

Pilot Plant NO₂ removal with sulfite inhibited by thiosulfate

Joseph Selinger (presenter)

Kent Fischer

Gary Rochelle

***The University of Texas at
Austin***

Andrew Sexton

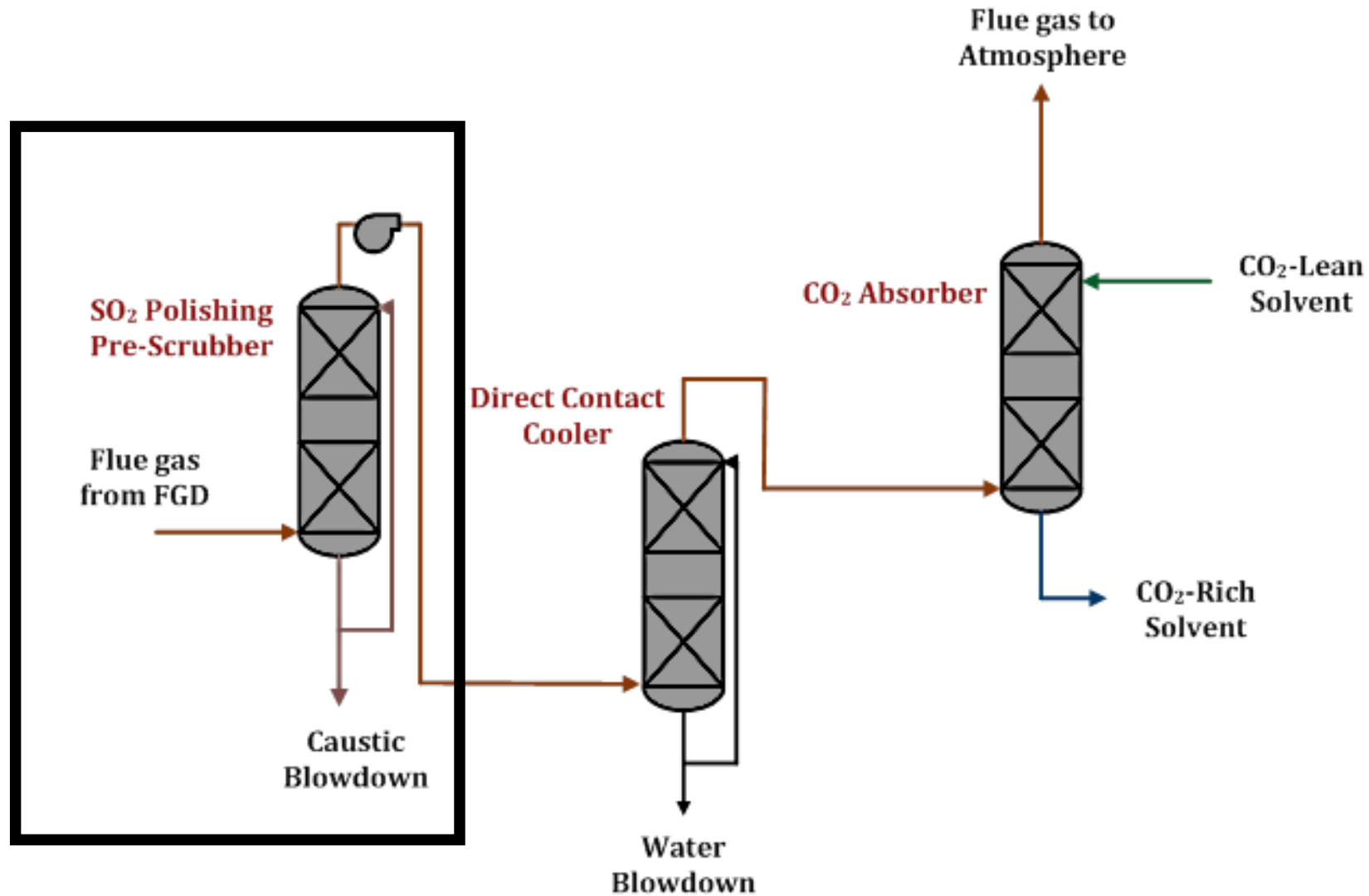
Darshan Sachde

Austyn Vance

