

# Measurement and Control of Mercury Emissions

McIlvaine Hot Topic Hour  
March 12, 2010

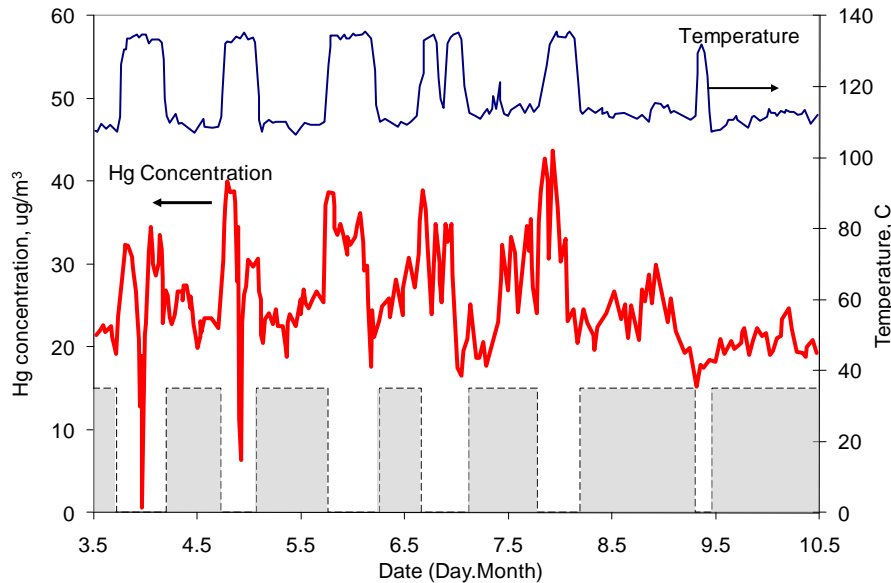
Connie Senior (senior@reaction-eng.com)



# Outline

- Mercury transients in cement kilns:  
Implications for measurement and control
- The Raw Mill and its effect on Hg emissions  
and speciation
- Effectiveness of air pollution control devices  
for removing Hg in cement kilns
- Thoughts on measurement and control of Hg

