

A Multipollutant Wet Scrubber for Capture of SO₂, NO_x and Hg

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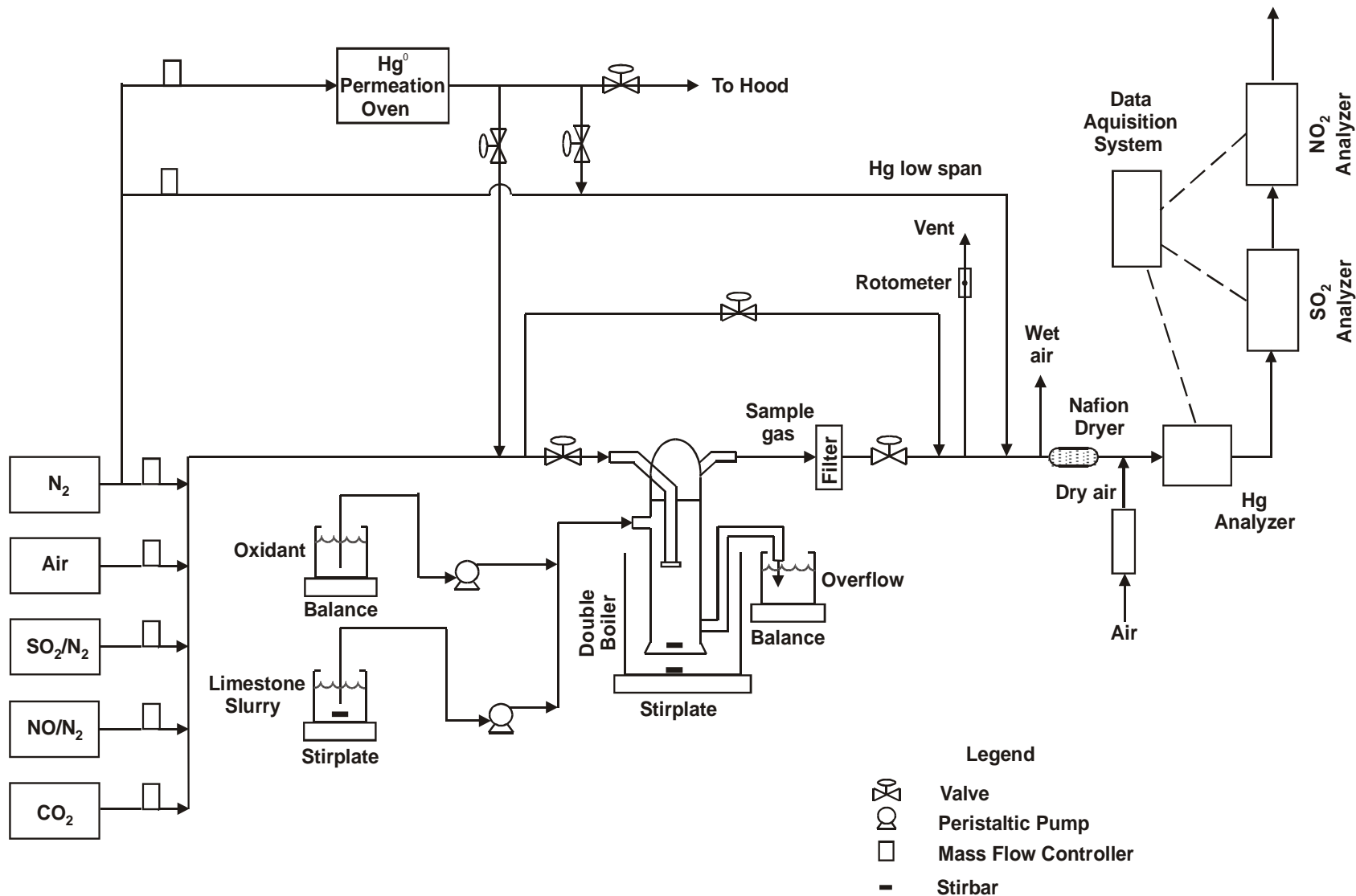
Technology Projections

