Agricultural Burning at the California-Mexico Border: A Collaborative Effort to Address Air Quality and Community Health

Kinnery Naik, MPH
CDC Public Health Prevention Specialist

What is agricultural burning?

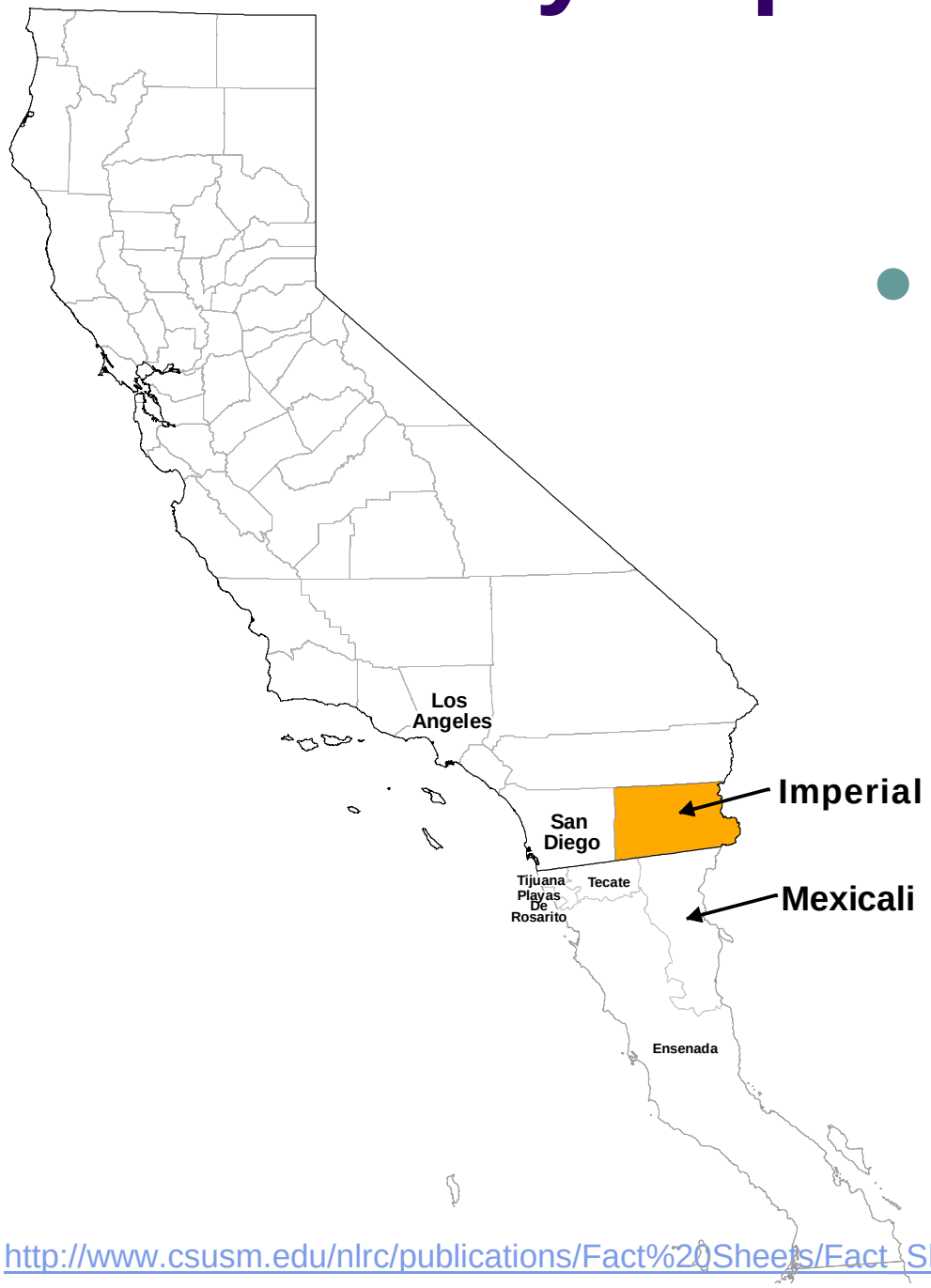
- The burning of agricultural fields to remove stubble and weeds after growing and harvesting crops

Image from: http://oceanworld.tamu.edu/resources/oceanography-book/Images/photo%202-7-4_l.jpg

Reasons to burn

- Clear fields for re-planting and seeding
- Control of pests and crop disease
- Improve crop propagation
- Reduces fire hazards in ditches and rangeland

Why Imperial County?