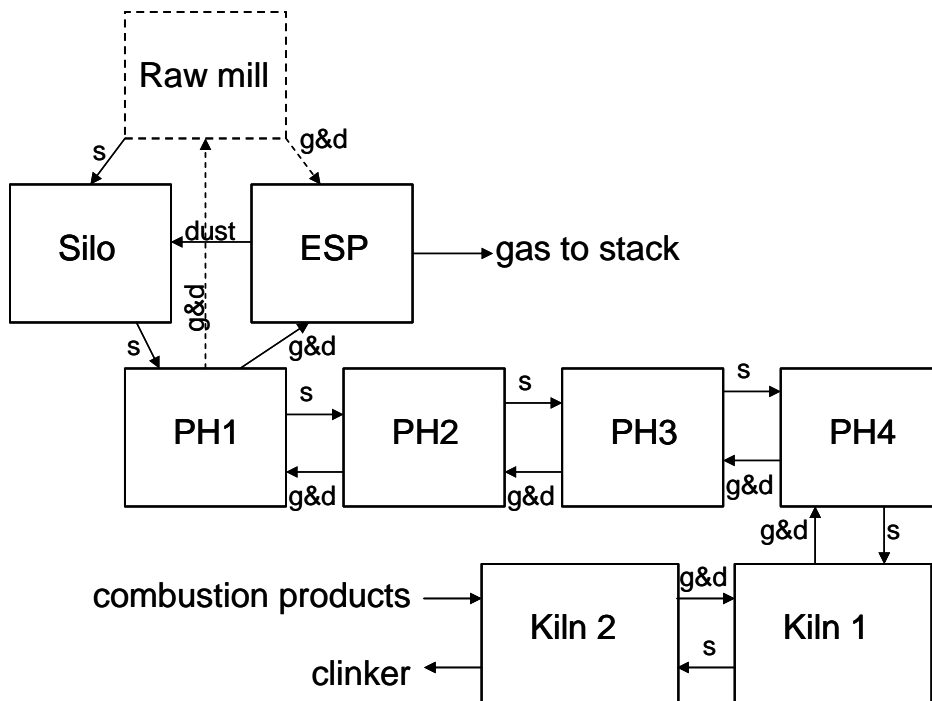
# Measurements of Stack Emissions



Shaded areas indicate times when Raw Mill was on line

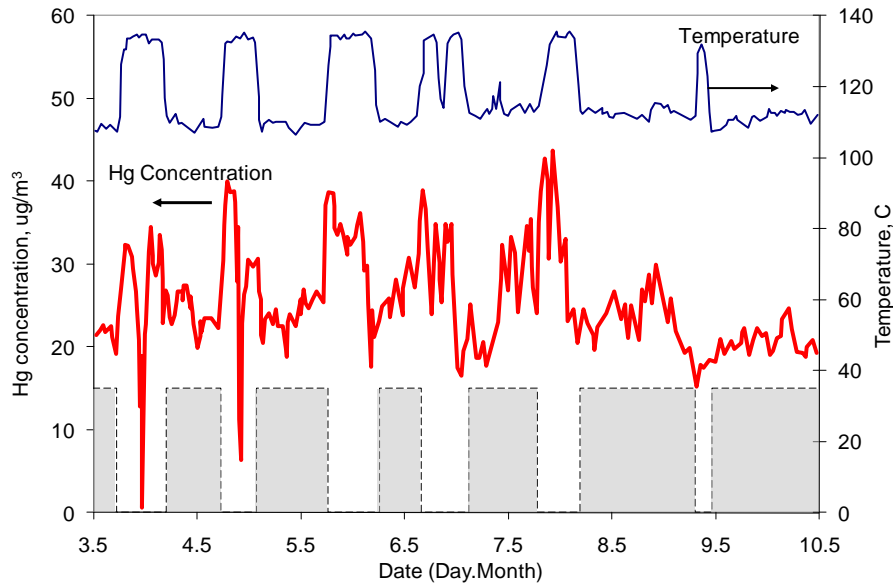
- Data from German Preheater Kiln
  - CEM to measure stack Hg concentration
  - Sampling of ESP dust
- Stack temperature and Hg emission change with Raw Mill on- or off-line

# REI Model of Hg in Cement Kiln

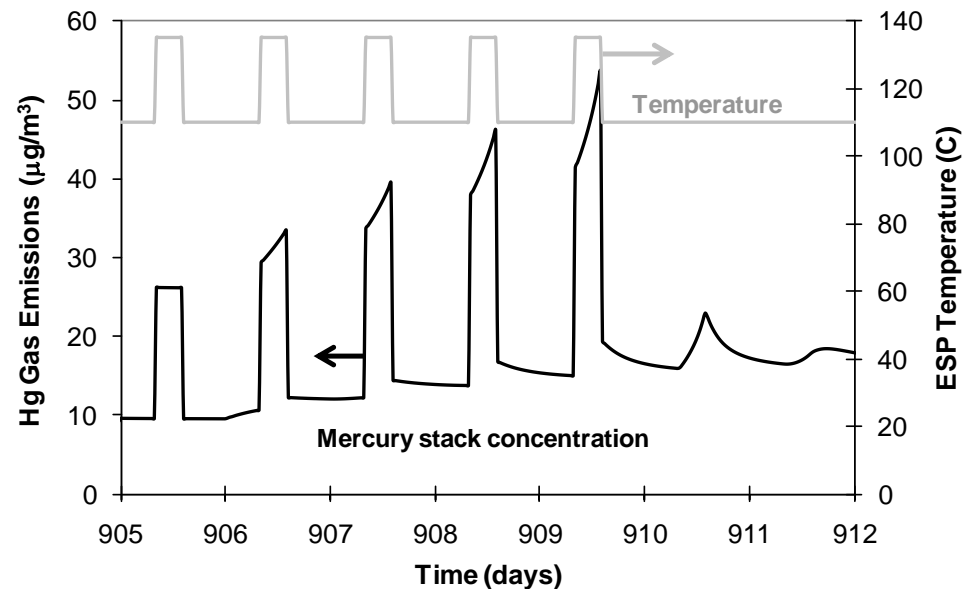


- Reactor network model tracks partitioning between gas and solid Hg
- Transient model accounts for changes in operation

