

Minimizing Solvent Oxidation With NO₂ Prescrubbing

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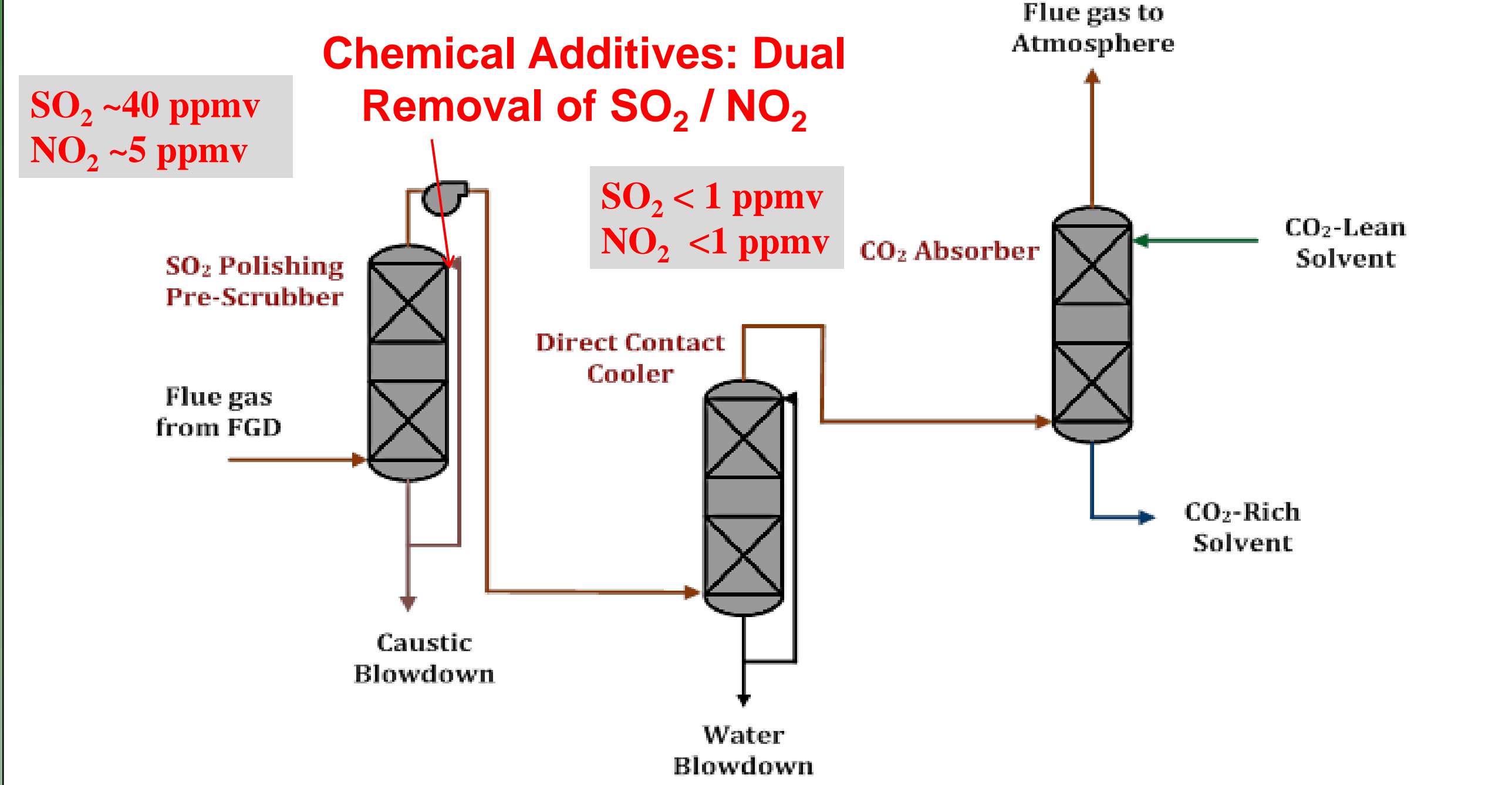
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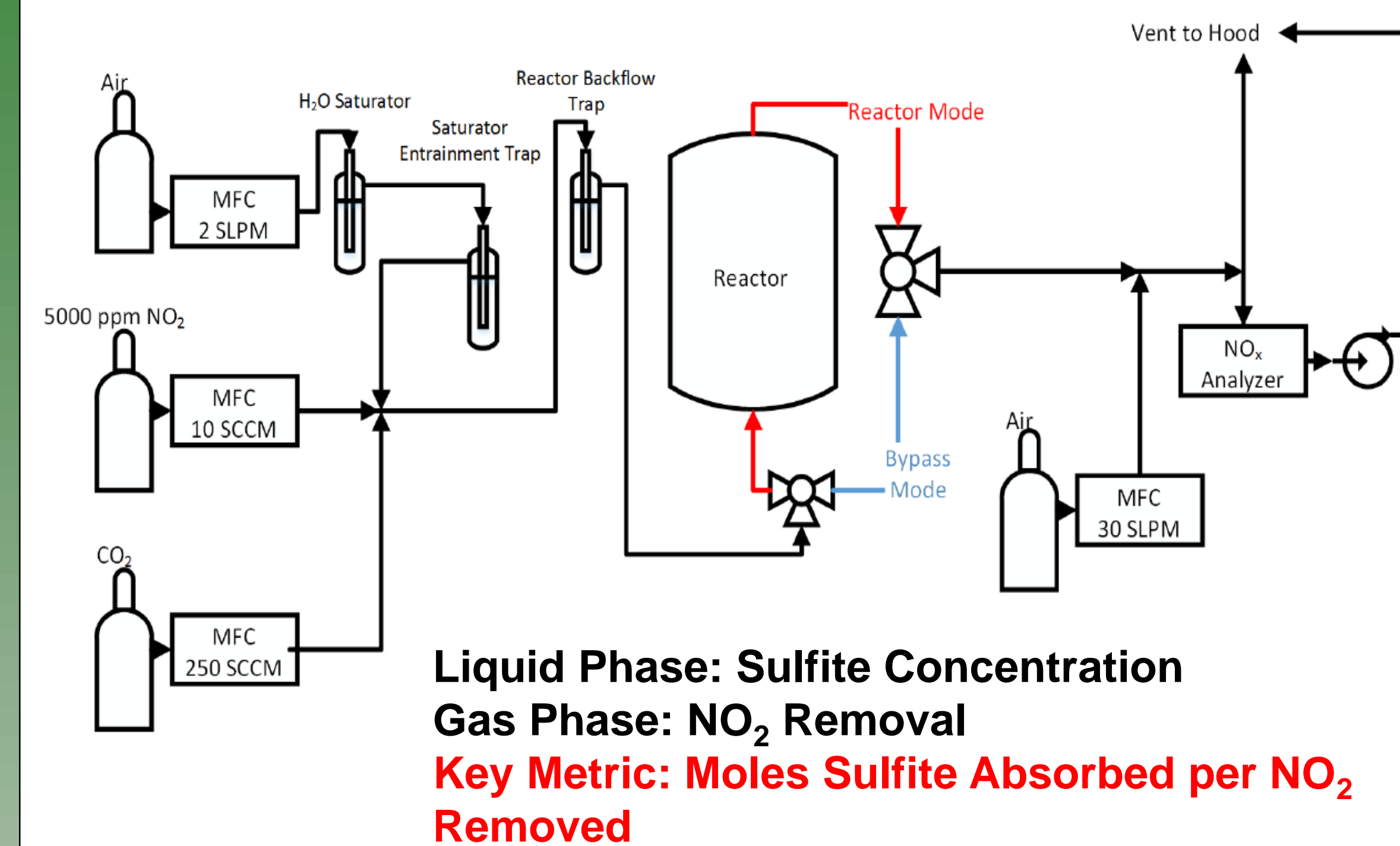
OBJECTIVES

