

HCl Removal in the Presence of SO₂ Using Dry Sodium Sorbent Injection

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Dry Sodium Sorbent Injection Proven results - Again

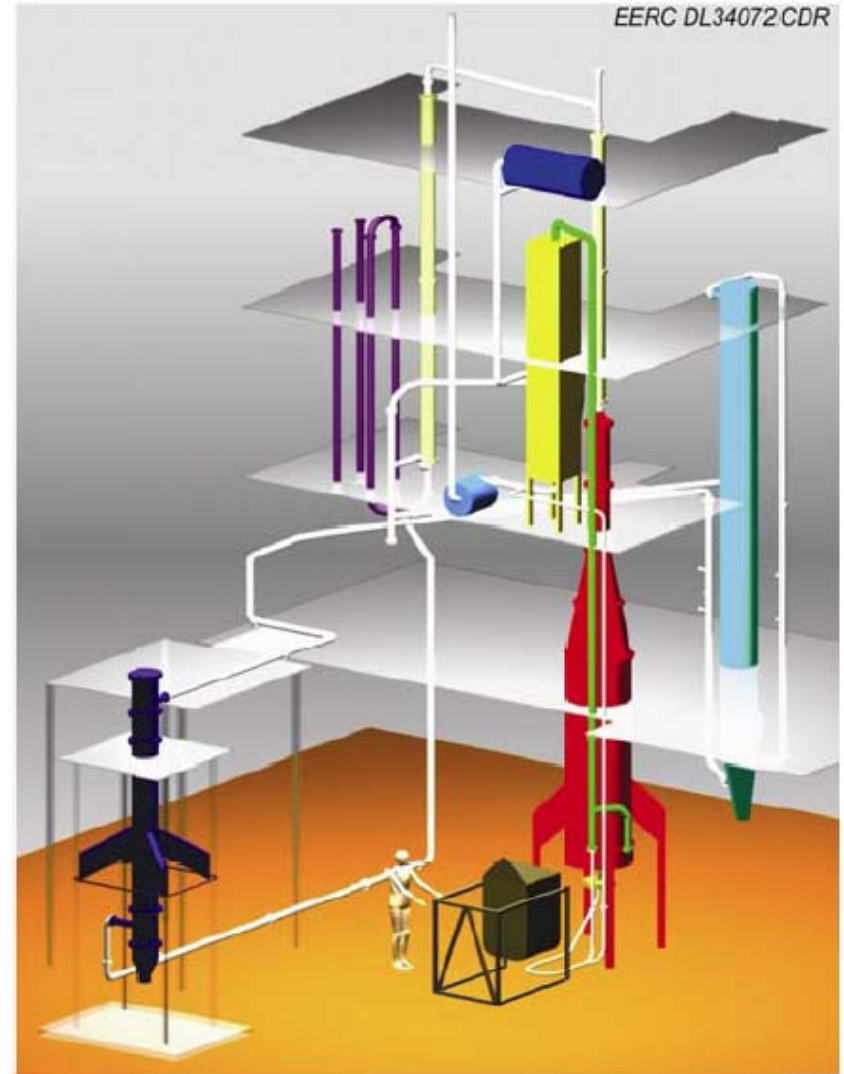
The recent EPA proposals for controlling HAPs, specifically HCl had raised questions regarding the efficacy of sodium DSI systems to treat high levels of HCl in the presence of SO₂.

Solvay Chemicals' SOLVAir Solutions group contracted a series of pilot tests to model coal fired power plants using moderate sulfur coal with high levels of chlorides.

As expected, sodium sorbents were easily able to achieve compliance even with the tightest emissions levels.

Test at EERC, University of North Dakota

- ◆ A pilot plant
- ◆ Central Appalachian Coal (CAPP)
- ◆ Two PM control devices
 - ESP
 - Bag house
- ◆ Four sodium sorbents and one hydrated lime
- ◆ Flue gas duct diameter: 6". The small duct size results in almost perfect mixing between sorbent and flue gas, and consequently much better HCl and SO₂ mitigation performance than with utility boilers.



