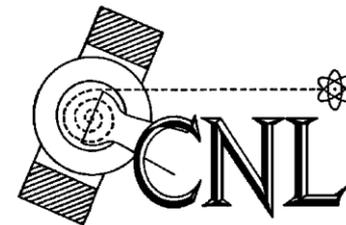


**IMPROVE**  
**Particle Monitoring Network:**  
**Status Report to**  
**IMPROVE Steering Committee**

Chuck McDade  
Crocker Nuclear Laboratory  
University of California, Davis  
Presented at Frostburg, Maryland  
October 2011

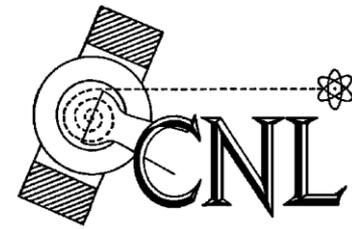


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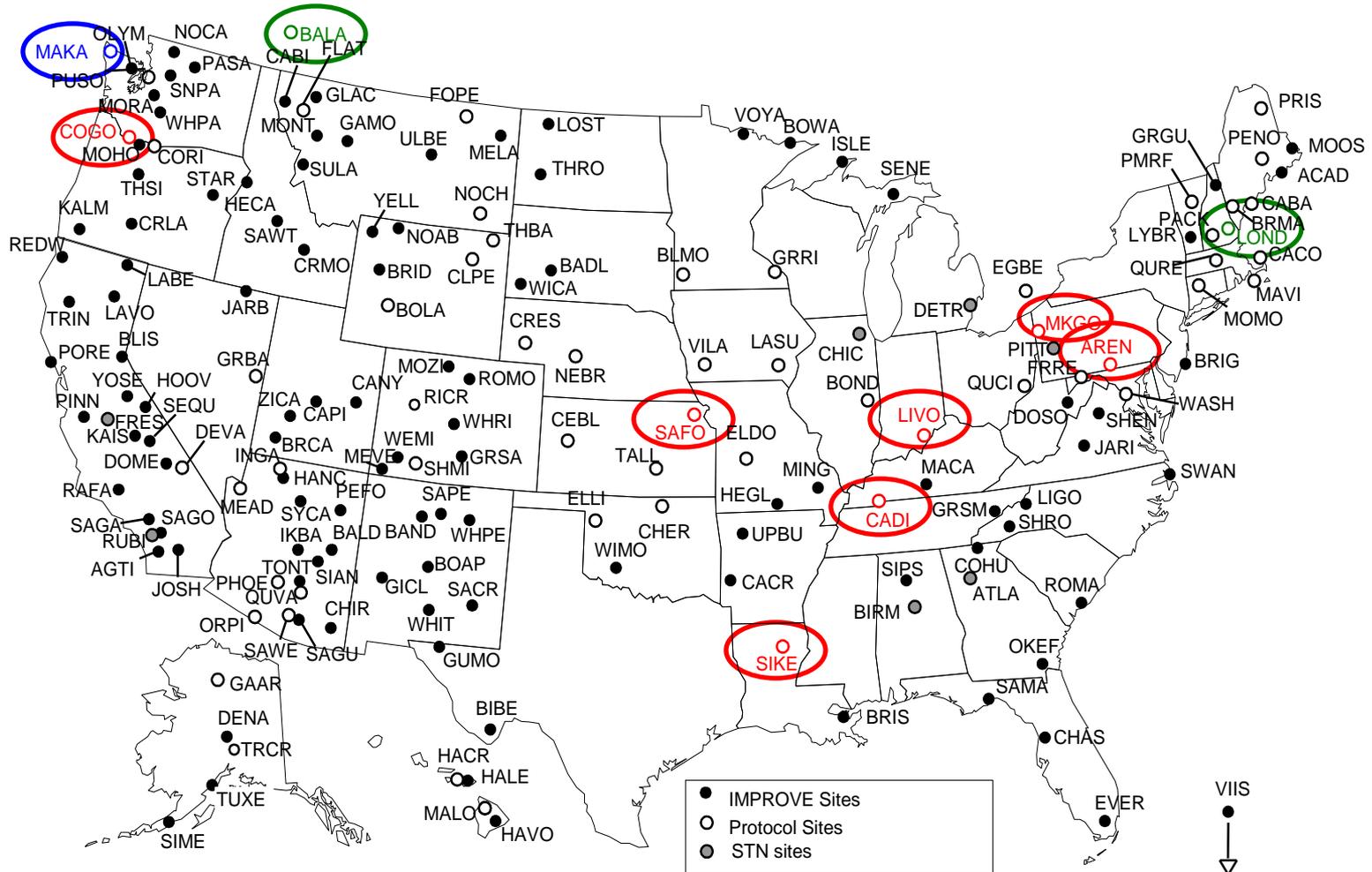