- DOE SBIR FY16 Phase I Release 2: Carbon Capture System Improvements
 - Aerosols, **Reclamation, Oxidation**
- Amine-based solvents = Ready for Deployment
- Flue gas contaminants oxidize amines (↑ costs)
 - Operating costs – amine replacement, waste disposal
 - Capital costs – solvent reclaiming
- Integrate NO₂ and SO₂ removal
 - No additional capital costs
 - Modify chemistry for existing equipment

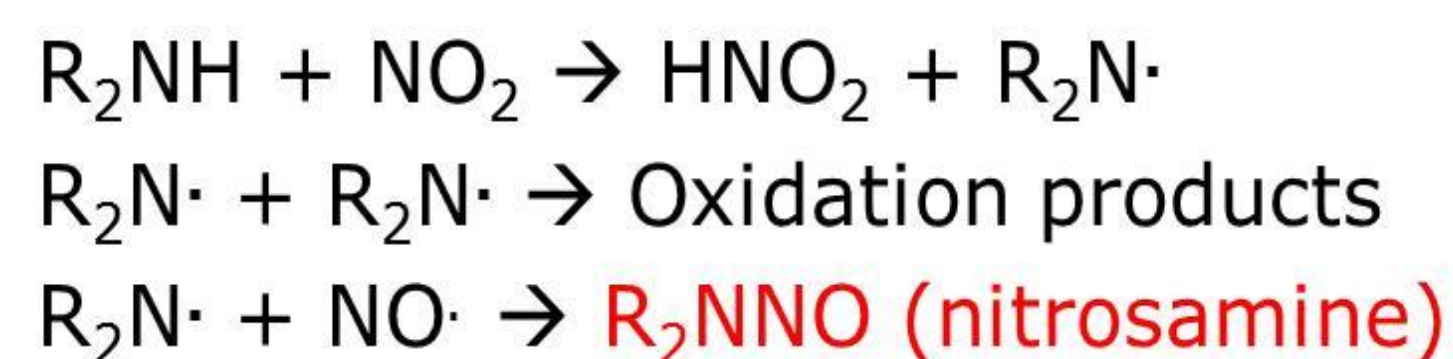
TYPICAL PRE-TREATMENT FOR AMINE POST-COMBUSTION CAPTURE SYSTEM



BENCH-SCALE PRE-SCRUBBER

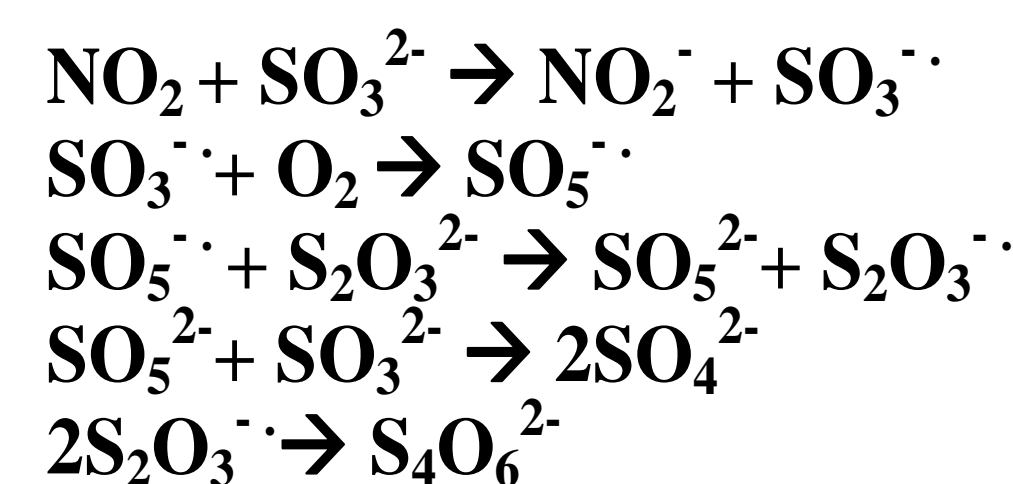


SOLVENT OXIDATION REACTIONS



- Thiosulfate addition inhibits sulfite oxidation
- Sulfite reacts with inlet NO₂

