Dry Injection of Sodium Sorbents to Mitigate HCl, SO_2, SO_3 and Mercury from Cement Kilns

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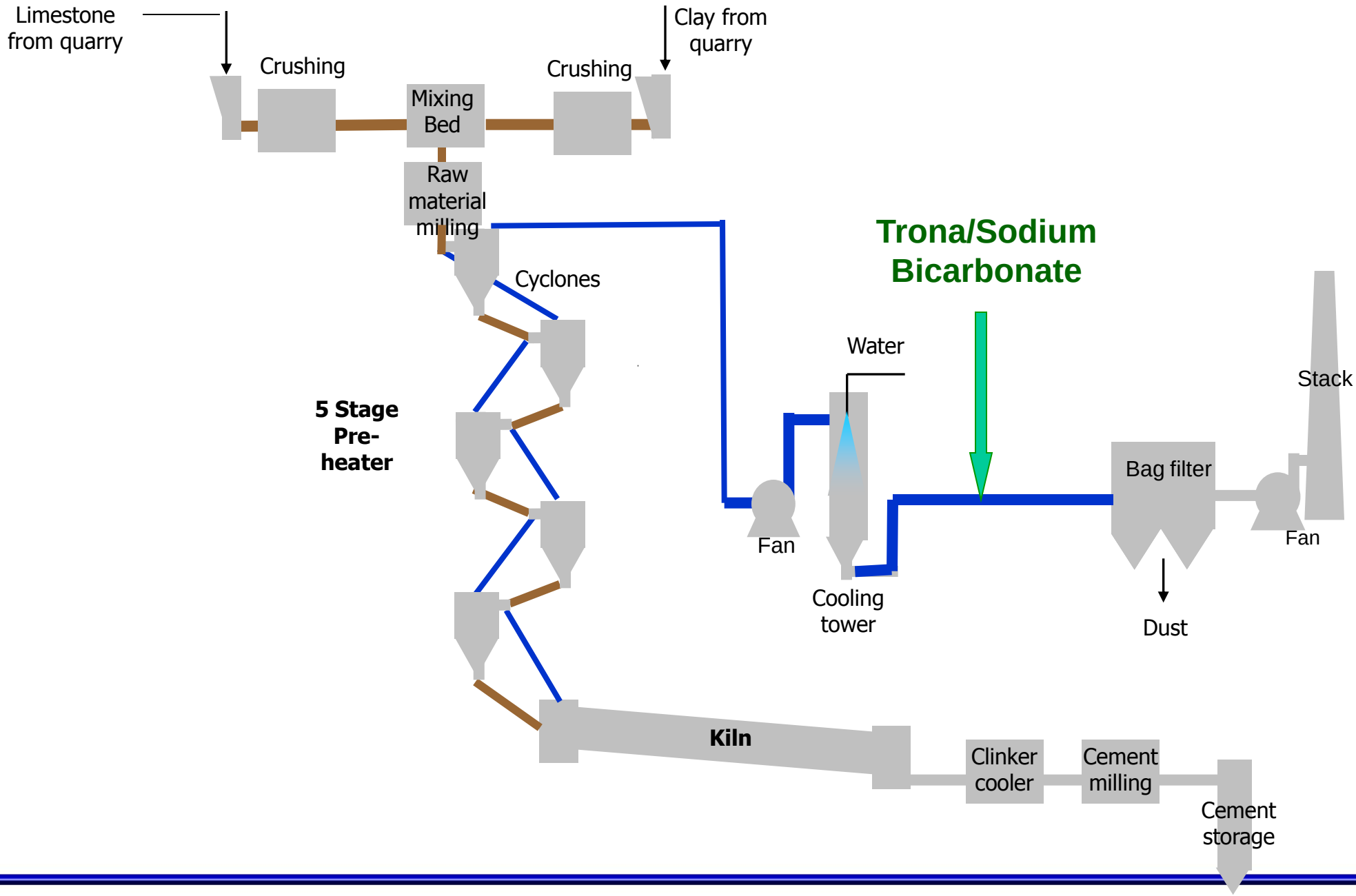
Solvay Chemicals

