South Bay Atmospheric Mercury Study

RMP TRC, October 2006

Project Collaborators

- USEPA Region IX (Andy Lincoff, Peter Husby, Luisa Valiela)
- Santa Clara County Parks
- NASA Ames (Kobin Lee)
- City of San Jose (Dan Watson)
- RB2 (Carrie Austin)

Objectives

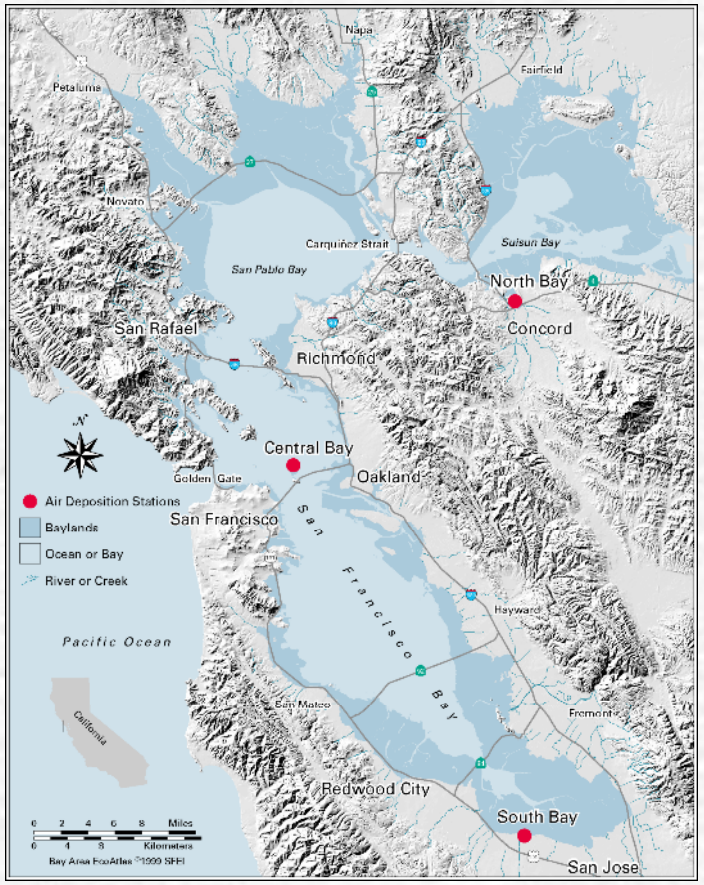
- Measure any differences in atmospheric Hg among different land use types (urban, open space, inactive mine)
- Obtain local data on Hg atmospheric speciation
- Observe if any changes in Hg air concentrations

Previous Work

- RMP Atmospheric Deposition Pilot Study (Tsai et al)- wet and dry deposition
  - 3 sites: Martinez, Treasure Island, NASA
- Ongoing MDN- wet deposition only
  - NASA Ames site only

Previous Results

- RMP Air Deposition Pilot Study (2000)
  - wet and dry deposition
  - 3 sites: Martinez, Treasure Island, NASA
- Ongoing MDN (2000-present)
  - wet deposition only
  - NASA Ames site only