CAPP Coal Analyses

| Proximate Analysis, as Received,% | Sample I | Sample II |
|-----------------------------------|----------|-----------|
| Moisture | 2.79 | 2.64 |
| Volatile Matter | 33.76 | 33.24 |
| Fixed Carbon | 52.16 | 52.26 |
| Ash | 11.29 | 11.85 |
| Ultimate Analysis, as Received,%) | | |
| Hydrogen | 5.04 | 5.05 |
| Carbon | 71.63 | 72.63 |
| Nitrogen | 1.22 | 1.22 |
| Sulfur | 0.78 | 0.78 |
| Oxygen (Ind) | 10.05 | 8.48 |
| Ash | 11.28 | 11.85 |
| Heat value (BTU/LB) | 11496 | |
| Chlorine, µg/g | 954-970 | |

Sorbents

◆ Trona (S200)

- d_{50} : 30 μm

◆ Milled Trona (S250)

- d_{50} : 15 μm , d_{90} : 60 μm

◆ Milled Sodium Bicarbonate (S350)

- d_{50} : 12 μm , d_{90} : 40 μm

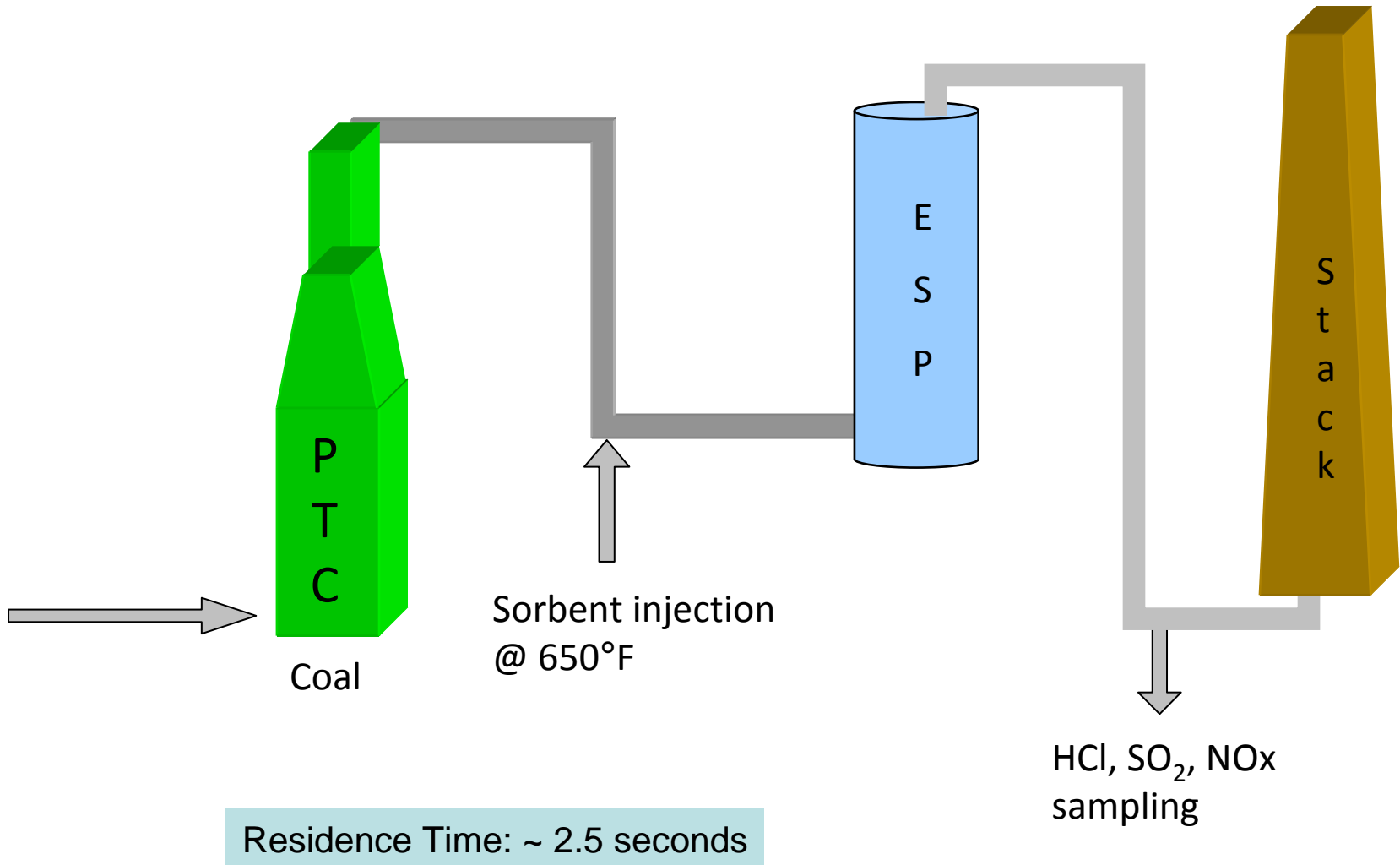
◆ Finely Milled Sodium Bicarbonate (S450)