# Measurements vs. Model Results

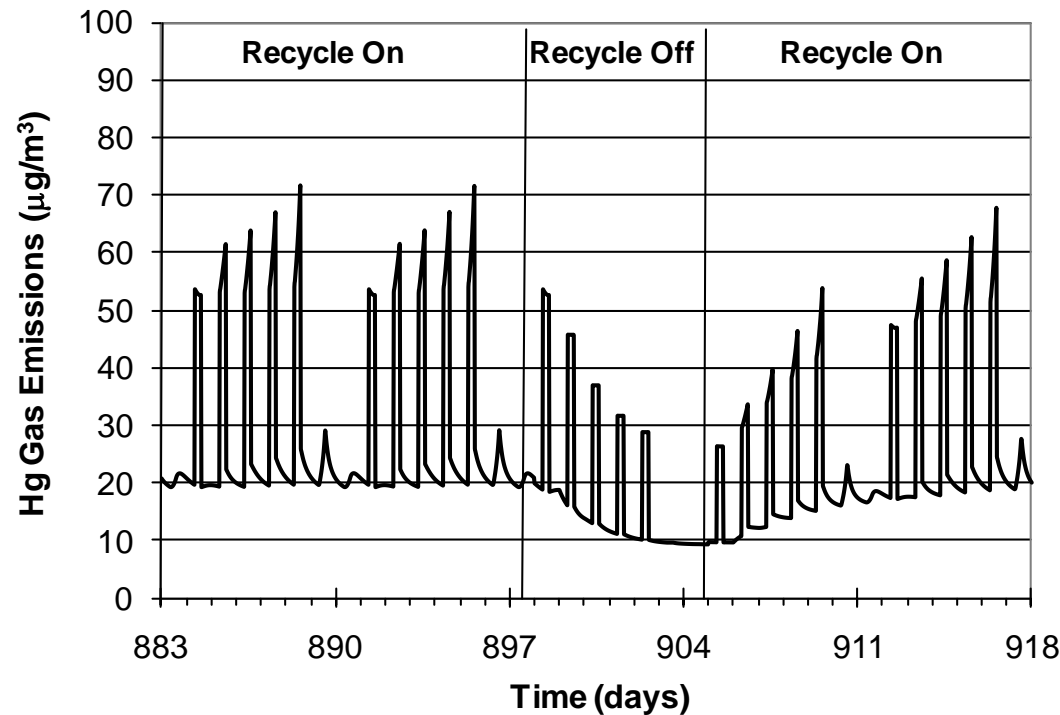


- Model predicts observed transients in Hg stack emissions



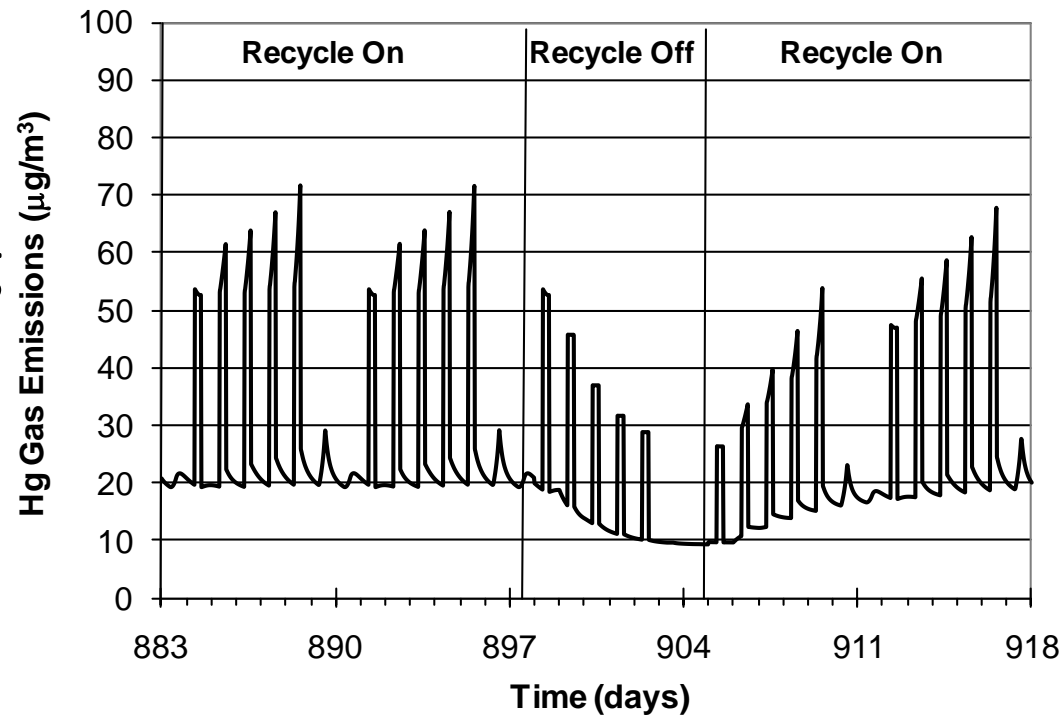
# Effect of CKD Recycle on Stack Emissions