Air Pollutants from Cement Kilns

- HCl
- SO_2, SO_3
- Mercury
- Total Hydrocarbons (THC)
- PM

Typical Dry Injection

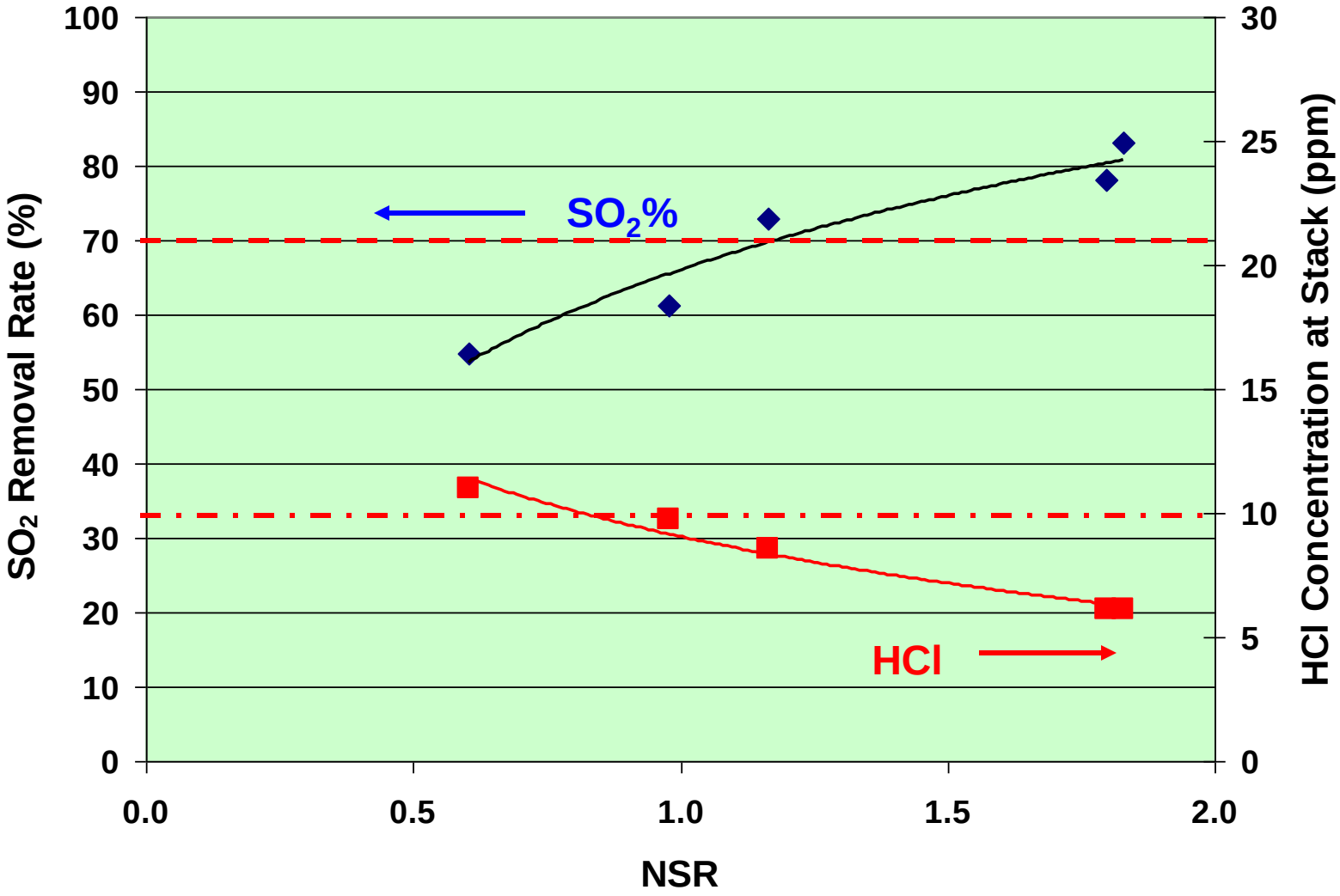


Dry Injection of Sodium Bicarbonate

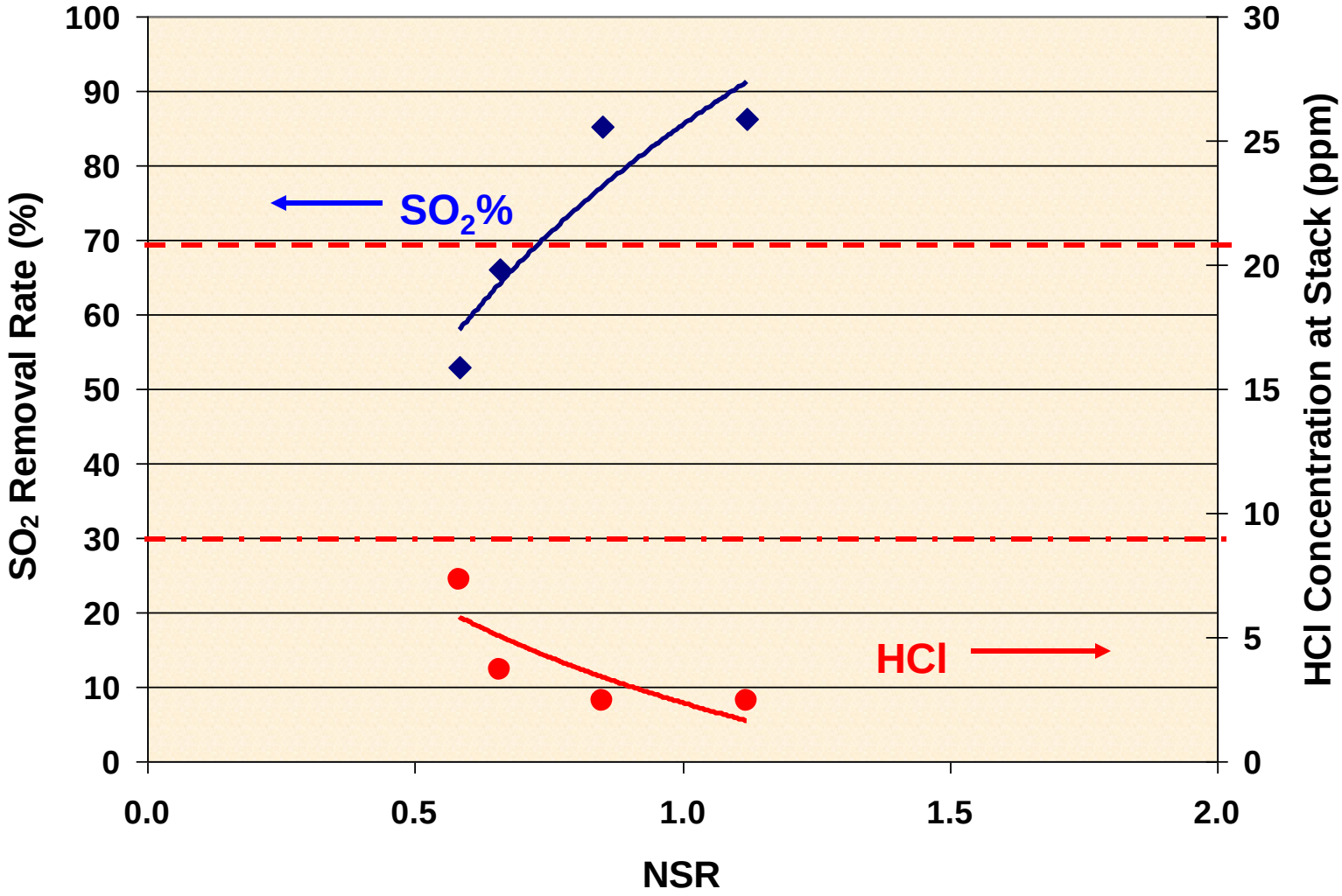
- SOLVAir® European Experience

- **Cement plant in France: two kilns. One with bag house and the other with ESP.**
- **Sodium bicarbonate (Bicar) injected into flue gas duct upstream of baghouse and ESP @ 340 ^{o}F**
- **Targets:**
  - **SO_2 removal rate > 70%**