Kevin Fisher

Trimeric Corporation

NO₂ Pretreatment

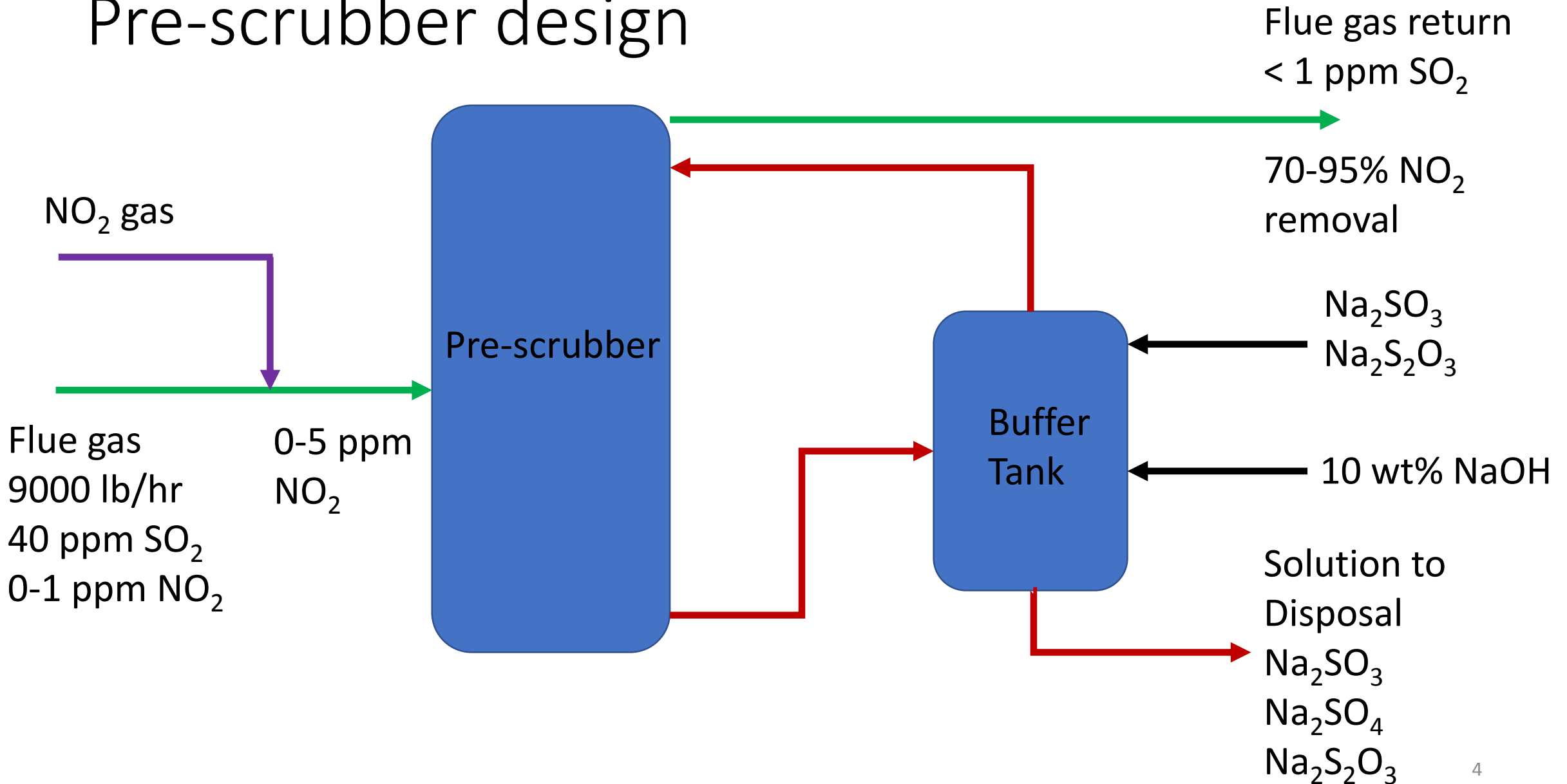


NCCC Pilot Plant

- 1400 gal pre-scrubber for SO₂ removal
- Additional NO₂ added to increase concentration to 5 ppm
- pH ranges from 7.5-9, intermittent control