- When CKD is recycled, stack emissions are higher
- After changing CKD (on or off), at least a week required to get to steady state
- Implications for sampling programs:
  - Know the local history of the kiln before sampling



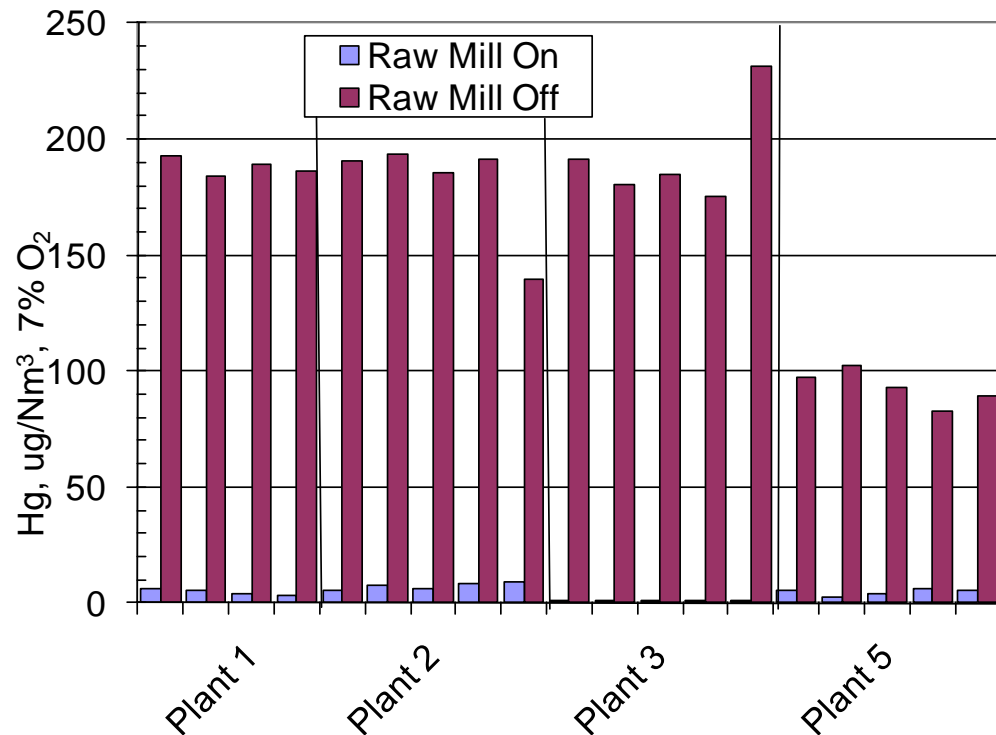
# Effect of CKD Recycle on Stack Emissions

- When CKD is recycled, stack emissions are higher
- After changing CKD (on or off), at least a week required to get to steady state
- Implications for control:
  - Control technologies must handle large Hg fluctuations
  - Wasting CKD has limited effect on stack emissions