APC Configuration	Current	2010	2020
	% of total capacity		
Cold-side ESP only	36.6	25.4	15.6
Cold-side ESP + Wet Scrubber	13.7	11.6	10.5
Cold-side ESP + SCR	15.1	11.8	7.2
Cold-side ESP + SCR + Wet Scrubber	9.1	21.0	31.2
Cold-side ESP + SCR + Dry Scrubber	0.0	4.0	4.2
Fabric Filter only	3.9	3.6	2.4
Fabric Filter + Dry Scrubber	2.9	2.7	2.9
Fabric Filter + Wet Scrubber	1.6	1.7	1.6
Fabric Filter + SCR + Wet Scrubber	0.3	0.3	6.3
Hot-side ESP only	6.2	3.9	3.2
Hot-side ESP + Wet Scrubber	2.9	3.5	3.3
Hot-side ESP + SCR	2.0	1.1	0.6
Hot-side ESP + SCR + Wet Scrubber	0.2	2.3	3.2
Total	94.4	93.0	92.1

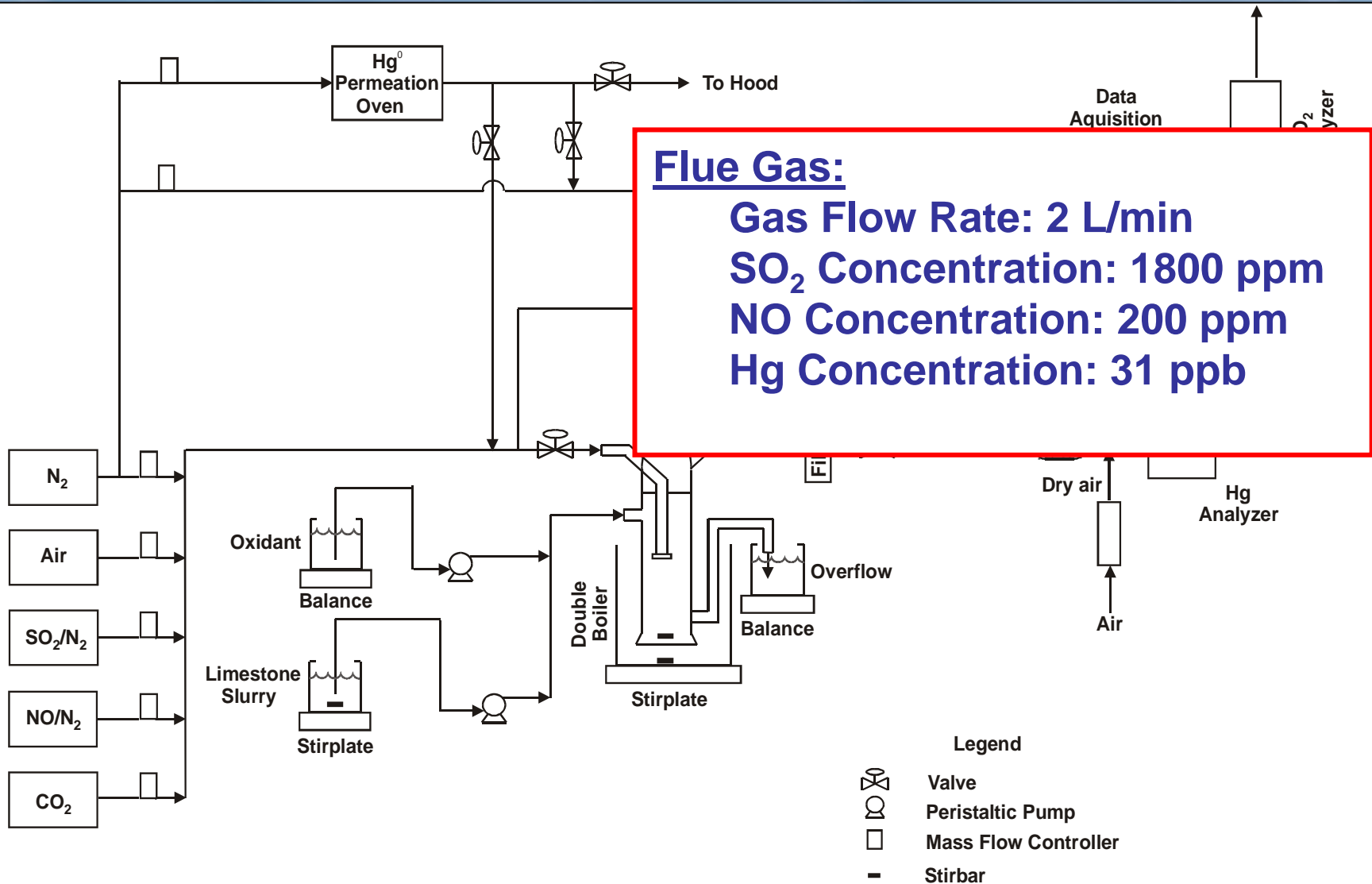
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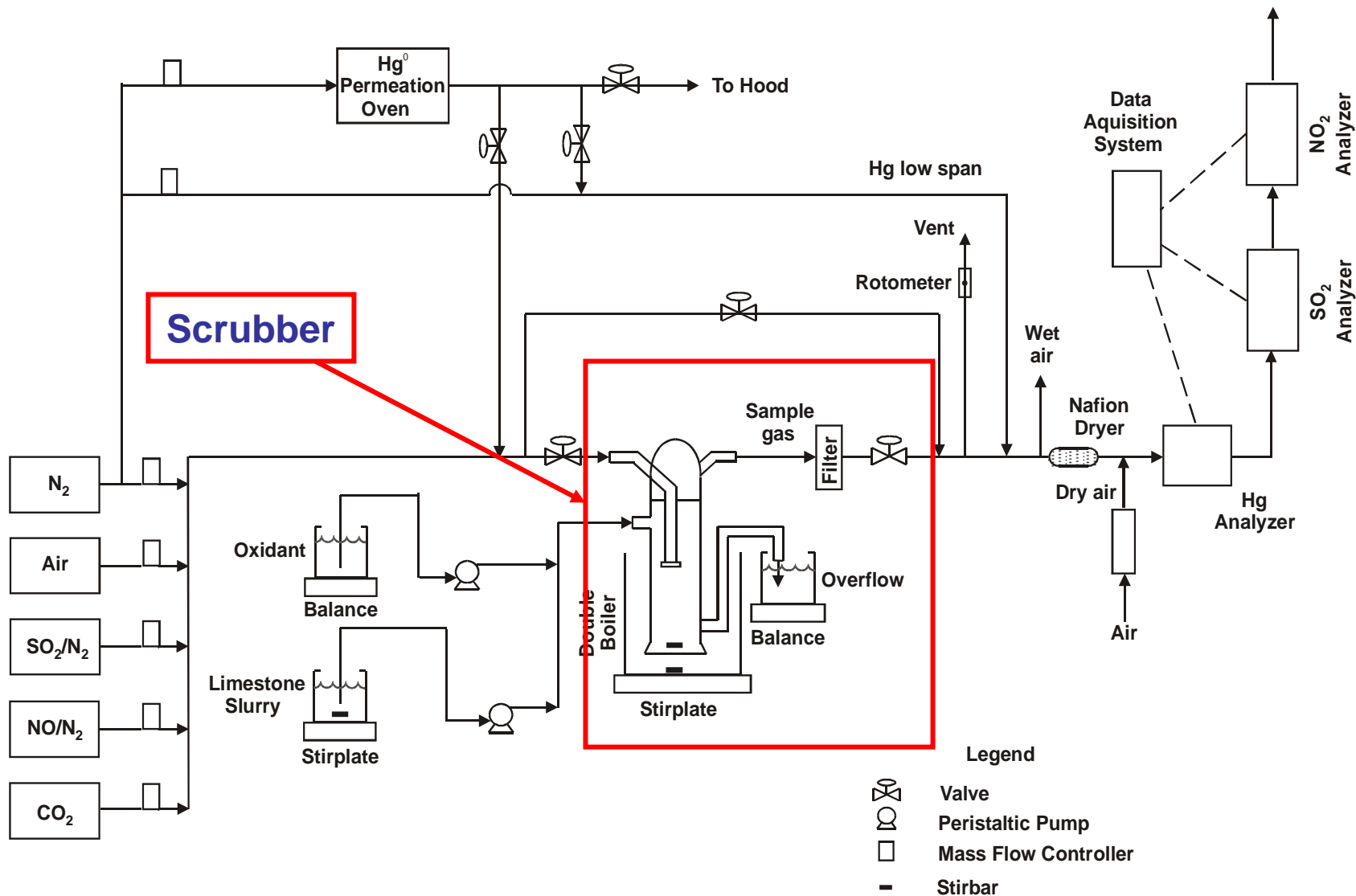
Multipollutant Scrubber Bench-scale Experimental Set-up