Results: RMP AD Pilot

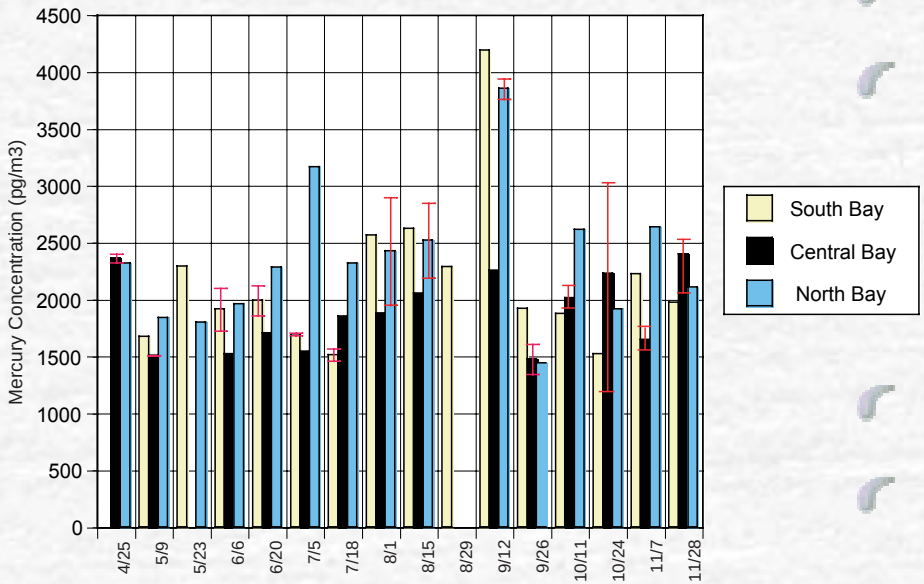


Figure 3. Mercury Concentration in the Ambient Air San Francisco Bay Area, Year 2000 (Bars indicate range of two measurements.)

- 14-15 samples
- Hg avg(±stdev) ng/m^3
  - N Bay: 2.3(±.59)
  - C Bay: 1.9(±.33)
  - S Bay: 2.2(±.66)
- North Bay > Central
- > "Global Avg" ~1.0 ng/m^3 but < US urban (East & Midwest)

Results: RMP AD Pilot

- Concentrations into dry deposition estimates
  - Gaseous (95% Hg^0) exchange
  - Assumed 3% particulate and 2% reactive (Hg^{2+})
  - Deposition velocity from literature
    - Hg^{2+} 1.0 cm/sec
    - Hg particulate 0.2 cm/sec
- Dry flux entire Bay average 19 $\mu g \cdot m^{-2} \cdot yr^{-1}$
- Wet flux (conc·precip) = 4.2 $\mu g \cdot m^{-2} \cdot yr^{-1}$
  - (~8 ng/L avg conc ~53 cm/yr precip)

Results: MDN Study

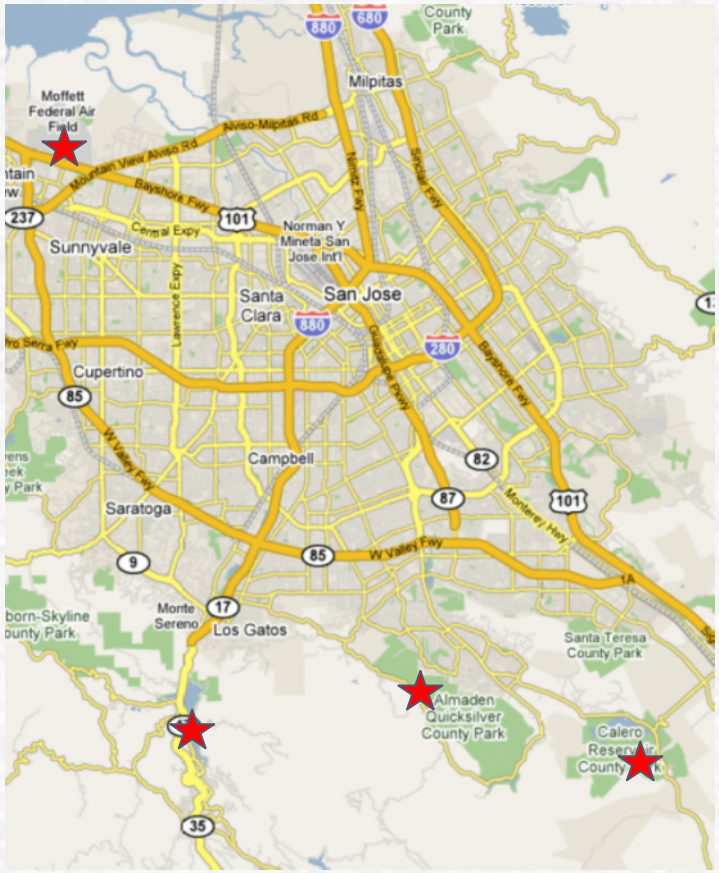
	San Jose 2000	**Covelo 1998**
Year 1	3770 ng/m^2 .365m precip 10.3 ng/L	4740 ng/m^2 1.36 m precip 3.5 ng/L
Year 2	2720 ng/m^2 .286 m precip 9.5 ng/m^3	4480 ng/m^3 1.09 m precip 4.3 ng/m^3
Year 3	1740 ng/m^2 .252 m precip 6.9 ng/L	2280 ng/m^2 (part yr) .63 m precip 3.6 ng/L