Pre-scrubber design



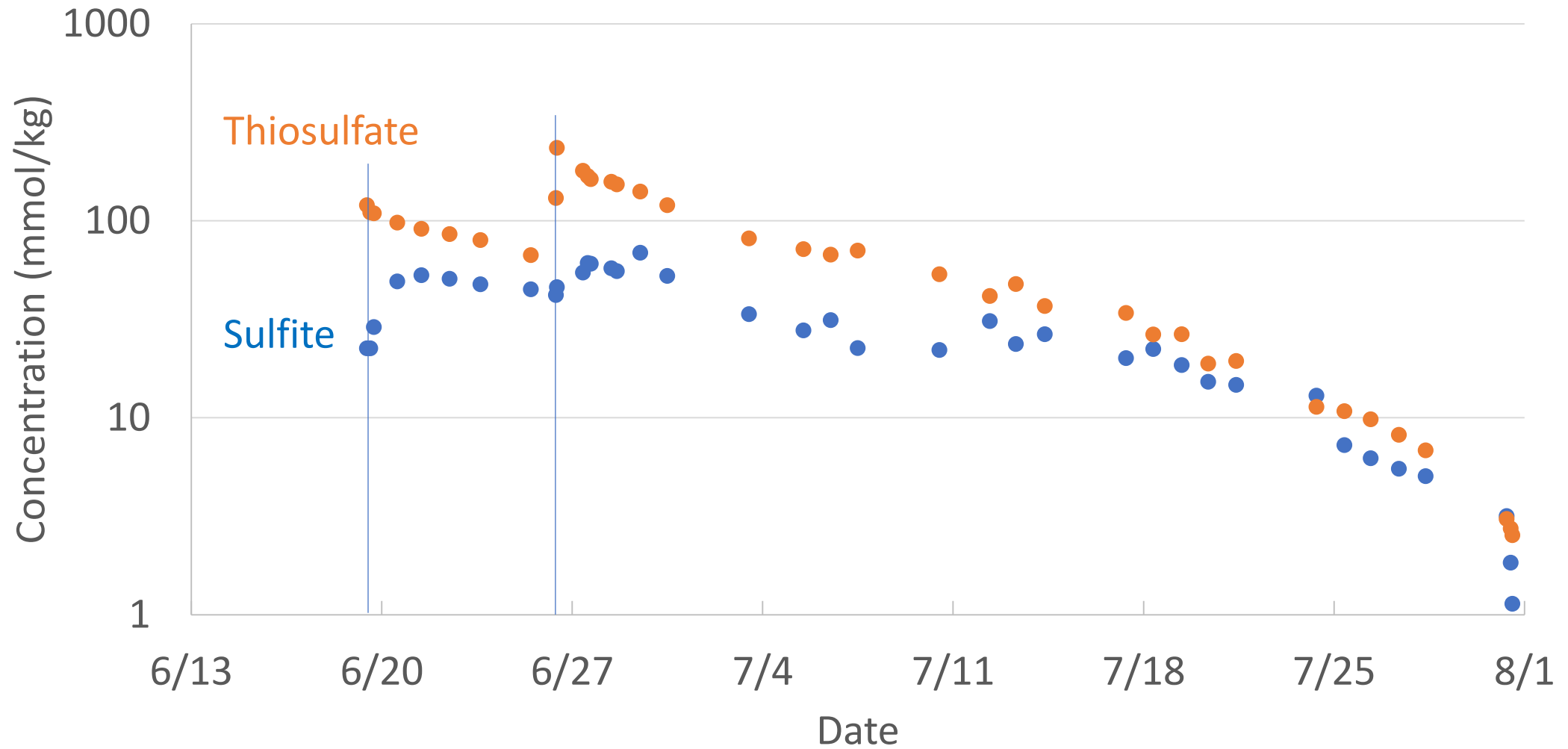
Test plan

- Week 1:
 - Add 20 mM sulfite, 200 mM thiosulfate, 0.02 mM EDTA
 - 20 lb Na_2SO_3 , 200 lb $\text{Na}_2\text{S}_2\text{O}_3 \bullet 5\text{H}_2\text{O}$, 1 lb EDTA
 - Flue gas contains 0-1 ppm NO_2
- Weeks 2-7:
 - Add additional thiosulfate to achieve 200 mM
 - Flue gas contains 5 ppm NO_2
- All times:
 - Flue gas contains 40 ppm SO_2 , 99% removal