# IMPROVE Network

## Fall 2011

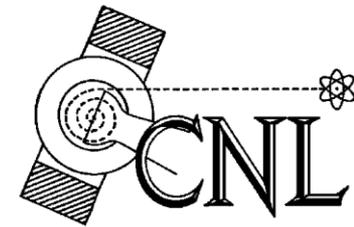


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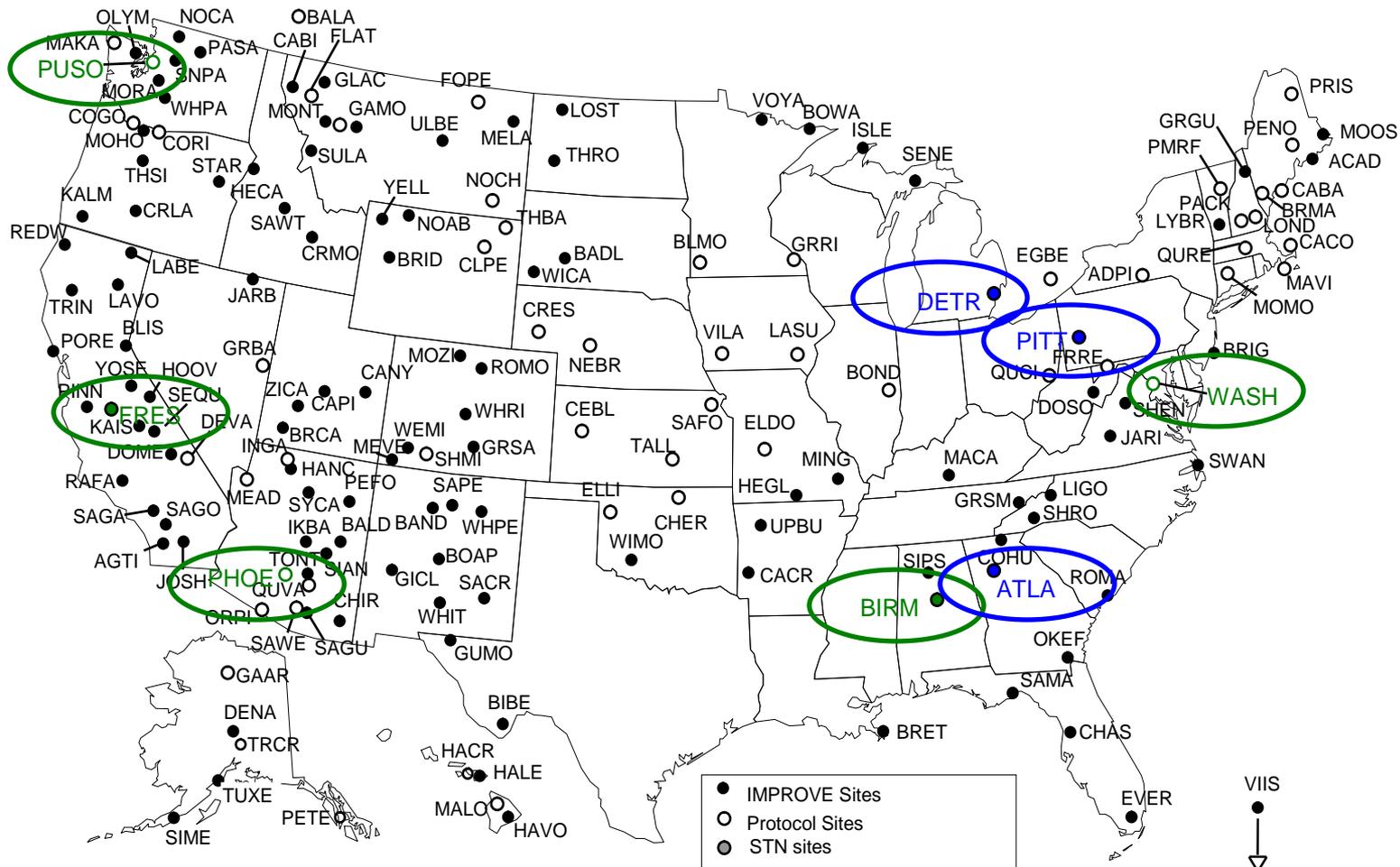