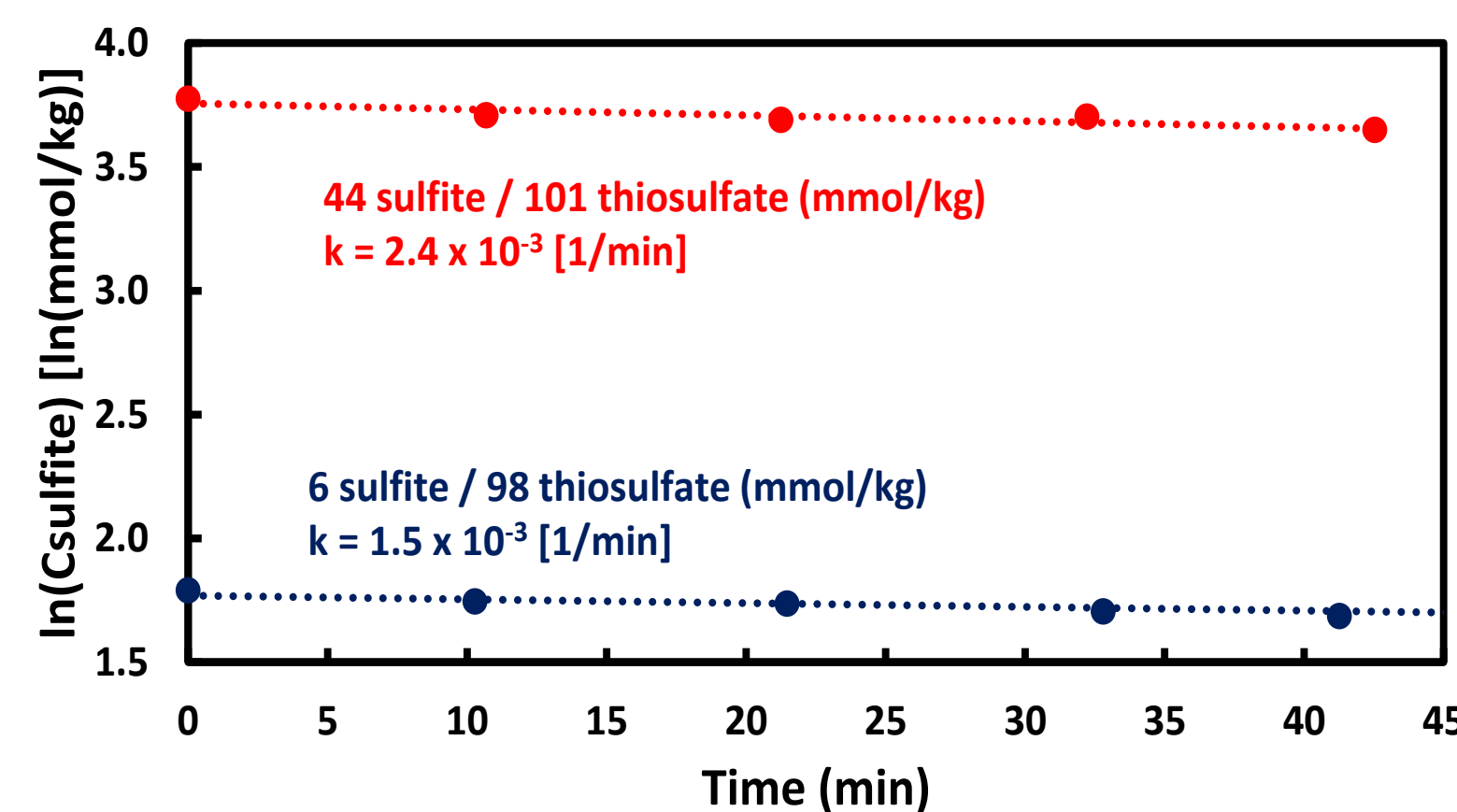
SULFITE OXIDATION INHIBITION AND REACTION