- d_{50} : 7 μm , d_{90} : 17 μm

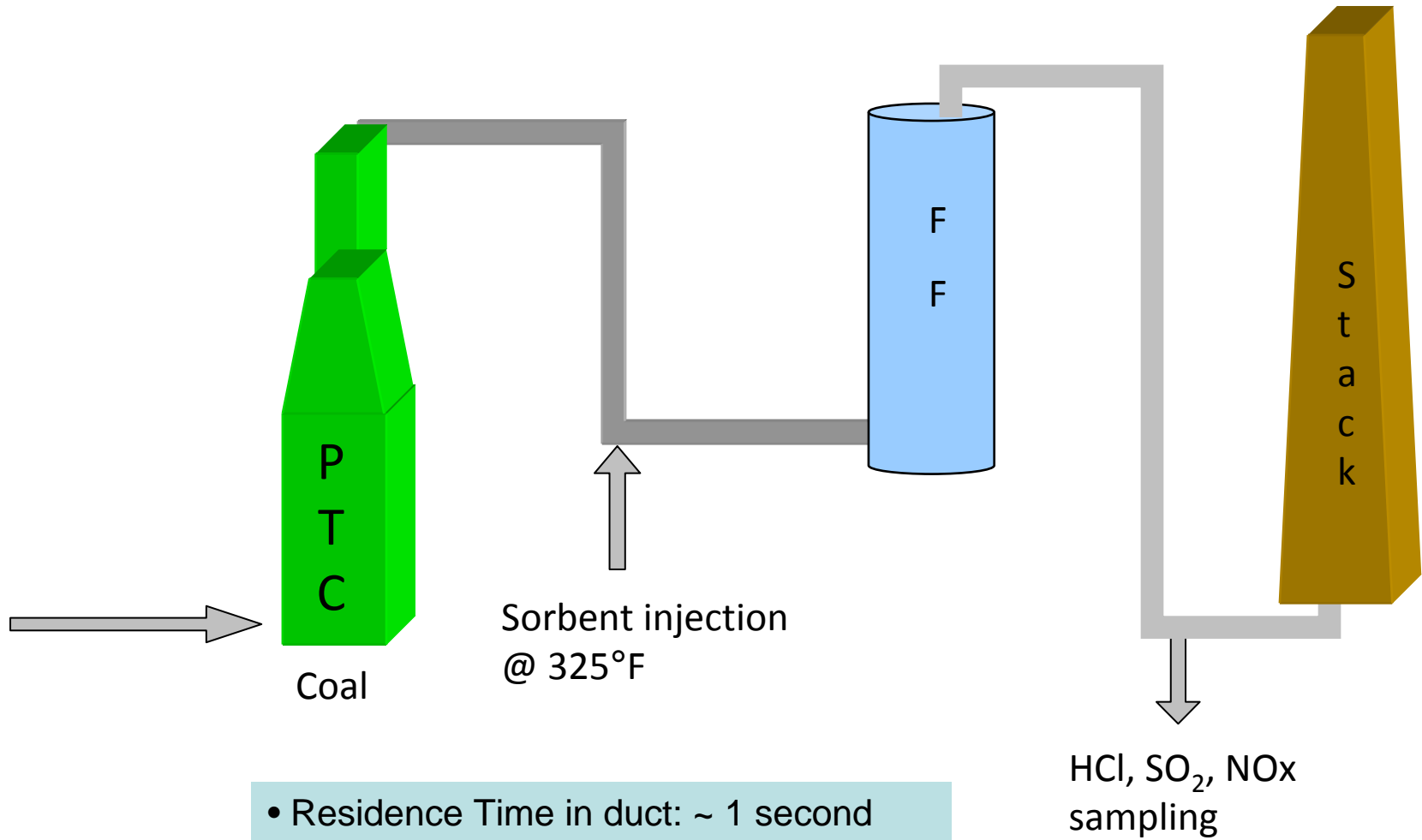
◆ Hydrated Lime

- d_{90} : 45 μm , purity: 96.8%

Injection Upstream of ESP



Injection Upstream of Baghouse