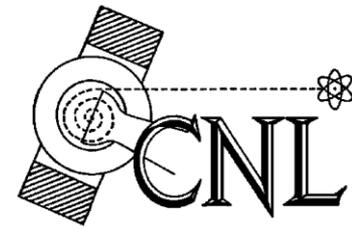


# IMPROVE Network Urban Sites, 2011



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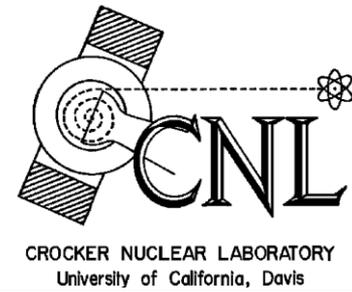


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# NETWORK PERFORMANCE: CALENDAR YEAR 2010



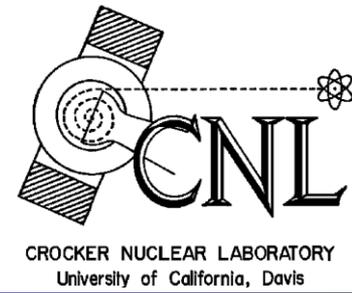
# 2010 Sample Recovery (A Channel, PM<sub>2.5</sub> Teflon)



- 95% Q1
- 95% Q2
- 94% Q3
- 94% Q4
- 95% Annual A Channel  
2009 was 94%



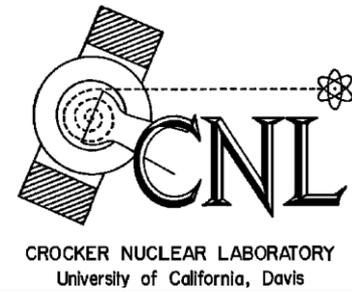
# 2010 Sample Recovery (All channels, ABCD)



- 94% Q1
- 94% Q2
- 92% Q3
- 93% Q4
- 93% Annual ABCD  
2009 was 91%



# Reasons for Sample Losses

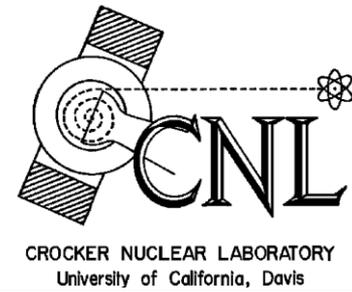


Of the 9% of lost samples (ABCD):

- 34% Equipment problems
- 34% Operator no-show
- 19% Power outages
- 8% Incorrect filter cassette installation
- 5% Torn or damaged filter



# Regional Haze Rule Requirements



A “complete” site has, for ABCD:

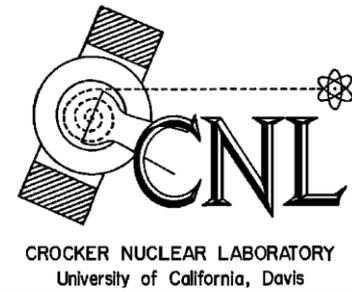
- >75% annual recovery
- >50% recovery in each quarter
- <11 consecutive missed samples

9 sites failed in 2010

(6 in '05, 4 in '06, 7 in '07, 13 in '08, 11 in '09)



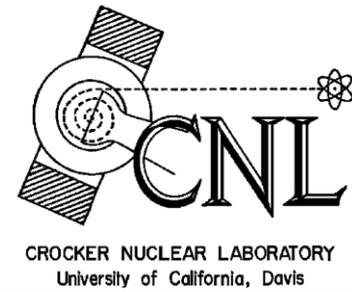
# Sites Failing RHR Requirements: Missed Sample Changes



- Gates of the Mountains, MT (IMPROVE)
  - Failed annual (71%)
  - Also controller malfunctions (frequent lightning)
- Great Gulf, NH (IMPROVE)
  - Failed all criteria
  - Also power outage due to late-2009 electrical fire
- Simeonof, AK (IMPROVE)
  - Failed annual (74%)
  - Also pump malfunction
- Remedy for missed sample changes
  - Discuss problem with operator and/or supervisor. All of these sites have improved in 2011.



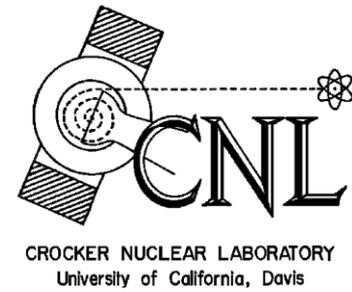
# Sites Failing RHR Requirements: Late Notification of Problems



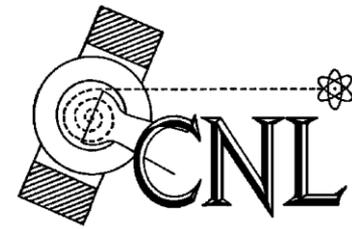
- Makah, WA (Protocol)
  - Failed consecutive samples. Failed in 2009, pump failure
- Sawtooth, ID (IMPROVE)
  - Failed consecutive samples. Failed in 2008, pump failure.
- Washington, DC (Protocol)
  - Failed annual (66%).
- Zion Canyon, UT (IMPROVEI)
  - Failed consecutive samples.
- Remedy for late notification
  - Operators have an example log sheet showing expected values



# Sites Failing RHR Requirements: Combinations of Problems



- Columbia Gorge West, WA (Protocol)
  - Failed consecutive samples
  - Pump failure followed by bad installation by new operator followed by power outage.
- Thunder Basin, WY (Protocol)
  - Failed quarterly & annual (69%). Failed in 2009 due to operator problems and in 2008 due to winter snow.
  - Controller & ebox problems. Replacement controller eventually fixed the problems.
  - Operator can be somewhat non-responsive, complicating problems. Unsuccessful at locating a replacement.

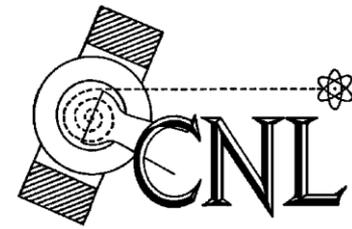


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# PROPOSED SITE IN SOUTH KOREA



# Baengnyeong Island



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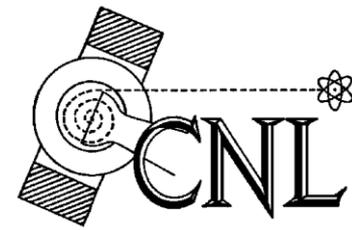
Baengnyeong Island

200 km from Seoul





# Downwind of Beijing, upwind of Seoul

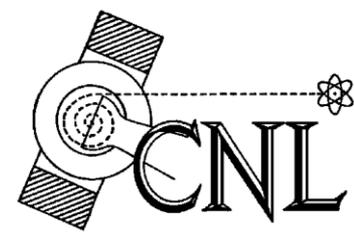


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# Urban air quality, monitored in Seoul