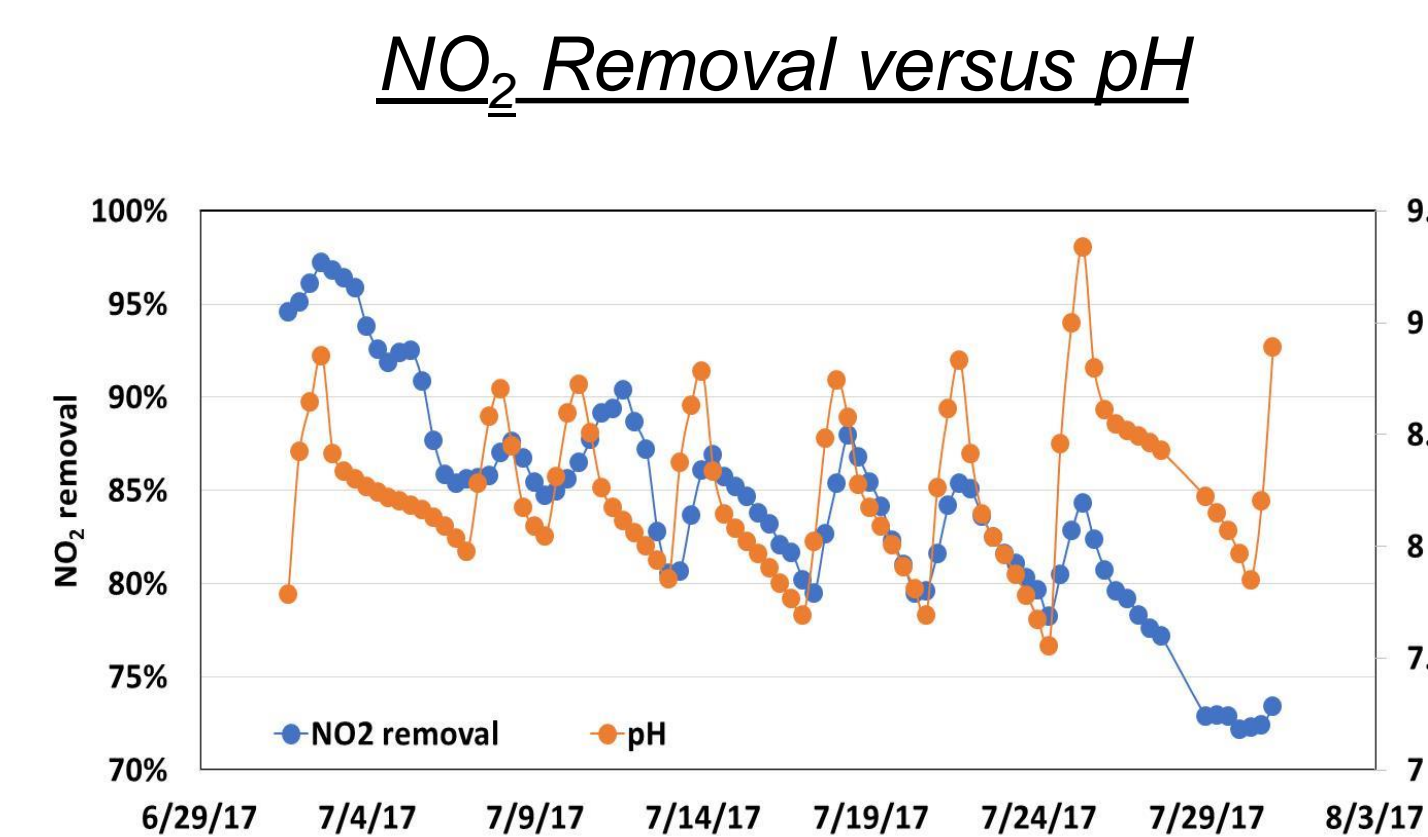