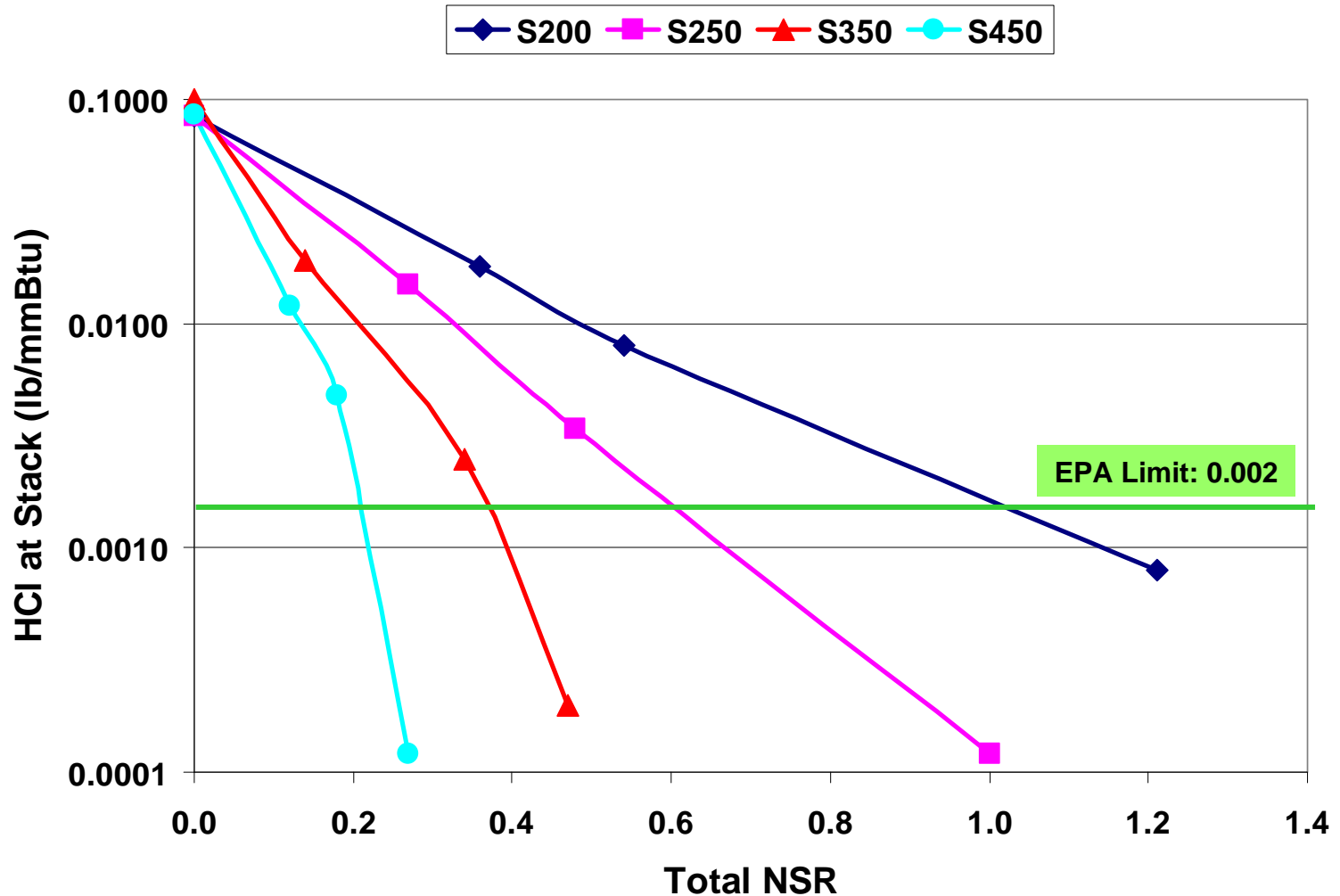


- Residence Time in duct: ~ 1 second
- Baghouse was cleaned before each run

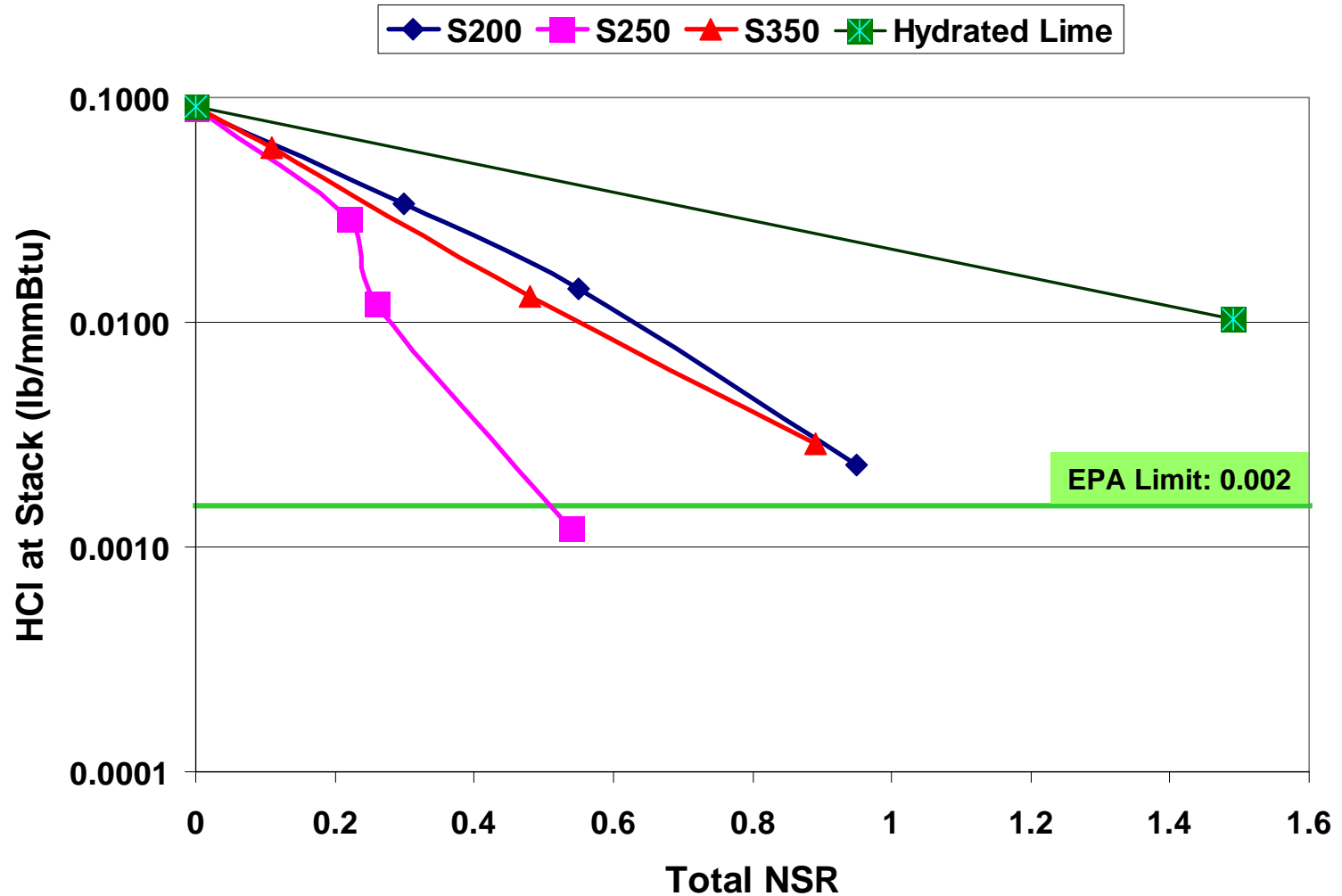