  - **HCl at stack < 10 mg/NM^3 (6 ppm)**

Sodium Bicarbonate Injected Upstream of ESP



Sodium Bicarbonate Injected Upstream of Bag House



Trona Addition to Feed Materials

- SOLVAir® US Experience

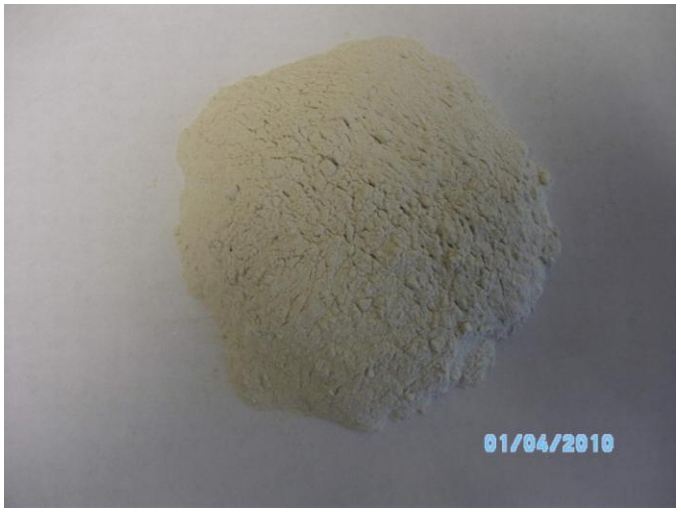
- **Plant:**
  - **CEMEX Cement Plant in Odessa, Texas**
- **Problems:**
  - **High volatile concentrations in clinker due to high sulfur in the fuel caused overheating of the chain section, and ring formation in the pre-heater and kiln, which in turn reduced kiln draft, and caused tower plugs and more ring formation, then loss of production and down time.**