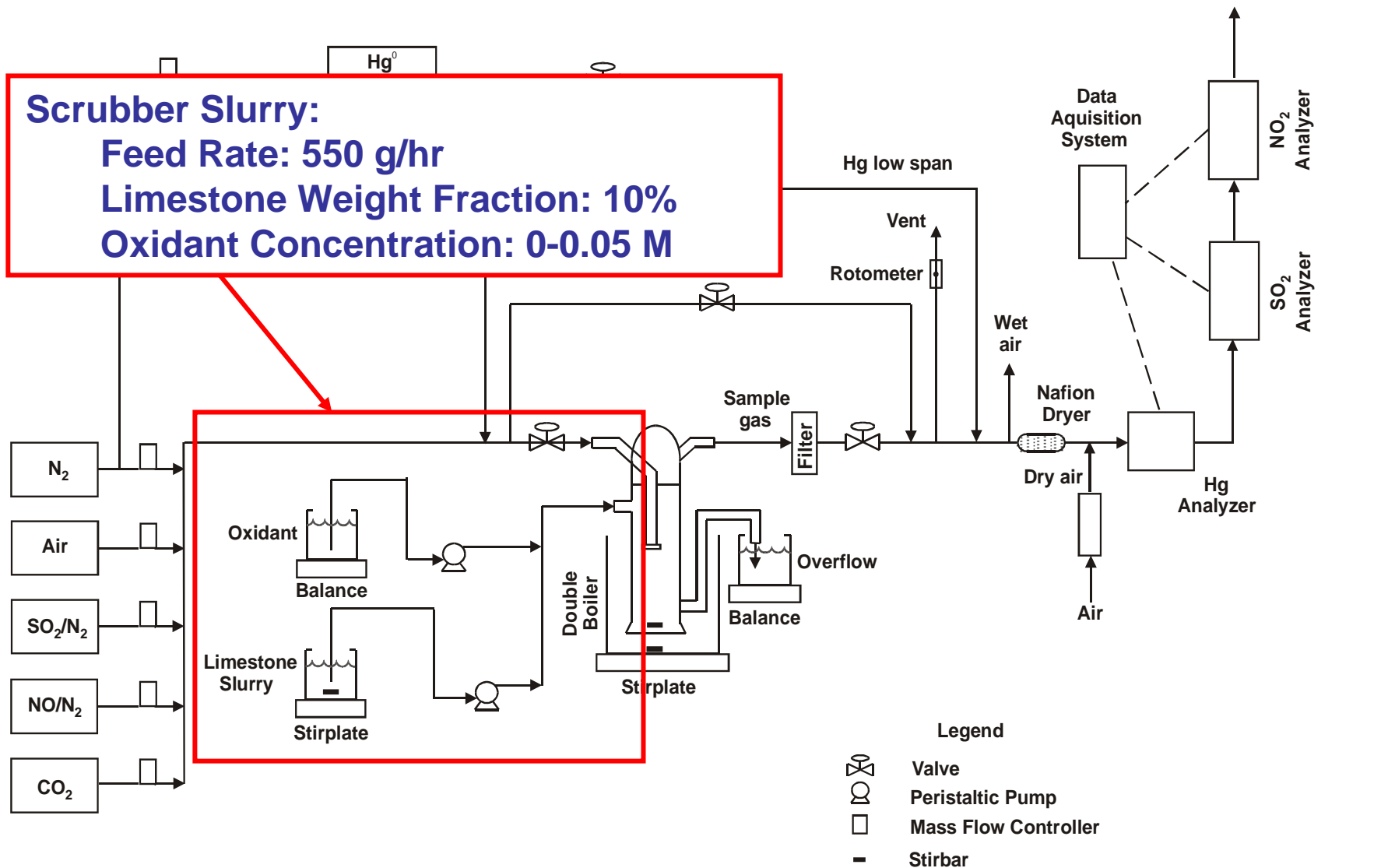
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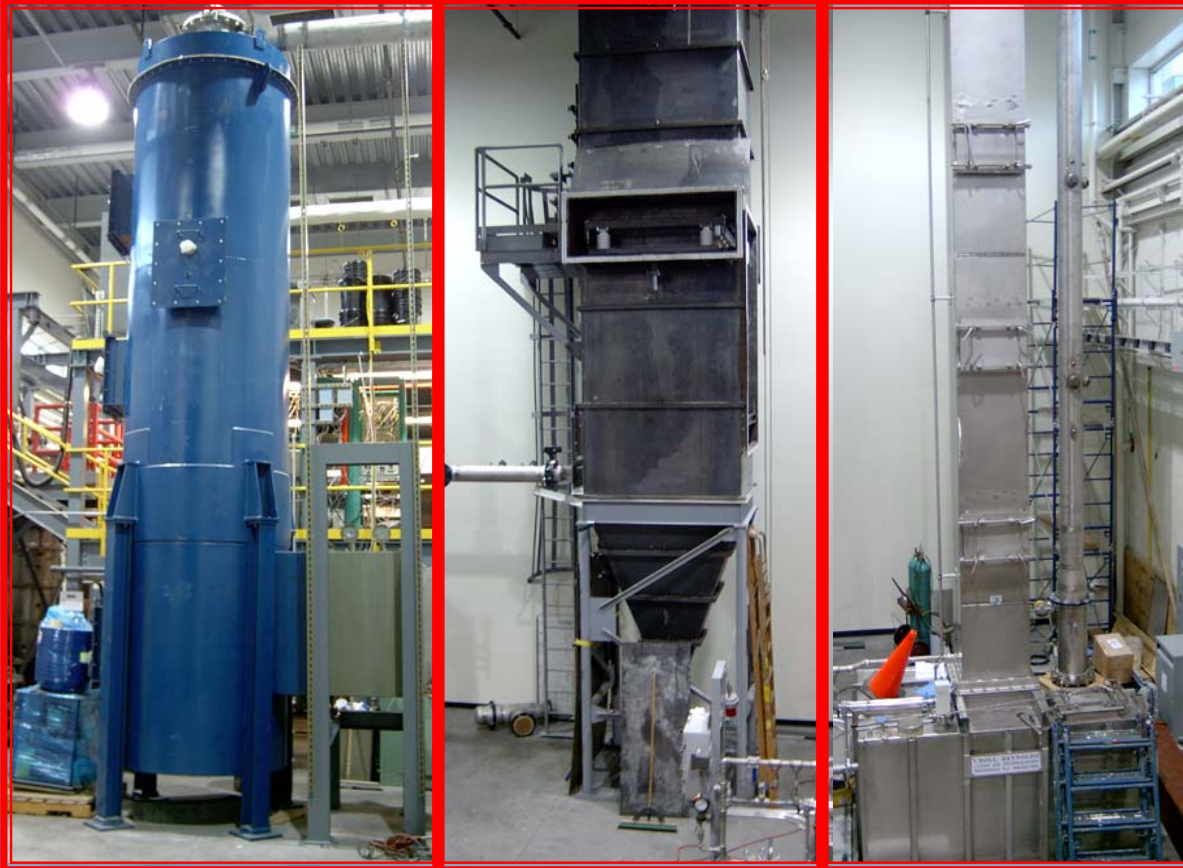
Bench-scale Results