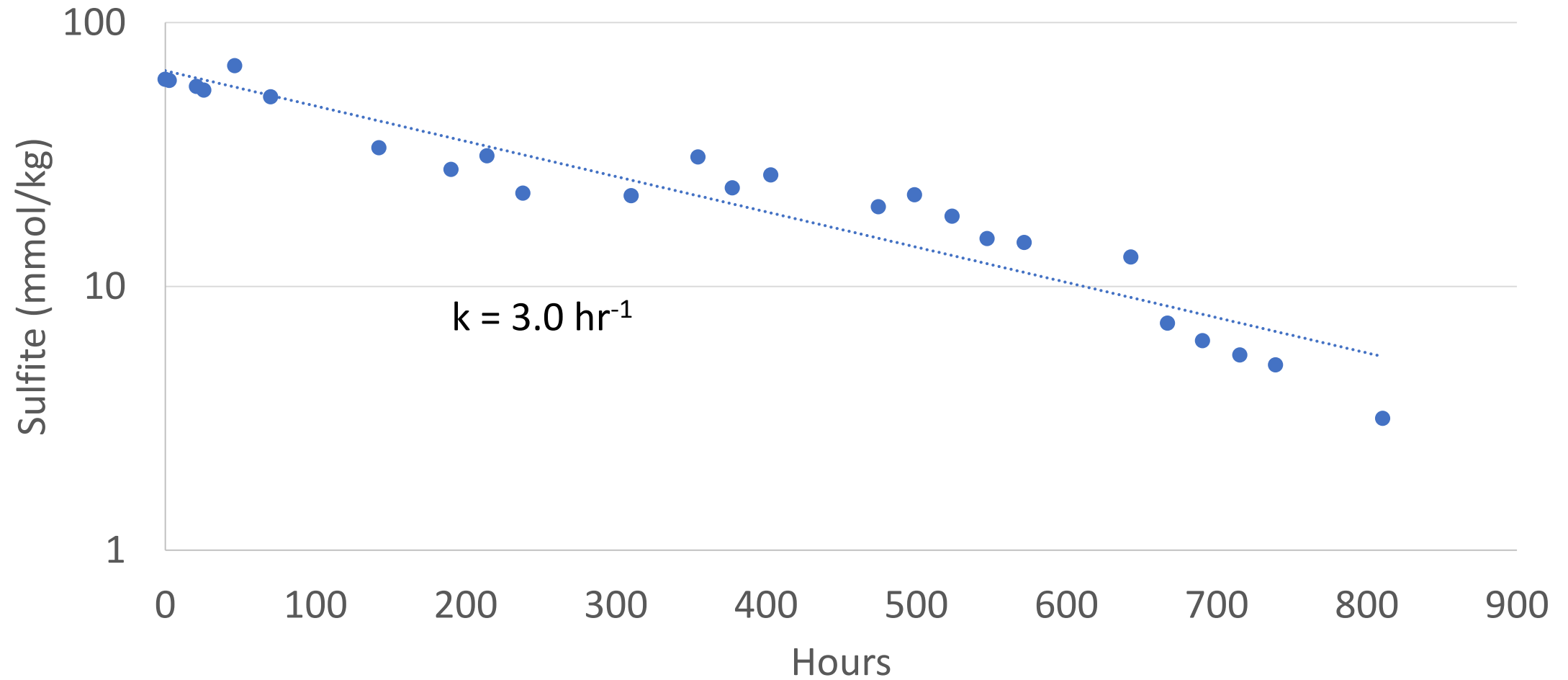
Analytical methods

- At site: Iodometric titration
 - Separate measurements of sulfite, thiosulfate
 - Used for primary results only, not reported
- Off site: Anion chromatography
 - Samples fixed with formaldehyde before shipping
 - KOH gradient elution (15mM – 50mM)
 - Measures sulfite, thiosulfate, sulfate