Results: MDN Study

	San Jose	**Sequoia**
2003	3600 ng/m^2 (2040/half) .268 m precip 13.4 ng/L	2560 ng/m^2 (2^{nd} half) .526 m precip 4.87 ng/L
2004	2015 ng/m^2 .256 m precip 7.88 ng/L	1740 ng/m^2 .412 m precip 4.21 ng/L
2005	3560 ng/m^2 .431 m precip 8.26 ng/L	6410 ng/m^2 1.29 m precip 4.98 ng/L

South Bay Sites

- Mix of sites
  - Urban: NASA Ames
  - Ex-mine: Guadalupe Reservoir
  - Open(?): Lexington (adjacent Hwy 17), Calero (SE of San Jose)
- Only NASA, Calero accessed



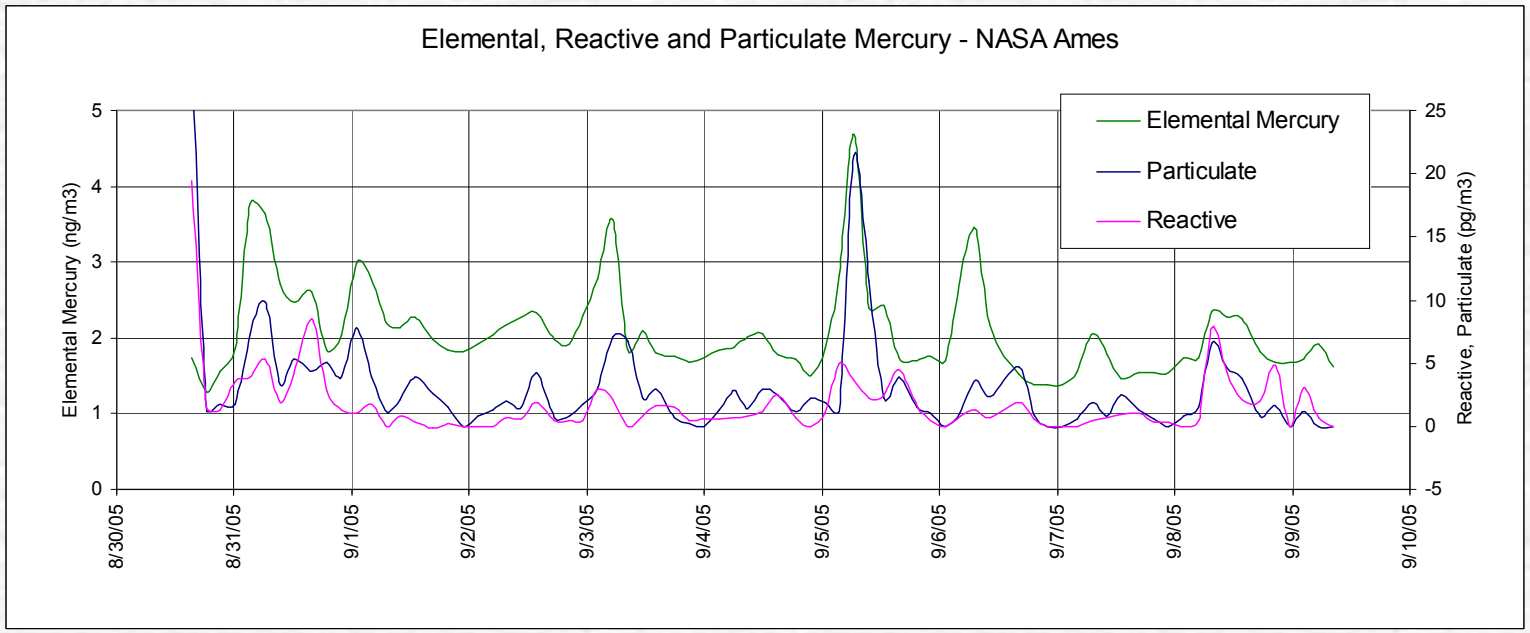
Methods

- Online Hg speciation/analyzer
  - (Tekran 2537/1135/1130)
  - Hg particulate, reactive, & elemental
    - Particulate & reactive 2 hr composites
    - Gaseous elemental 5 min
  - All instruments in EPA Region IX Hg mobile lab trailer