    - **High alkali causes a light powdery build up but high sulfur causes a hard solid build up.**
  - **Stack Emissions**
- **Solution:**
  - **Add trona to the feed.**

Results at CEMEX Odessa Plant

- **Reduced ring formation in Kiln**
  - **If no trona added, the ring would be formed by sulfur in ~ 18 hours**
- **Reduced build-up in pre-heater tower**
- **Removed some SO_2/SO_3**

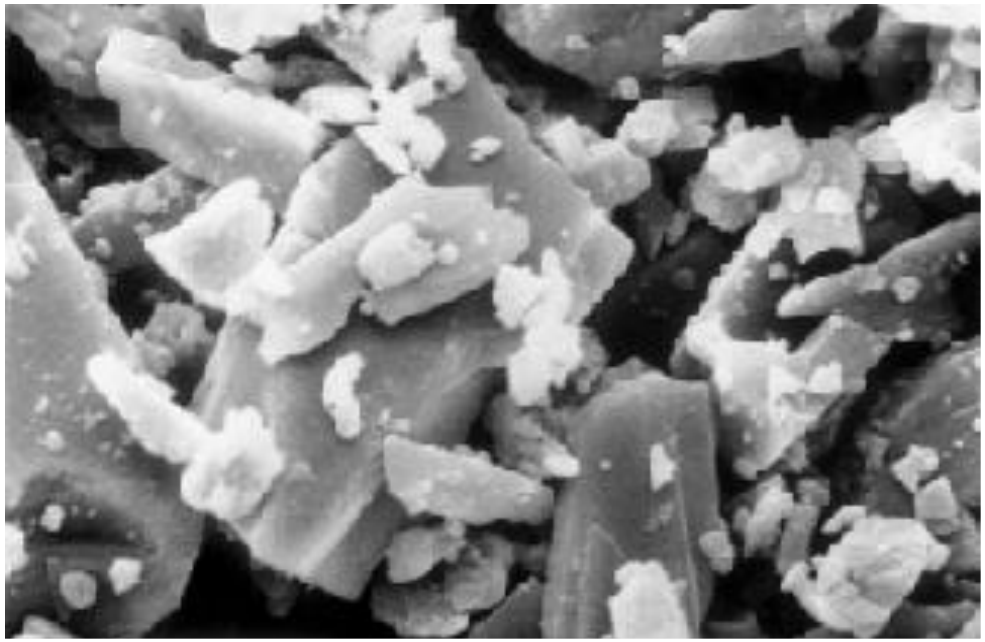
What is Trona?