Sorbent Performance

HCl Removal

HCl Removal with Sorbent Injected at ESP Inlet



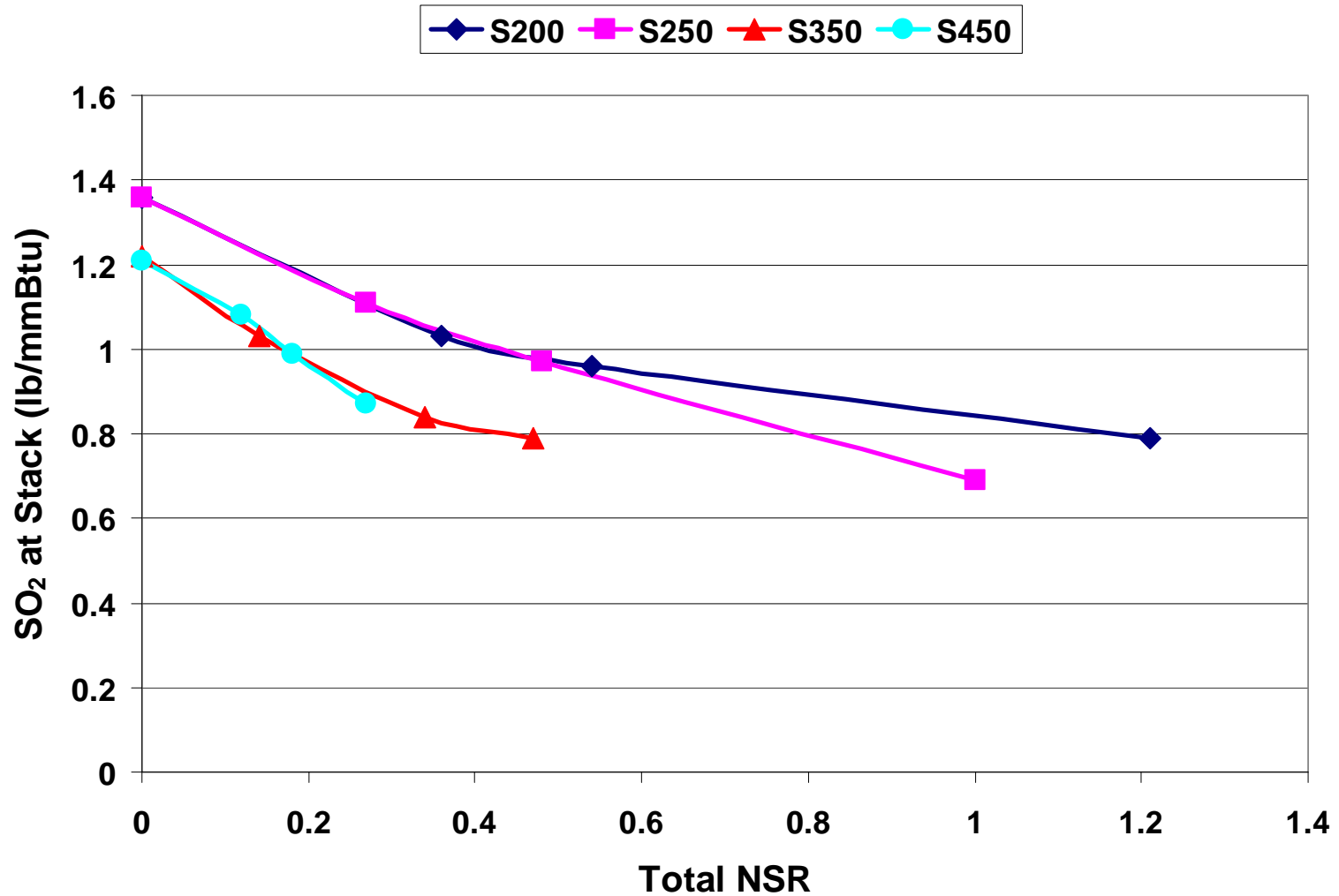
HCl Removal with Sorbent Injected at Baghouse Inlet