EPA Hg Mobile Lab

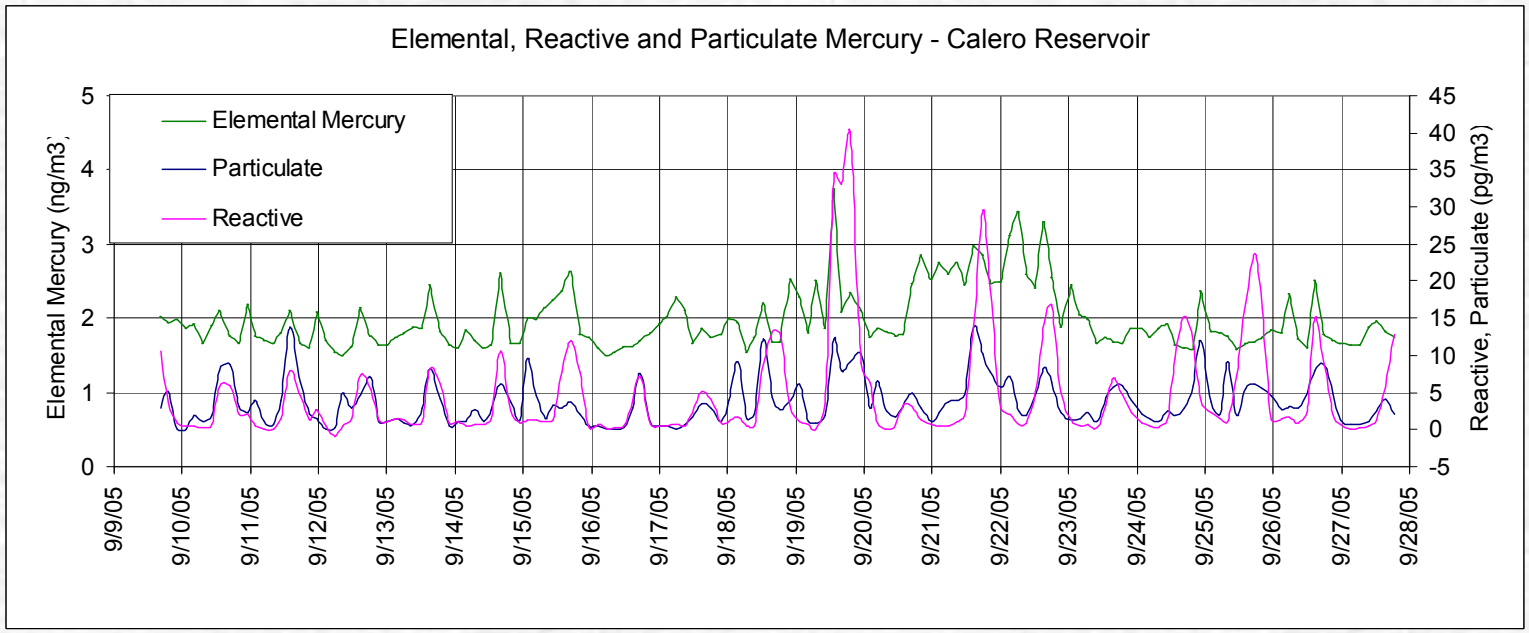
NASA Ames

- Hg^0 1.7ng/m^3, Hg_P 3.1pg/m^3, Hg^{2+} 1.8pg/m^3
- Daily morning max ?