- Trona is an ore mined underground
- Trona is naturally formed sodium sesquicarbonate ($Na_2CO_3 \bullet NaHCO_3 \bullet 2H_2O$)
- Green River, Wyoming, has billions of tons of Trona

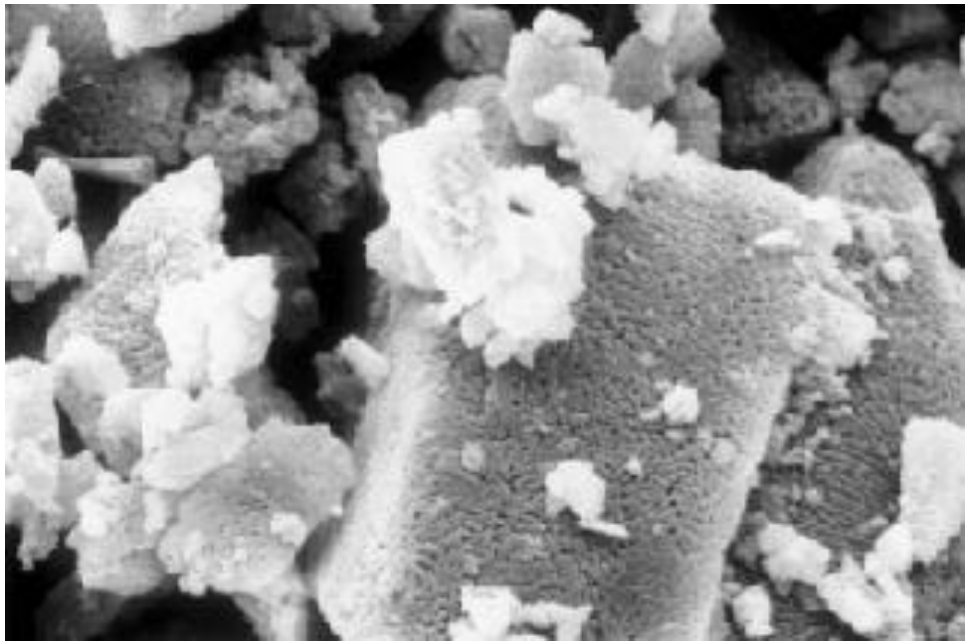


Trona Calcination After Injection

Raw Ground Trona



Trona Heated at > 275 ºF

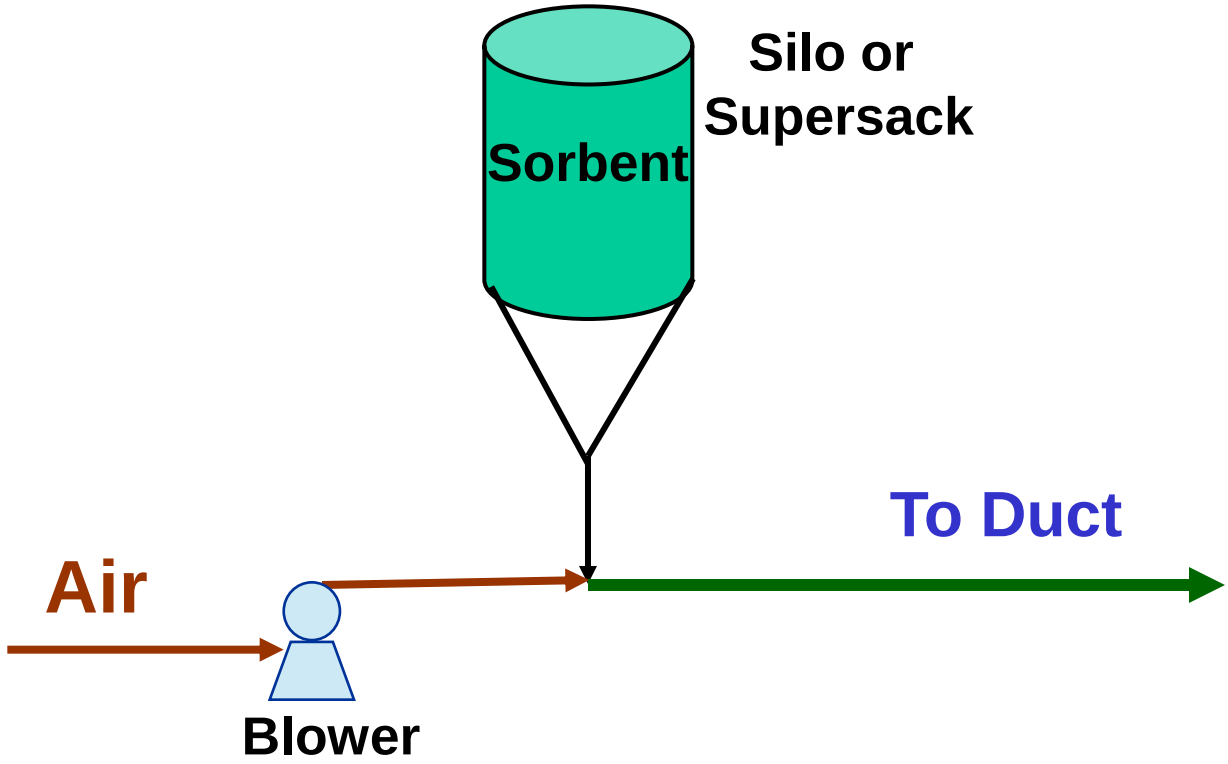


$$2(Na_2CO_3 \cdot NaHCO_3 \cdot 2H_2O)(s) + \text{heat} \rightarrow 3Na_2CO_3(s) + 5H_2O(g) + CO_2(g)$$

Sodium Bicarbonate

- **Existing product: SOLVAir® Select SBC**
  - **Raw**
    - **D_{50}: ~ 110 µm**
    - **D_{90}: ~ 250 µm**
  - **After Milling**
    - **D_{50}: ~ 15 µm**
    - **D_{90}: ~ 40 µm**
- **Upcoming product: SOLVAir® Select 300**
  - **A new plant designed and built for air pollution control.**
  - **Start up in 03/2010**

Typical Dry Injection System



* A mill is needed to use sodium bicarbonate

Guidelines of Dry Injection System

- Distribute dry sorbent evenly in flue gas so that the sorbent and acid gases are well mixed.
- Residence time: > 1 second
- Flue gas temperature: 275 ~ 1500 ^{o}F
- Conveying air: < 140 ^{o}F
- SOLVAir® Products Group is able to assist with the design.

Summary

- **Sodium sorbents (trona or sodium bicarbonate) can be added either to the feed or injected into the flue gas duct upstream of bag house or ESP.**
- **Sodium sorbents are effective in removing HCl, SO_2 and SO_3 which enhances mercury removal.**
- **SOLVAir® Products Group is ready to apply the experiences learned in Europe to the cement industry in USA.**

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