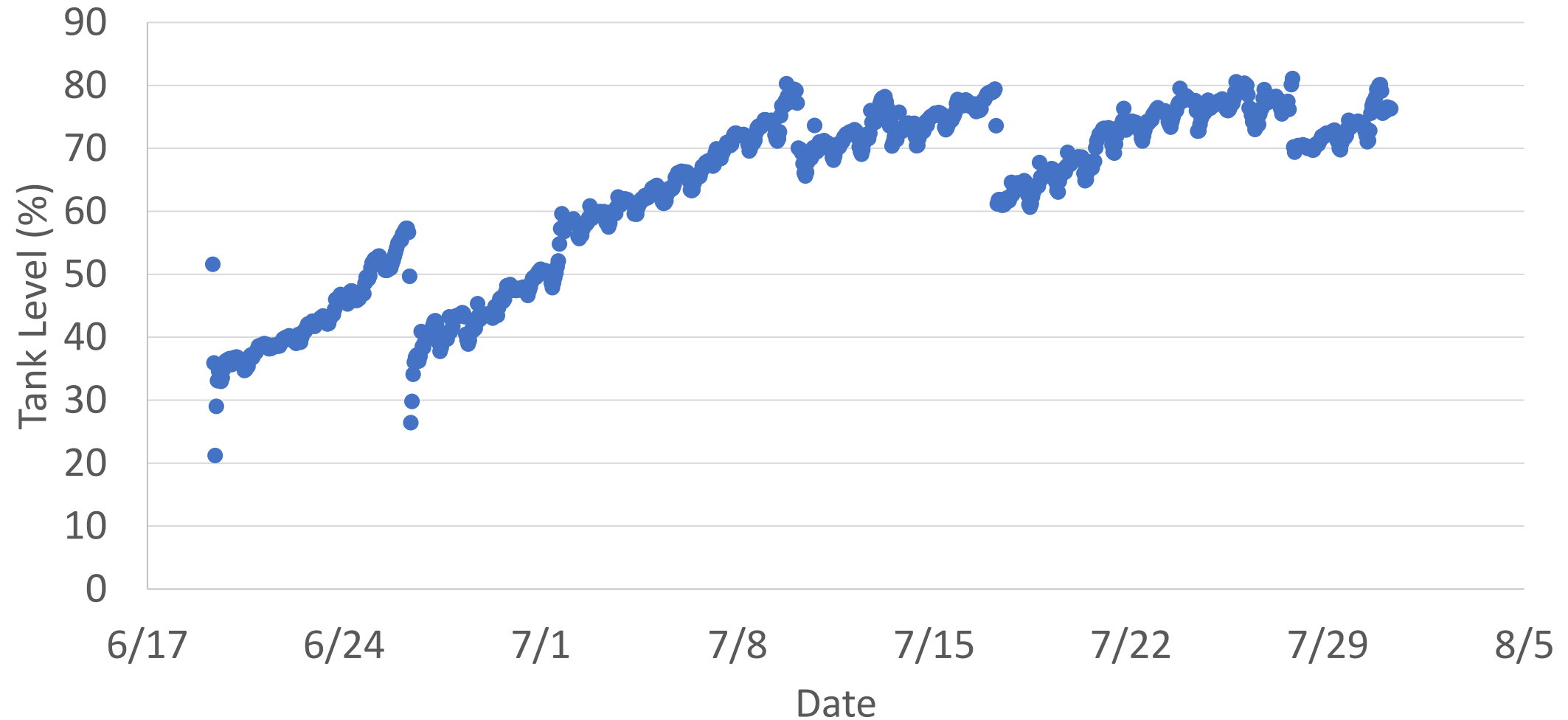
Sulfite and Thiosulfate Oxidation and Dilution