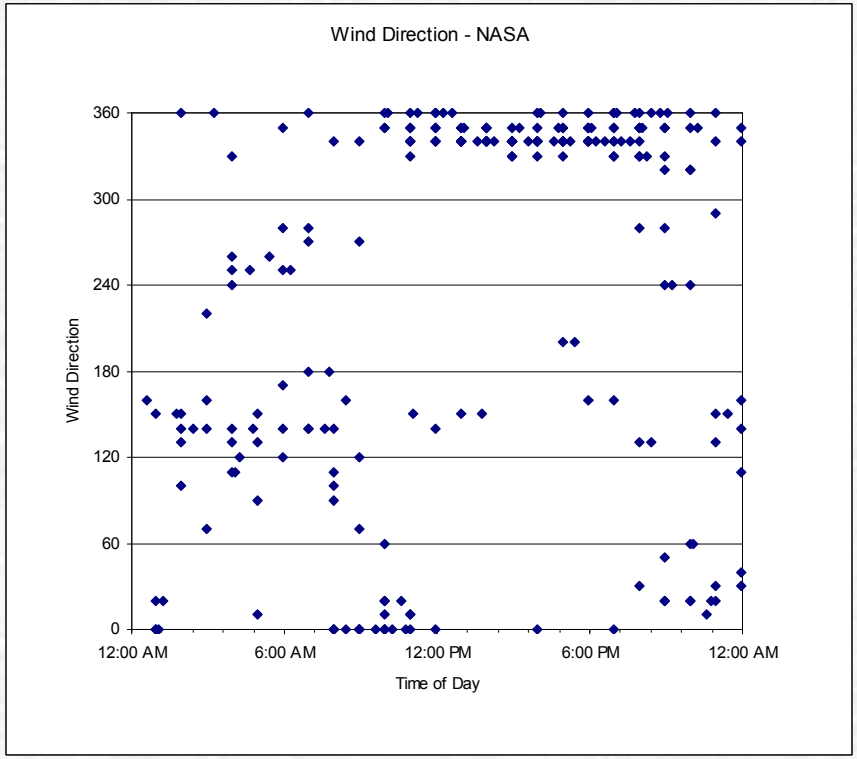


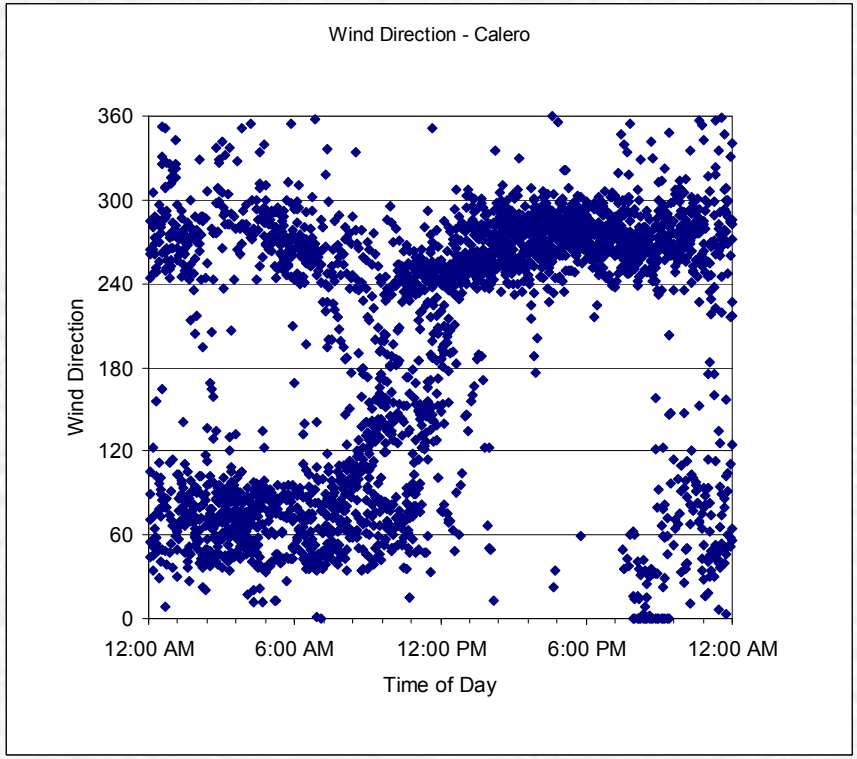
Calero Reservoir

- Hg^0 1.9ng/m^3, Hg_P 3.1pg/m^3, Hg^{2+} 4.6pg/m^3
- Daily afternoon max?