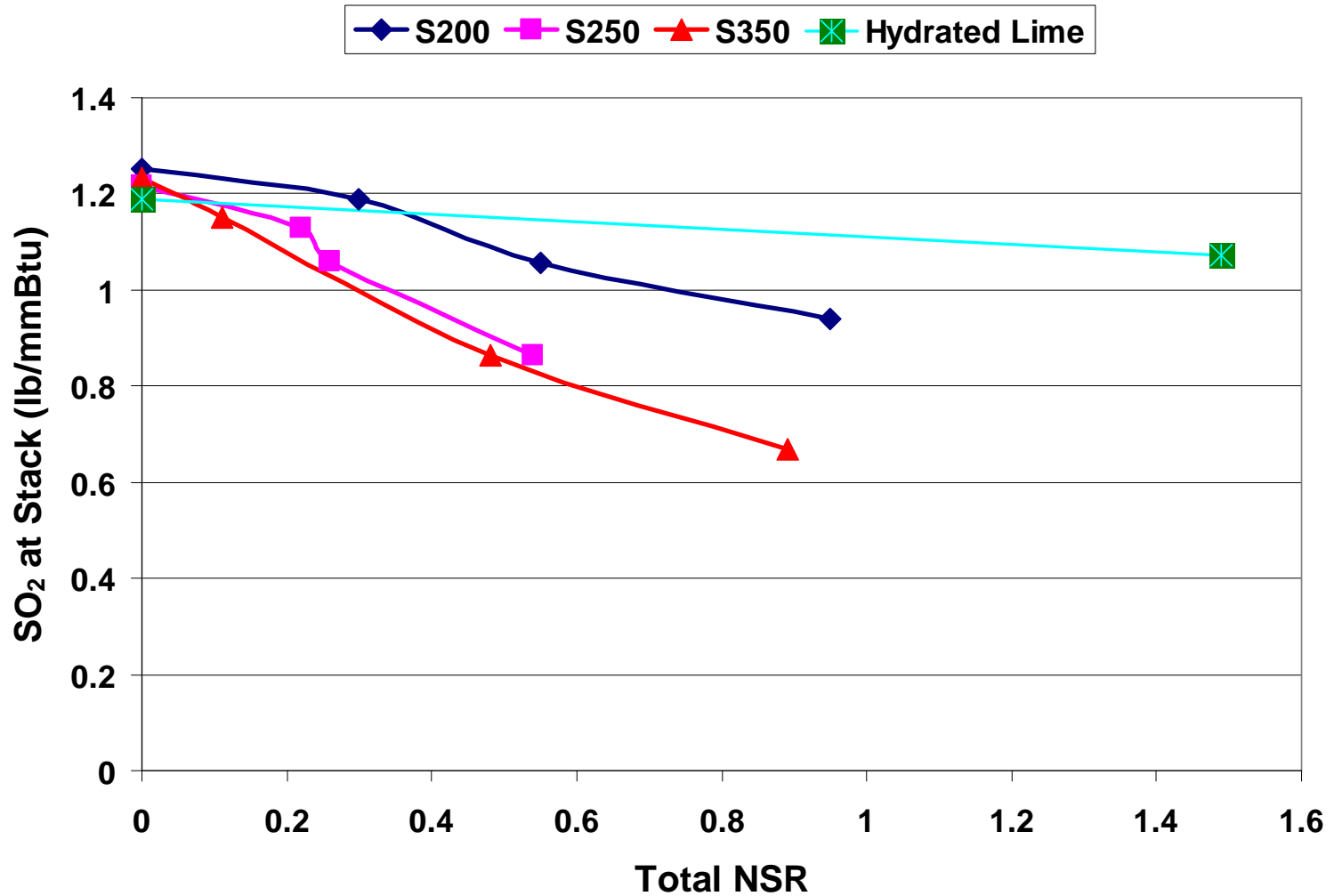
Sorbent Performance

Some SO₂ is unavoidably removed coincident with the removal of HCl. Higher reactivity rates of HCl than SO₂ would