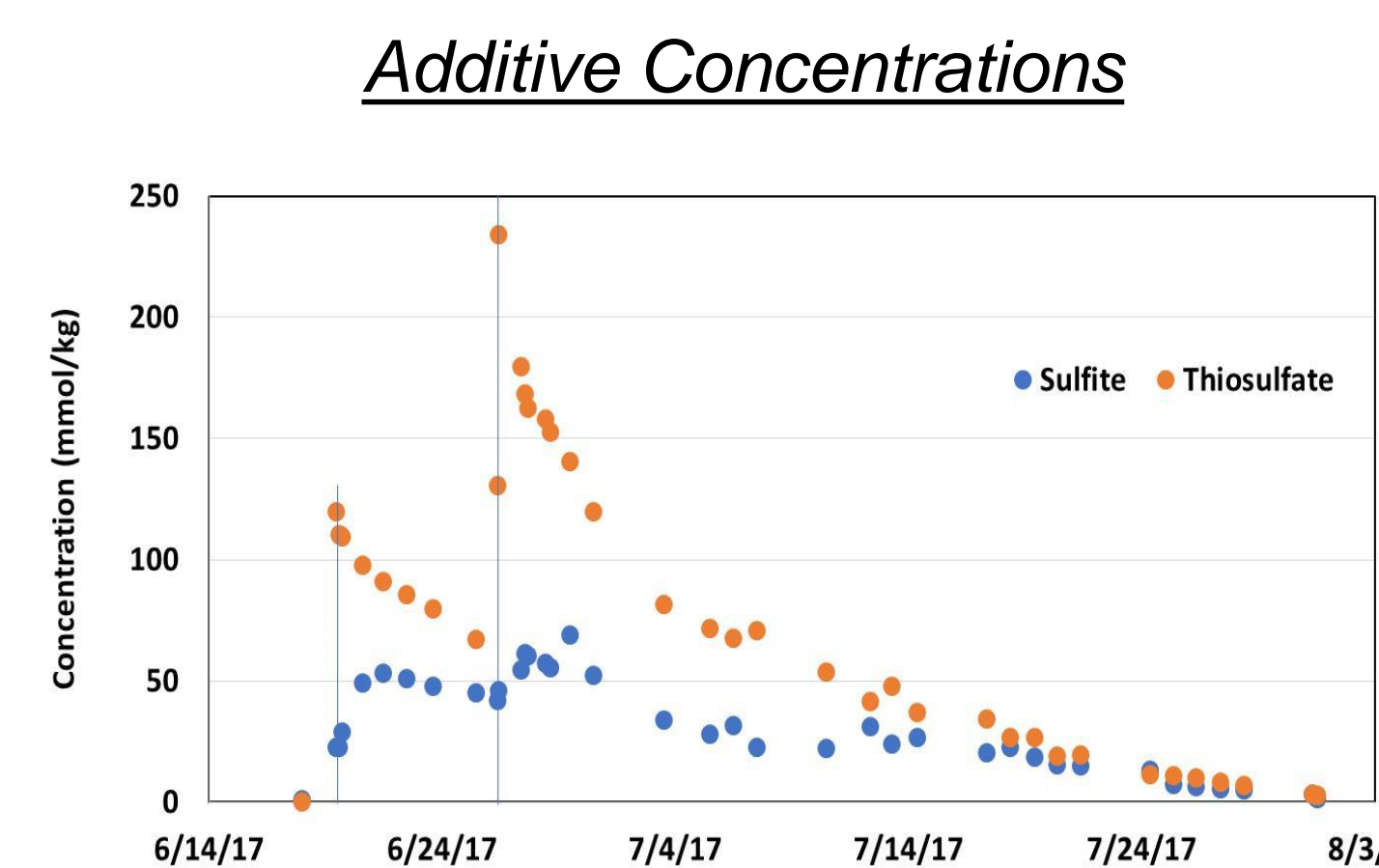
BENCH SCALE TEST PARAMETERS