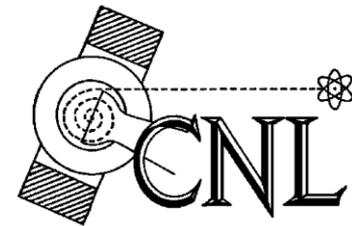


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# Baengnyeong Island Atmospheric Research Center

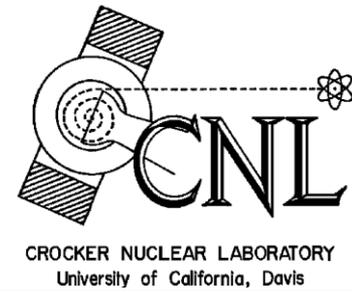


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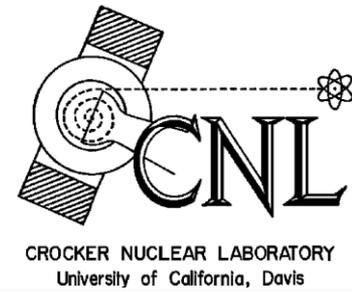
# Instruments at the Center



- PM (10, 2.5, 1) particle samplers
- Beta gauge & TEOM (for mass)
- MOUDI
- Aethalometer
- Sunset Lab time-resolved OC/EC
- URG-9000D time-resolved ions
- Xact 620 time-resolved XRF (John Cooper)



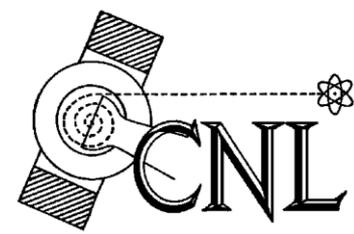
# Instruments at the Center



- Wide-range Particle Spectrometer (WPS)
- Aerosol Mass Spectrometer (AMS)
- Ionicon PTR-ToF-Mass Spectrometer
- Semicontinuous Elements in Aerosol Sampler (SEAS, U. of Maryland)
- ICP-MS
- Gaseous pollutant monitors
- Complete weather station



# Inside the Lab

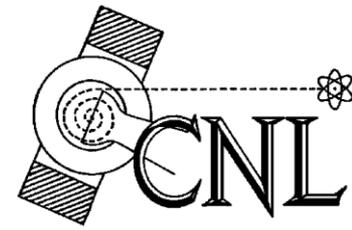


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# Rooftop Instruments & Inlets

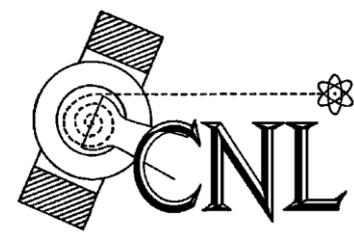


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# Looking down on the particle samplers

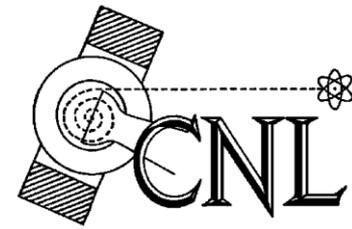


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# Apartments built for the staff

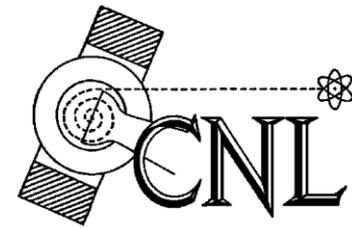


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# View toward the north coastline

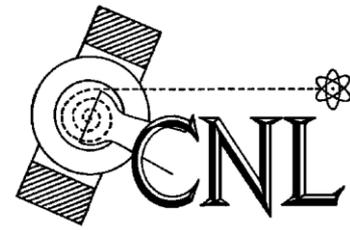


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# The little town near the lab