suggest lower levels of SO₂ removal

SO₂ Removal with Sorbent Injected at ESP Inlet



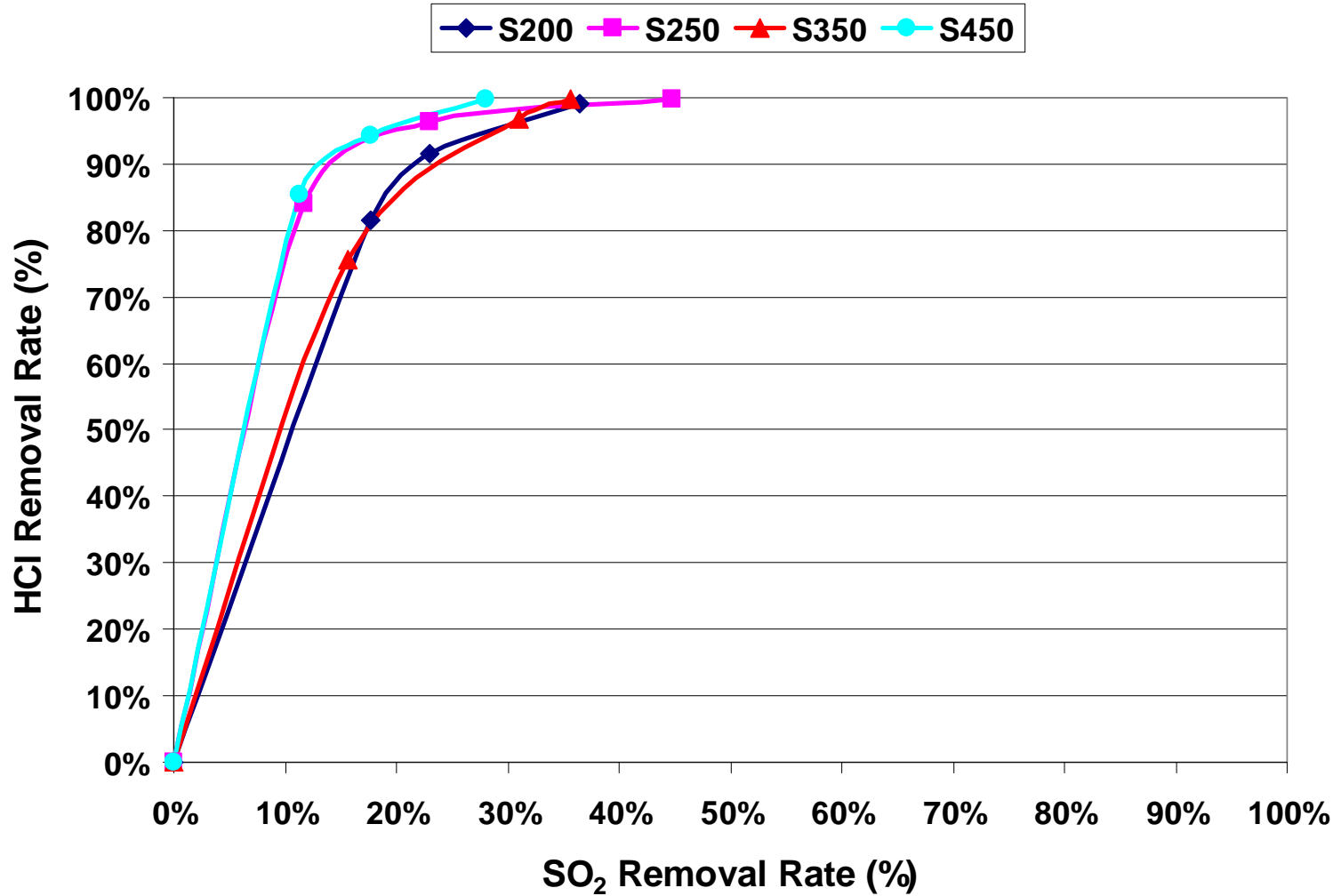
SO₂ Removal with Sorbent Injected at Baghouse Inlet