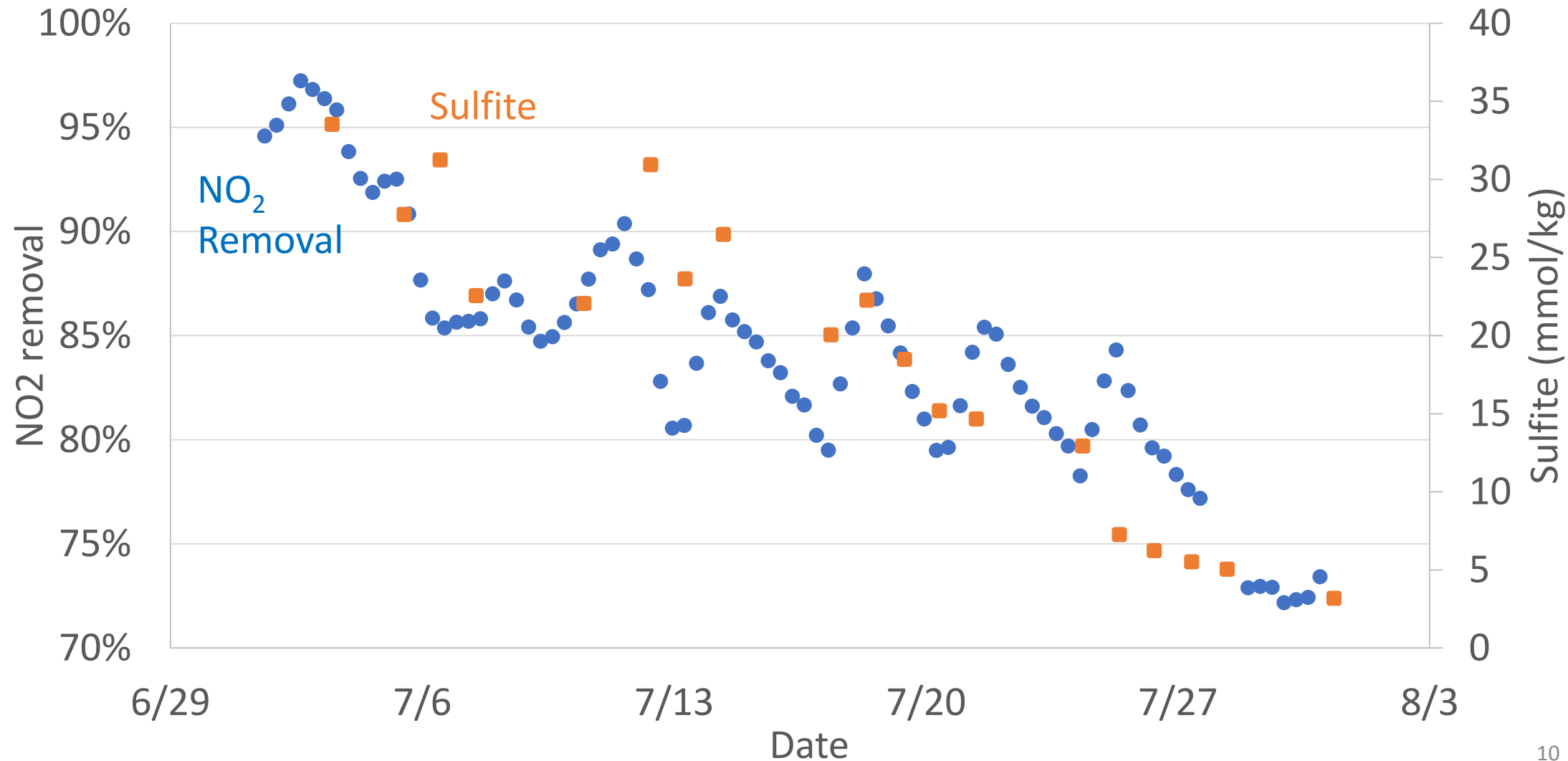
Sulfite Reaction Rate



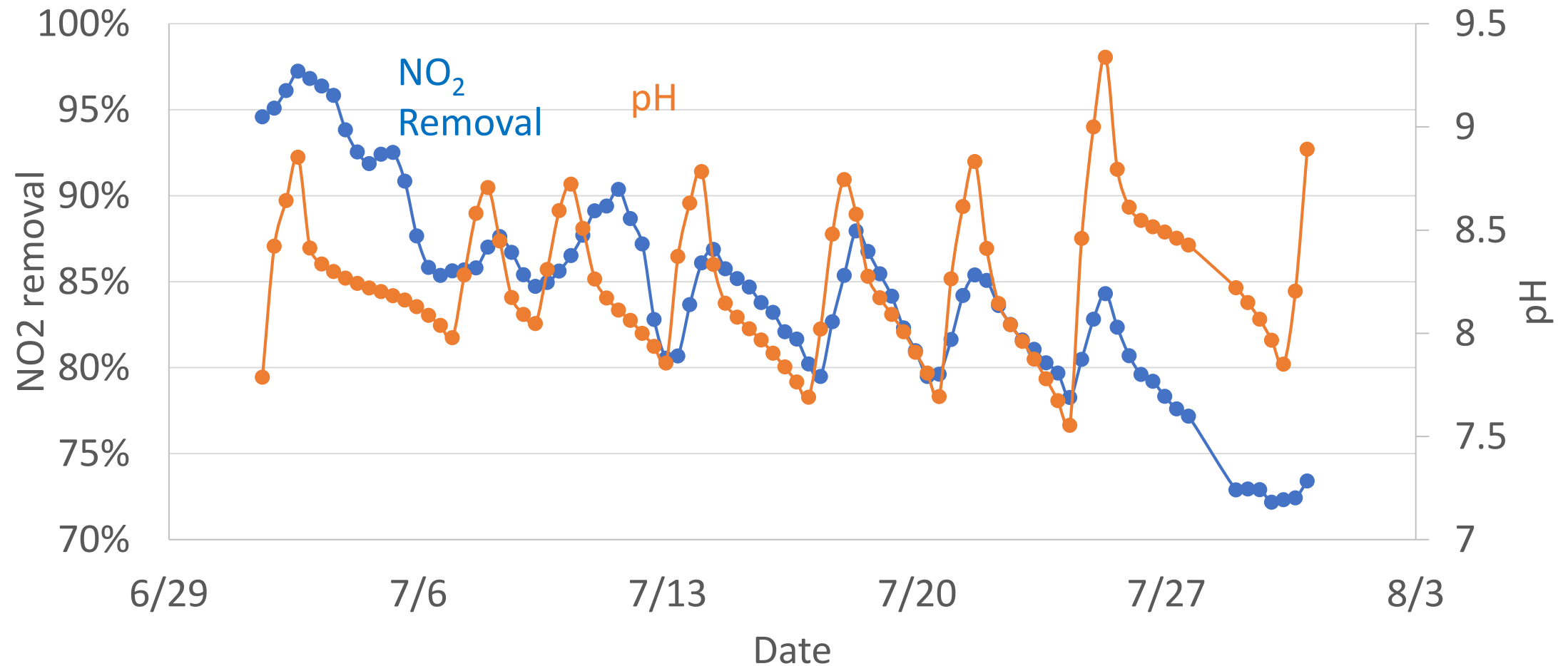
Pre-scrubber Dilution and Disposal



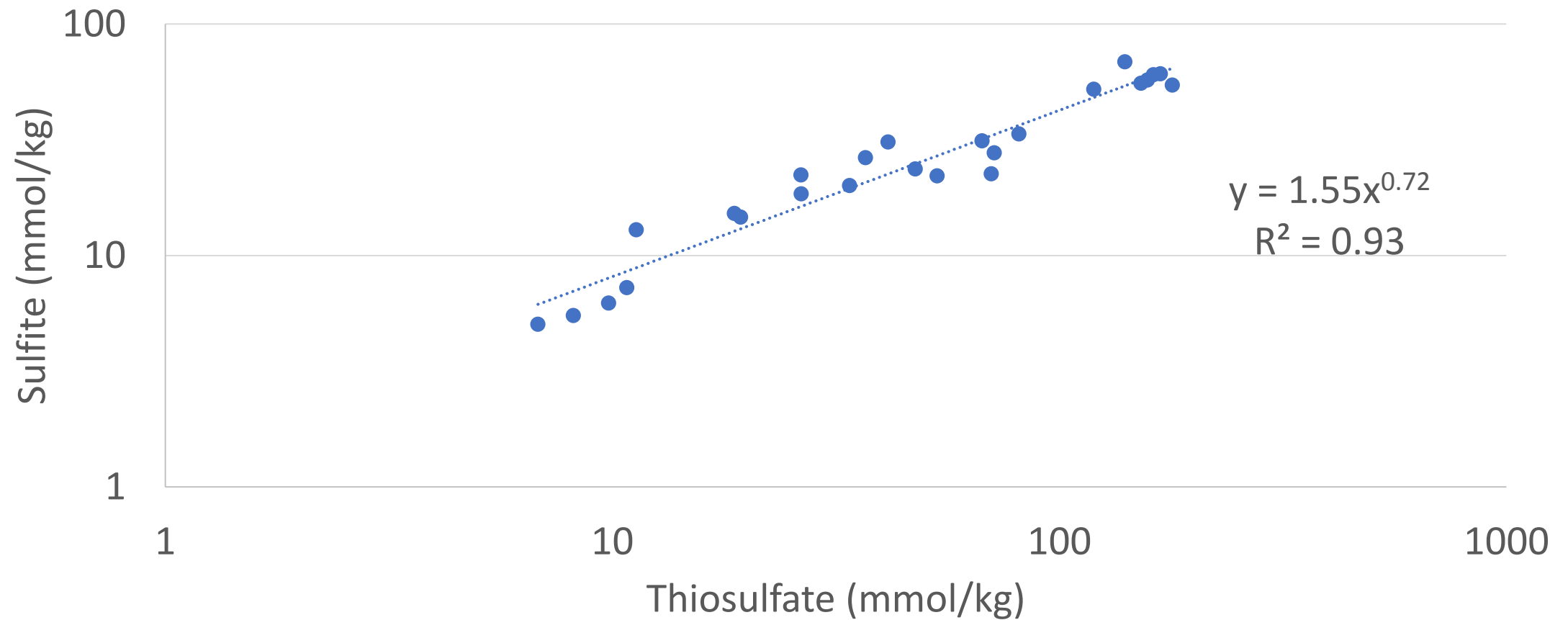
NO₂ removal - Sulfite