Baseline Tests	SO₂	NOx	NO	Hg
baseline 10% limestone	100.4%	1.7%	0.2%	-3.6%
baseline 10% limestone	100.3%	3.2%	1.8%	-5.2%
baseline 10% EPA-S	100.2%	2.3%	0.9%	-7.8%
Other oxidants	SO₂	NOx	NO	Hg
0.05 M OX-1	100.0%	6.0%	2.6%	-22.5%
0.01 M OX-1	100.1%	7.1%	3.5%	3.2%
0.02M OX-2	100.1%	33.5%	33.1%	100.0%
0.01 M OX-3	100.1%	4.7%	2.2%	-4.8%
0.01 M OX-3	99.7%	6.0%	3.2%	2.6%
0.05 M OX-3	99.1%	4.8%	4.4%	-6.9%
OX-4 Additive	SO₂	NOx	NO	Hg
0.025 M OX-4	94.1%	60.8%	100.2%	101.9%
0.010 M OX-4	97.9%	74.3%	100.1%	99.4%
0.010 M OX-4 in EPA-S	99.0%	76.8%	100.2%	97.9%
0.010 M OX-4	100.1%	47.4%	100.0%	97.0%
0.006 M OX-4	100.2%	41.6%	100.1%	101.1%
0.005 M OX-4	100.1%	42.3%	97.9%	91.8%
0.003 M OX-4	100.3%	26.2%	66.9%	108.7%
0.003 M OX-4	100.3%	32.6%	85.1%	96.6%
0.002 M OX-4	99.7%	35.8%	62.2%	95.3%
0.001 M OX-4	100.1%	7.5%	10.3%	29.7%