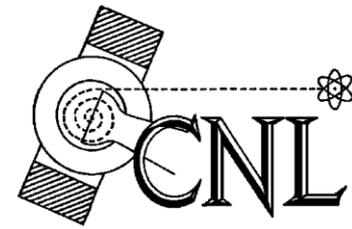


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# The island's answer to Home Depot

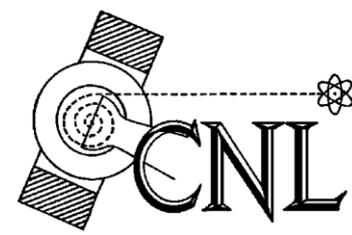


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# Only 12 km to North Korea

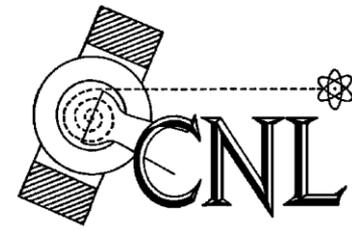


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# Military facilities line the north coastline

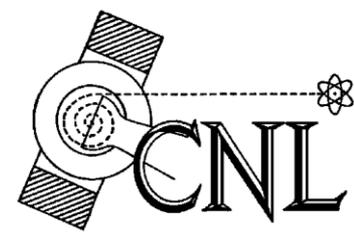


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# The Ferry

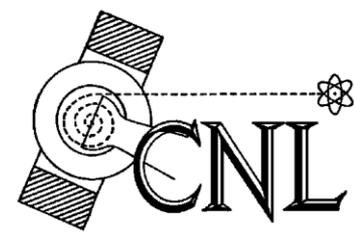


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# Inside the Ferry

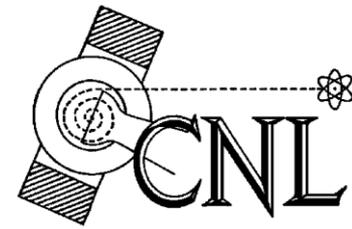


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# Sage advice for rough seas

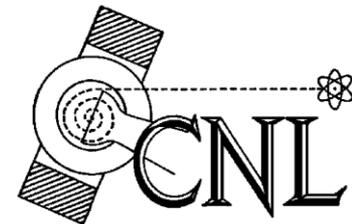


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# Taehyoung and Jeff

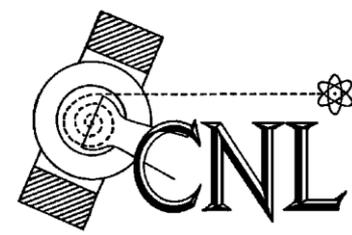


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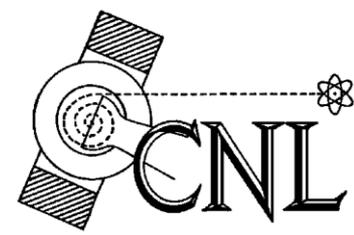


# Taehyoung and Gangwoong



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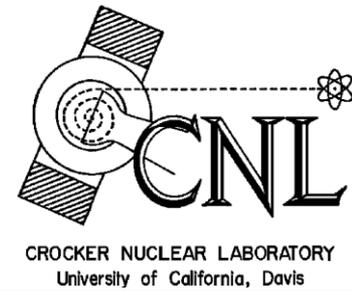


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# UC DAVIS RESPONSES TO EPA FIELD AUDITS



# Audit Summary



- 46 audits conducted in 2010
  - Magnehelic (cyclone) flowrate differences exceeded 10% limit in 6 audits
  - UCD responses on following slides
- No exceedances in 11 audits reported thus far in 2011



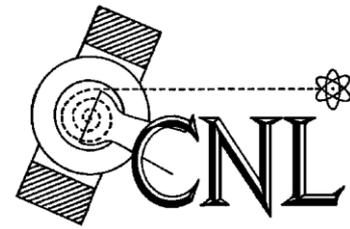
# Saguaro West, 1/13/10



- A, B, & C Mod flows high 10-15% in audit
- Operator reported a controller freeze on 1/28/10; new controller sent
- UCD maintenance on 2/3/10; all flows <10%