Parameter	Units	Value
NO ₂ Concentration	ppmv	1-5
Temperature	°C	25-55
Sulfite Concentration	mmol/kg	4-50
Thiosulfate Concentration	mmol/kg	0-200
Tertiary Amine Concentration	mmol/kg	5-200
Metals Concentration	mmol/kg	0.1-0.5
EDTA Concentration	mmol/kg	0.02-1

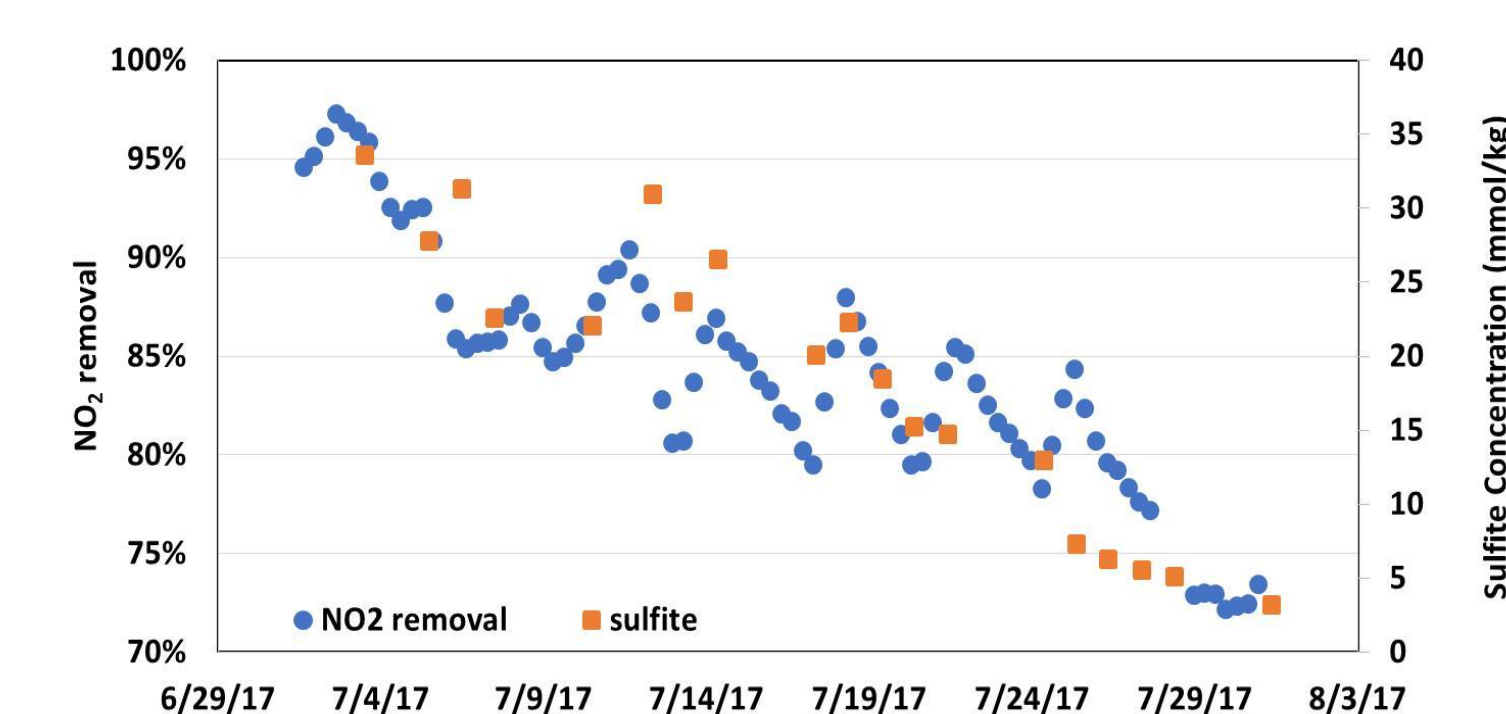
EXAMPLE TEST RESULTS



NCCC PILOT TEST RESULTS



NO₂ Removal versus Additive Concentration



SUMMARY

- Validated concept at bench and pilot scales
- Identified novel inhibitors
 - Stronger oxidation inhibition
 - Lower cost
- No new unit operations required
 - Utilizes existing equipment
- Potential net savings > \$1/MT CO₂ captured

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ESTIMATED ECONOMICS

BASELINE CHEMISTRY

ADVANCED ADDITIVES

- Lower cost
- More effective oxidation inhibitor