Combustor

Fabric Filter

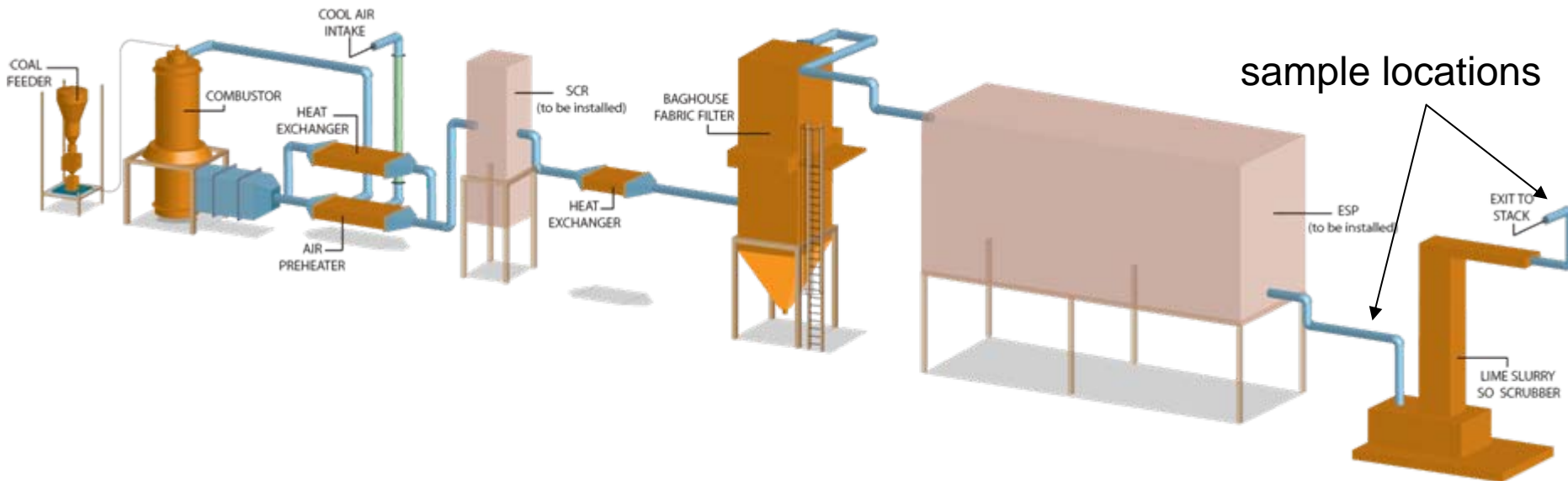
**Lime
FGD Scrubber**



EPA's Multipollutant Combustion Research Facility

- 4 Million Btu/hr (1.2 MWt)
- Capability to fire coal, natural gas, or fuel oil.
- Evaluate and optimize technologies for control SO₂, NO_x, PM and Hg.
 - NO_x: Low NO_x Burner, Selective Catalytic Reduction (SCR)
 - SO₂: Lime Flue Gas Desulfurization (FGD)
 - PM: Electrostatic Precipitator (ESP), Electrostatic Fabric Filter (ESFF)

Proof of Concept Pilot Test



Test conditions:

Coal: W. subbituminous (PRB)
Firing: 400 lb/hr

Oxidant Concentration : 0.017 M
SO₂ Concentration: 200 ppm
NO Concentration: 400 ppm

Mercury into the baghouse:

Hg⁰ = 6 ug/m³
Hg_{Total} = 7.5 ug/m³ (80%elem)

Mercury into the scrubber:

Hg⁰ = 1 ug/m³
Hg_{Total} = 2 ug/m³ (50% elem)

Preliminary Pilot-scale Results