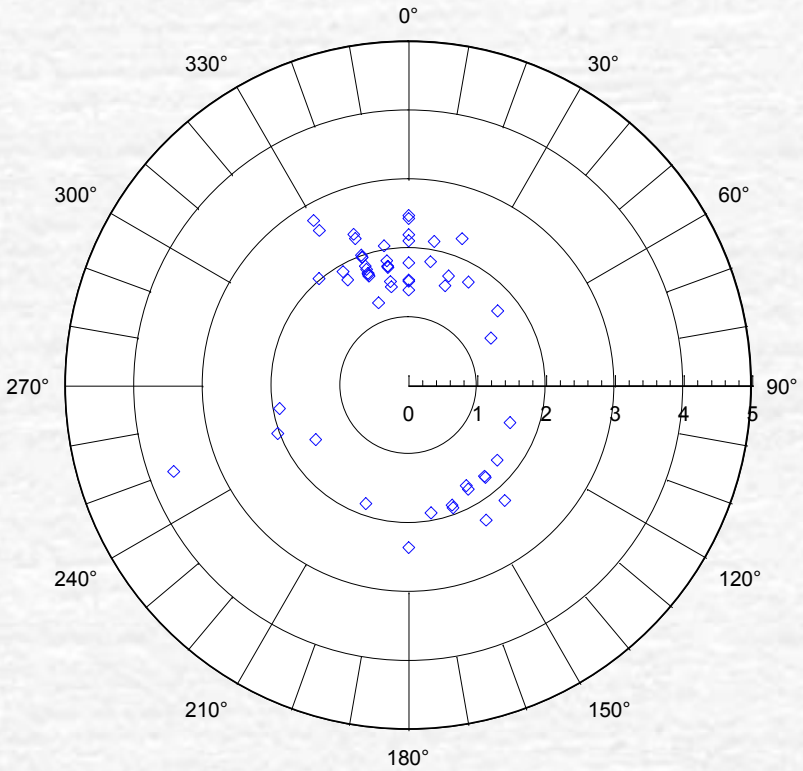
Daily Wind Direction



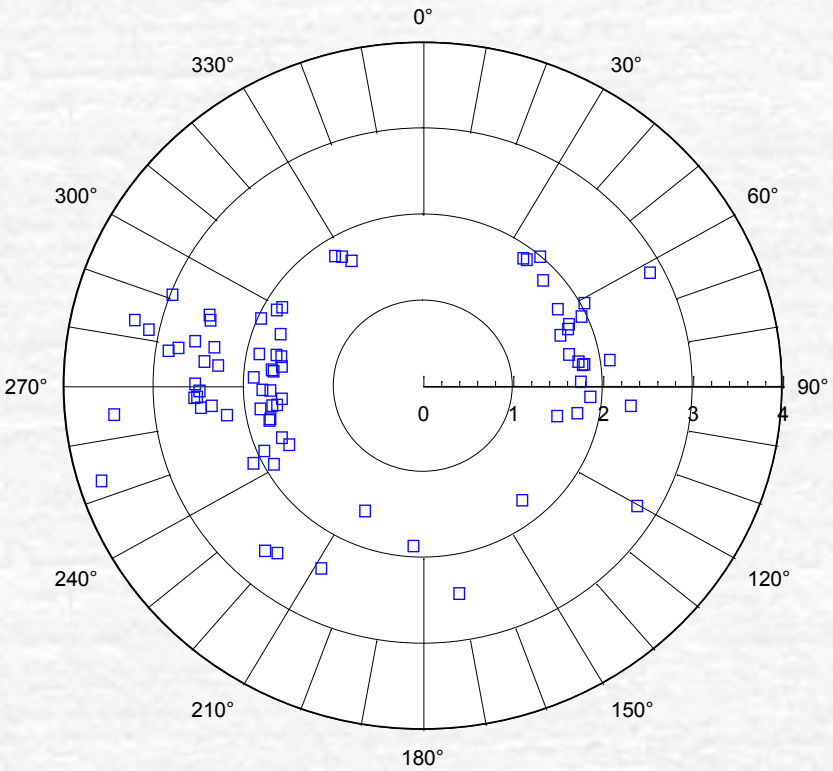


Daily Mercury Direction

- NASA ~uniform



Calero higher from W



Summary

- NASA & Calero Hg^0 similar, and comparable to previous SF Bay measurements (~2ng/m^3)
- Hg_P, Hg^{2+} average 0.1-0.2% of Hg^0 versus previously (literature) estimated 2-3%
  - Tekran speciation also <1% range other regions
  - RMP ADPS dry flux ~5-10x too high? (19→2µg/m^2yr)
- Diel cycle in wind direction and Hg @ Calero
  - Almaden source?
  - Need Guadalupe/Lexington/Almaden Reservoir data to resolve