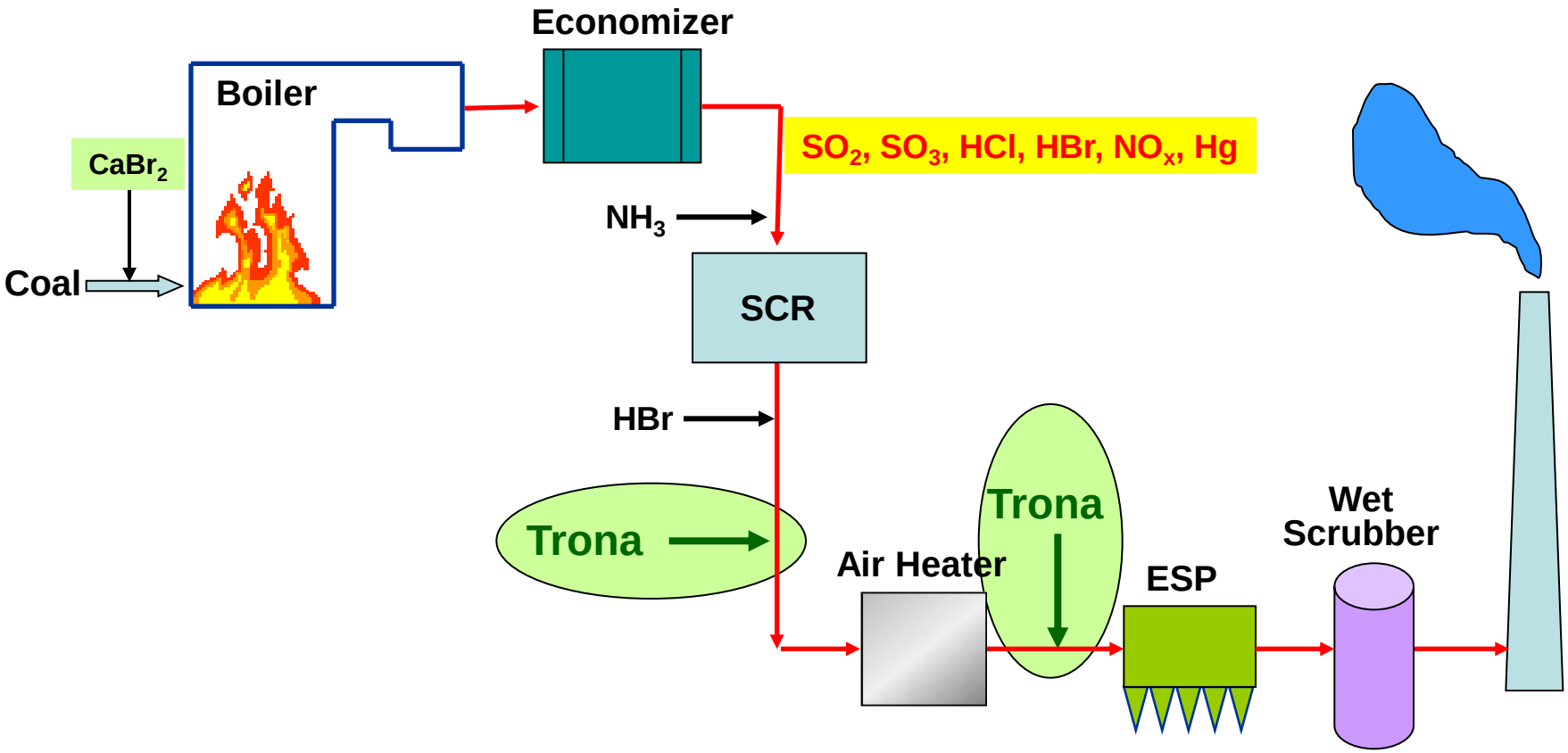
$$Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$$

$$Na_2CO_3 + 2HBr \rightarrow 2NaBr + H_2O + CO_2$$

Chemical Reactions in Flue Gas

- $Na_2CO_3 + SO_3 \rightarrow Na_2SO_4 + CO_2$
  - Sometimes SO_3 is used to condition fly ashes to enhance ESP performance.
  - Trona is effective in mitigating SO_3 and can lower the ash resistivity thus conditioning the ESP. However trona does add the dust load for ESP and may cause a problem on undersized units.
- $Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$
- $Na_2CO_3 + 2HBr \rightarrow 2NaBr + H_2O + CO_2$
  - HCl and HBr can oxidize mercury, thus enhance mercury removal.
  - HCl is the surrogate for all acid gases in both MATS (Utility MACT) and Boiler MACT.

Solution: Location!



Summary

- **Flue gas treatment has become a chemical processing plant**
  - Treating one component can affect others
  - Good understanding of chemistries helps
  - Apply system approach
- **All parties need to work closely, especially the one who designs and integrates the system should involve all suppliers in the trial and design of permanent systems.**

Questions?

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