# Mohawk Mountain, 11/2/10

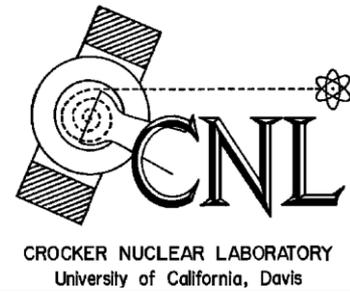


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- A, B, & C Mod flows high 10-15% in audit
- Sampler had been moved to an outdoor temporary stand due to site construction
- Move from indoors to outdoors precipitated electronic interference
- Following troubleshooting the controller was replaced; all flows  $<10\%$



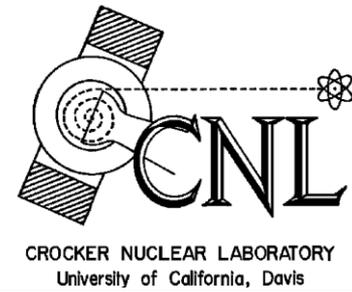
# Phoenix, 10/13/10



- All Mod flows high 25-30% in audit for PHOE1
- Temperature probe was faulty. Substituting PHOE5 temps brought all flows <5%



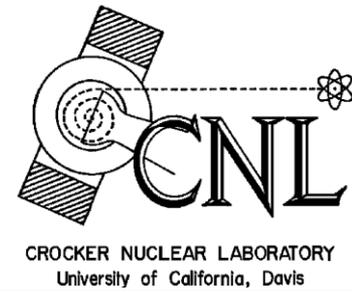
# Addison Pinnacle, 6/24/10



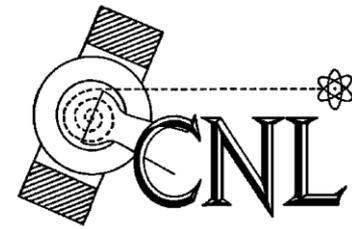
- All Mod flows low  $>50\%$  in audit
- Auditor's notes expressed problems with the plug while performing leak check
- UCD maintenance visit on 6/29/10 showed all flows  $<5\%$
- We concluded that audit was flawed, sampler functioning normally



# Queen Valley, 3/10/10 Washington, 12/14/10



- In both cases, A +/- or B mod was high by 11-12% in audit
- In both cases, audit trical was low (<21 lpm), sampler value was normal
- Routine data review revealed no apparent problems so samplers were not modified
- Next cal check at QUVA1 <1%, WASH1 <2%

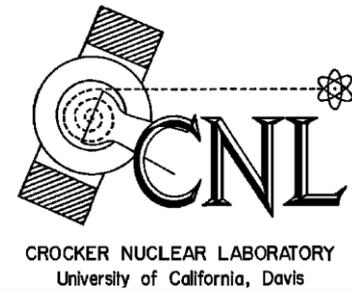


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# CONTRACT & COOPERATIVE AGREEMENT



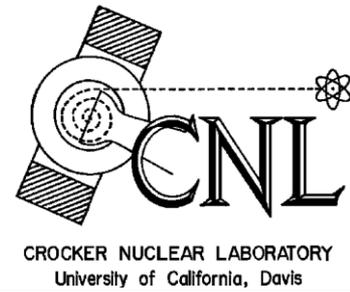
# Contract



- Supports the routine operation of the network (~75% of our effort)
  - Day-to-day operations, weighing & supplying filters to the network
  - Field maintenance & troubleshooting
  - Lab analysis at UC Davis (XRF, PESA, HIPS)
  - Data management & data validation
  - Documentation & reporting



# Cooperative Agreement



- Supports research associated with our measurements (~25% of our effort)
  - Enhanced QA of the IMPROVE data
  - XRF calibration advancements
  - FTIR method development
  - Multi-wavelength HIPS
  - OC measurement assessment
  - PM-10 sampler flow measurement improvements