# Effect of Raw Mill

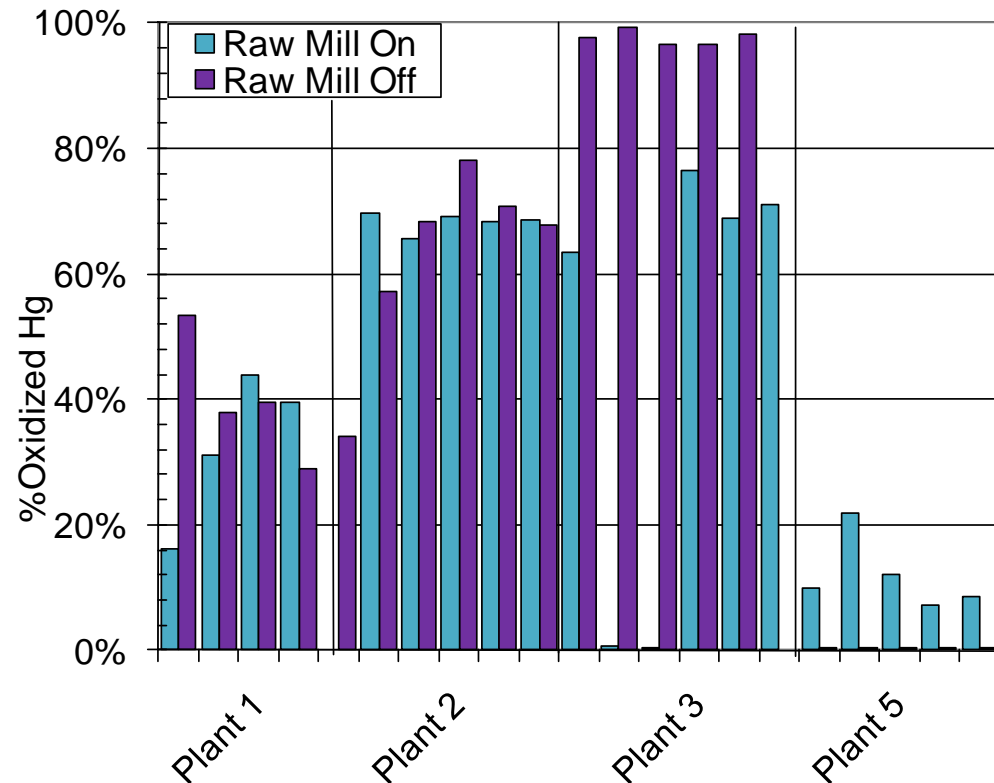
- Transient measurements show that Raw Mill affects concentration of Hg at exit of mill
- Short-term data (sorbent traps) from four kilns with scrubbers
- Concentrations of Hg at scrubber inlet were 15 to 200 times higher when Raw Mill was off-line



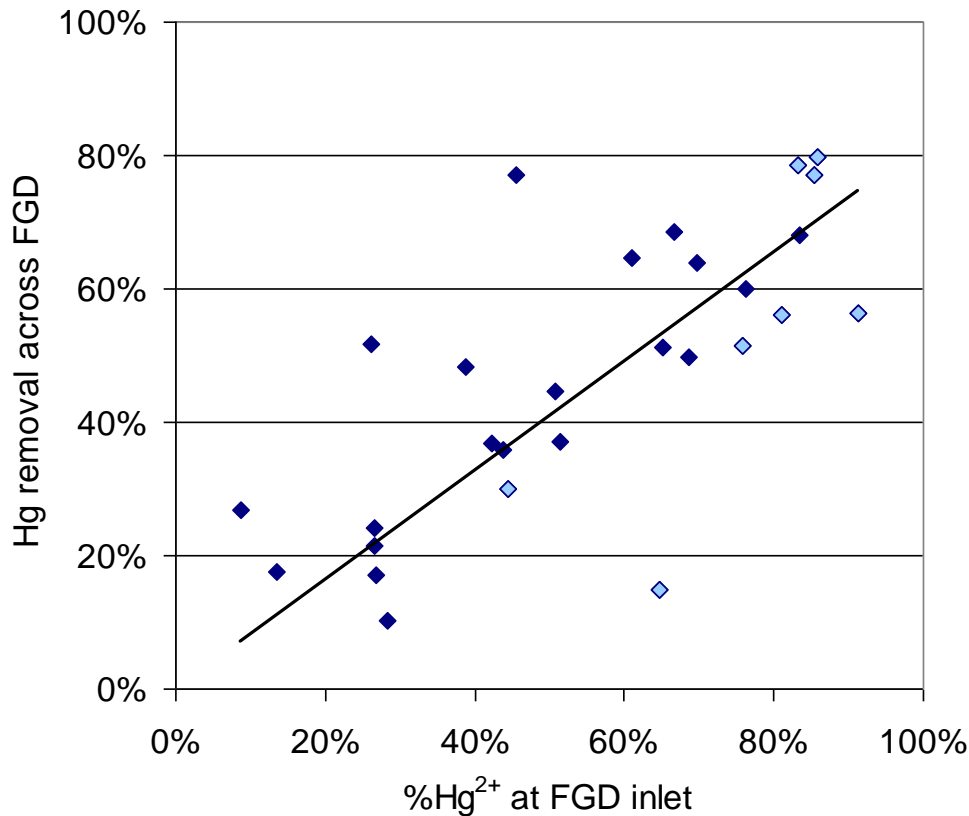


# Effect of Raw Mill

- Short-term sampling data (sorbent traps) from four kilns with scrubbers
- Speciation (%Hg<sup>2+</sup>) of mercury at scrubber inlet changes Raw Mill on/off
- Little consistency from one plant to another