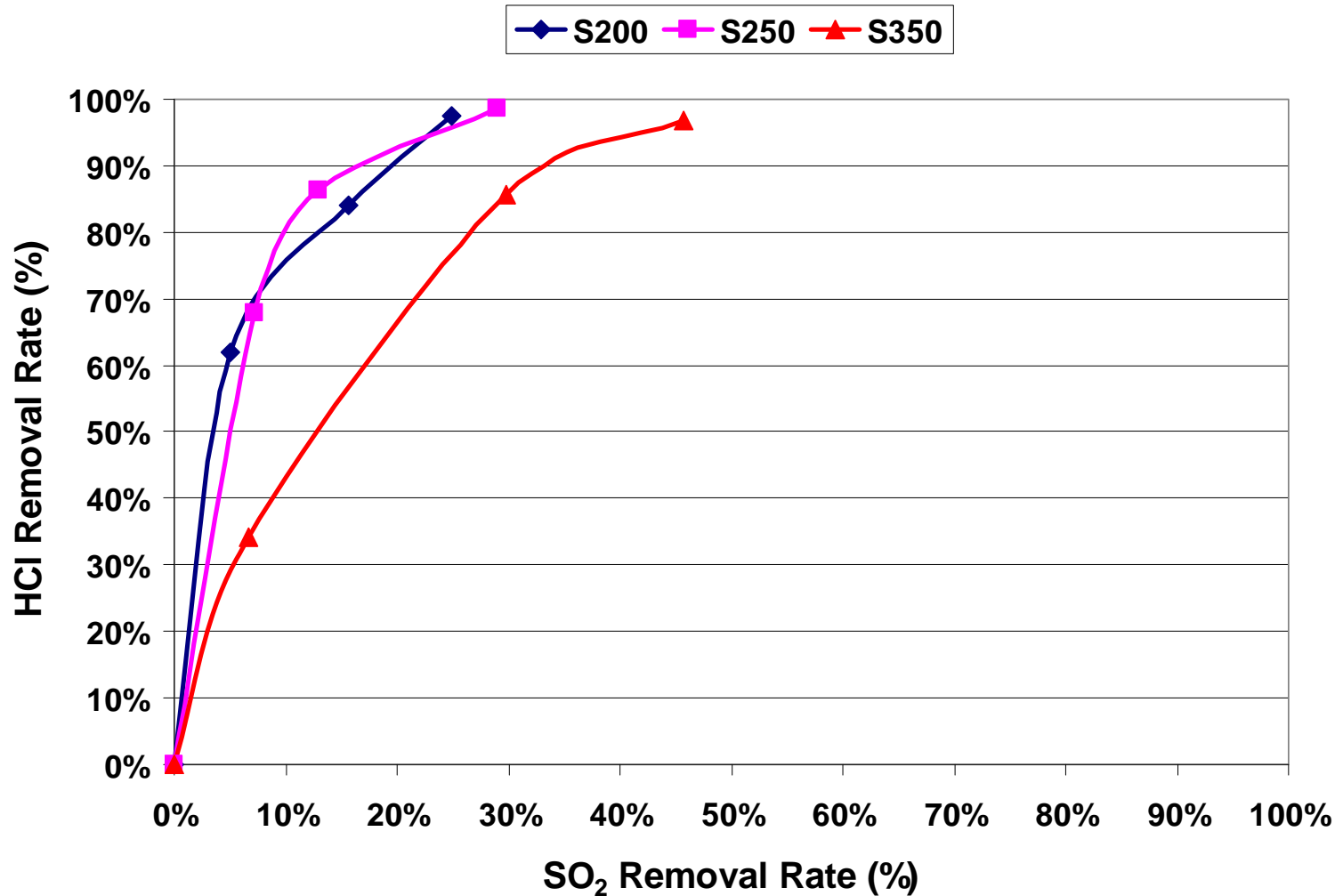
Sorbent Performance

Combined HCl and SO₂ results

HCl Removal vs. SO₂ Removal - ESP



HCl Removal vs. SO₂ Removal - Baghouse



Summary

- ◆ **Dry Injection of trona or sodium bicarbonate is a cost effective way to mitigate HCl, SO₂ and SO₃.**
 - Low capital cost.
 - Compatible with ESP and Baghouses.
- ◆ **Able to achieve high removal rates for HCl (>99%) and SO₂ (>90%)**
 - Able to meet the HCl limit in the proposed Utility MACT (0.002 lb/MMBtu)
- ◆ **Effective over a wide temperature range (275 °F – 1500 °F)**
- ◆ **Has been implemented at many coal-fired power plants in the United States and waste incinerators in Europe .**