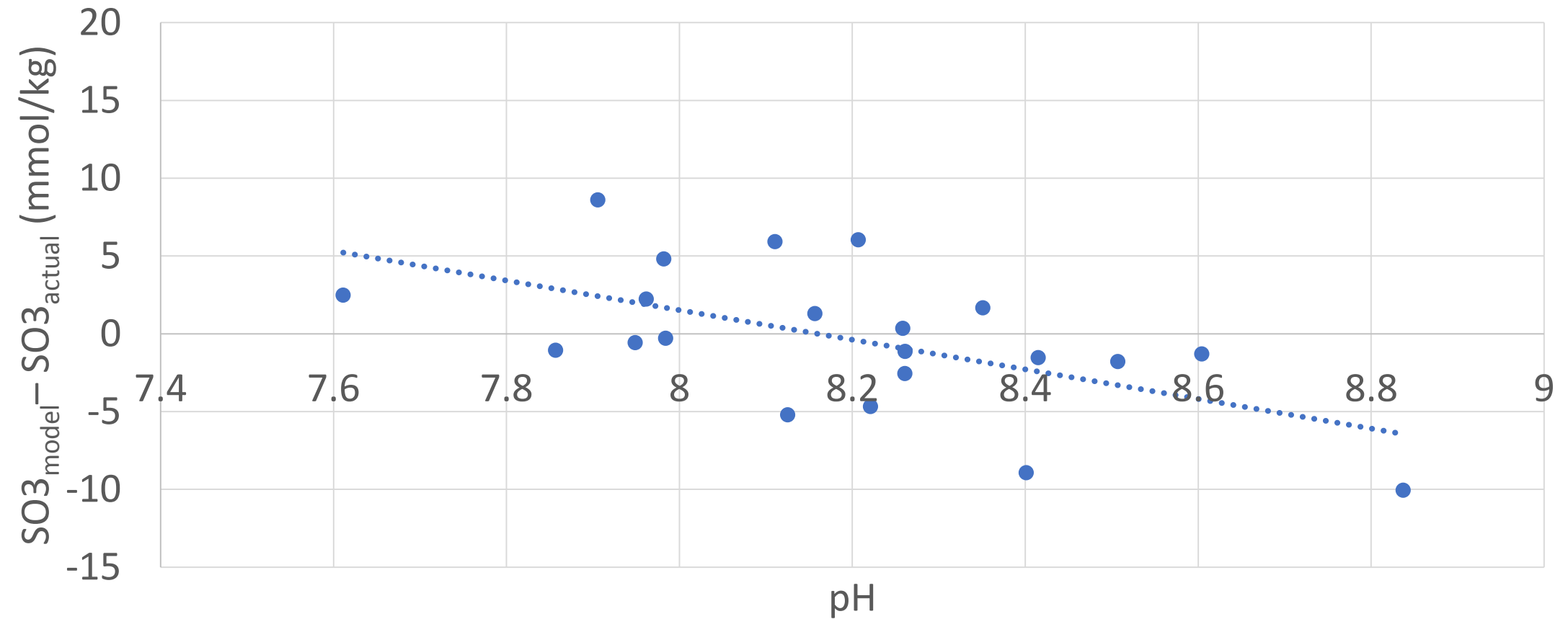
NO₂ removal fluctuations from pH



Sulfite and Thiosulfate steady state



Model residual – pH dependence



Conclusions

- 50 mM thiosulfate can provide 25 mM sulfite resulting in 90% removal
 - Given 40 ppm SO_2 and 5 ppm NO_2
- Increasing pH is strongly correlated with increased NO_2 removal
- Repeated thiosulfate additions needed to replace losses from dilution and disposal

Questions?