# Mercury Speciation: Why Do We Care?

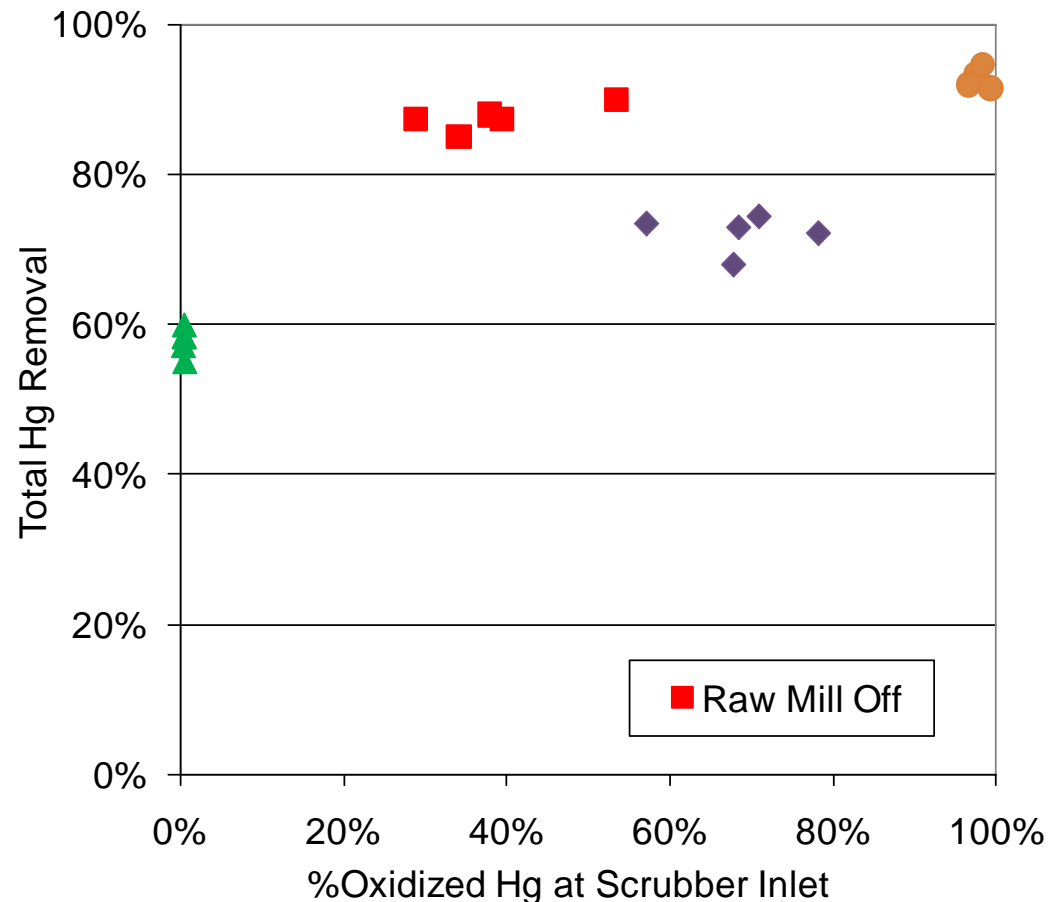


*Removal of TOTAL mercury across wet FGD scrubbers as a function of INLET  $\text{Hg}^{2+}$*

- In coal-fired power plants, mercury speciation ( $\text{Hg}^{2+}$ ) strongly affects removal across wet scrubber
- Is this true in cement kilns?

# Removal Across Wet Scrubbers

- Four different plants with Raw Mill off-line (higher Hg at scrubber inlet, speciation varies)
- 60%-90% removal
- Hg speciation at scrubber inlet was not a good indicator of removal across scrubber





# Summary

- Measuring Hg in cement kilns requires planning and knowledge of kiln operation
  - Know the local history of the kiln before sampling
  - Understand how long it takes to reach steady state
  - “Snapshot” measurements difficult to interpret
- Applications of controls for Hg
  - Control technologies must handle large Hg fluctuations in plants with in-line mills
  - Wasting CKD has limited effect on stack emissions
  - Need better understanding of Hg removal by scrubbers