- Agricultural burning occurs throughout the CA-Mexico border region
  - Imperial county is centered around agricultural and has high levels of field burning in the state
    - About ¼ of those fields are located near highways, residential areas, and schools.

http://www.csusm.edu/nlrc/publications/Fact%20Sheets/Fact_Sheet_Health_Disparities_Imperial.pdf

Why Imperial County?

- Unique geography: a valley below sea level
  - Pollutants from the smoke can persist in the atmosphere leading to prolonged exposure for the residents
- Designated as being a non-attainment zone for the state and national PM_{10} and ozone levels
  - Reports the highest levels of PM10 and number of days out of compliance in the state
- Reports the highest childhood and adult asthma rates California
  - Highest age-adjusted asthma hospitalization rate in CA; specifically in children under the age of 17

Particulate Matter (PM)

- PM are fine particles made up of solids and liquids
  - PM10 can settle in the bronchi and lungs and cause respiratory health problems.
  - Agricultural smoke tends to be PM2.5 that can penetrate into deeper regions of the lung and cause inflammation.

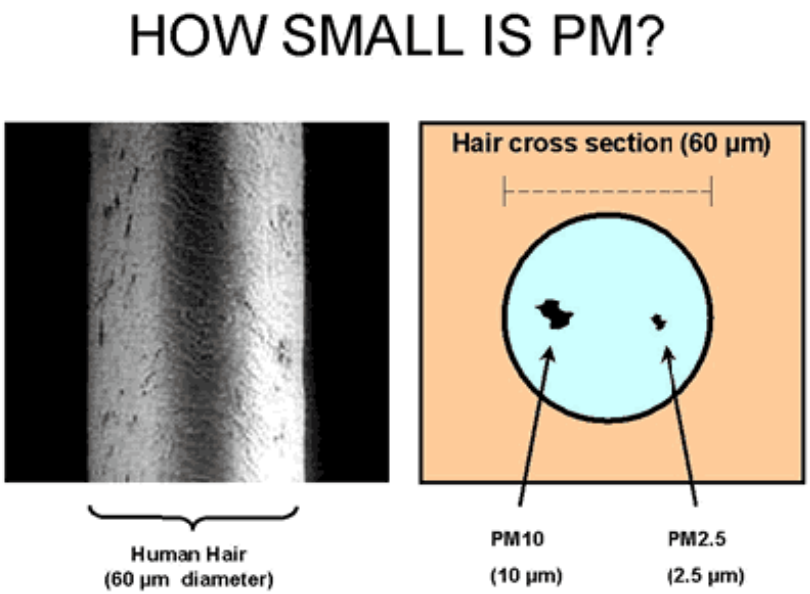


Image from: http://www.arb.ca.gov/research/aaqs/pm/hair-slide3-1-450px.gif

Why Imperial County?

CALIFORNIA COUNTIES WITH THE WORST PM10 EMISSIONS

By some criteria, Imperial County suffers from the worst dust pollution in California. Coarse particles known as PM10 have been a health concern for years, but the Environmental Protection Agency recently said they aren t a serious problem in rural areas.

County	Tons per day
Imperial	237
Los Angeles	184
San Bernardino	154
Inyo	150
San Diego	133

SOURCES OF DUST IN IMPERIAL COUNTY

Imperial County s air-particle pollution is largely from dust that blows off the vast barren lands ringing populated areas.

Source	Total particulate matter (PM) in tons per day
Windblown dust	339
Unpaved-road dust	57
Farming operations	34
Paved-road dust	9
Other	9
Mining	5
Total	**453**

SOURCE: California Air Resources Board, 2005 estimates

PETE CHENARD / Union-Tribune

Why Imperial County?

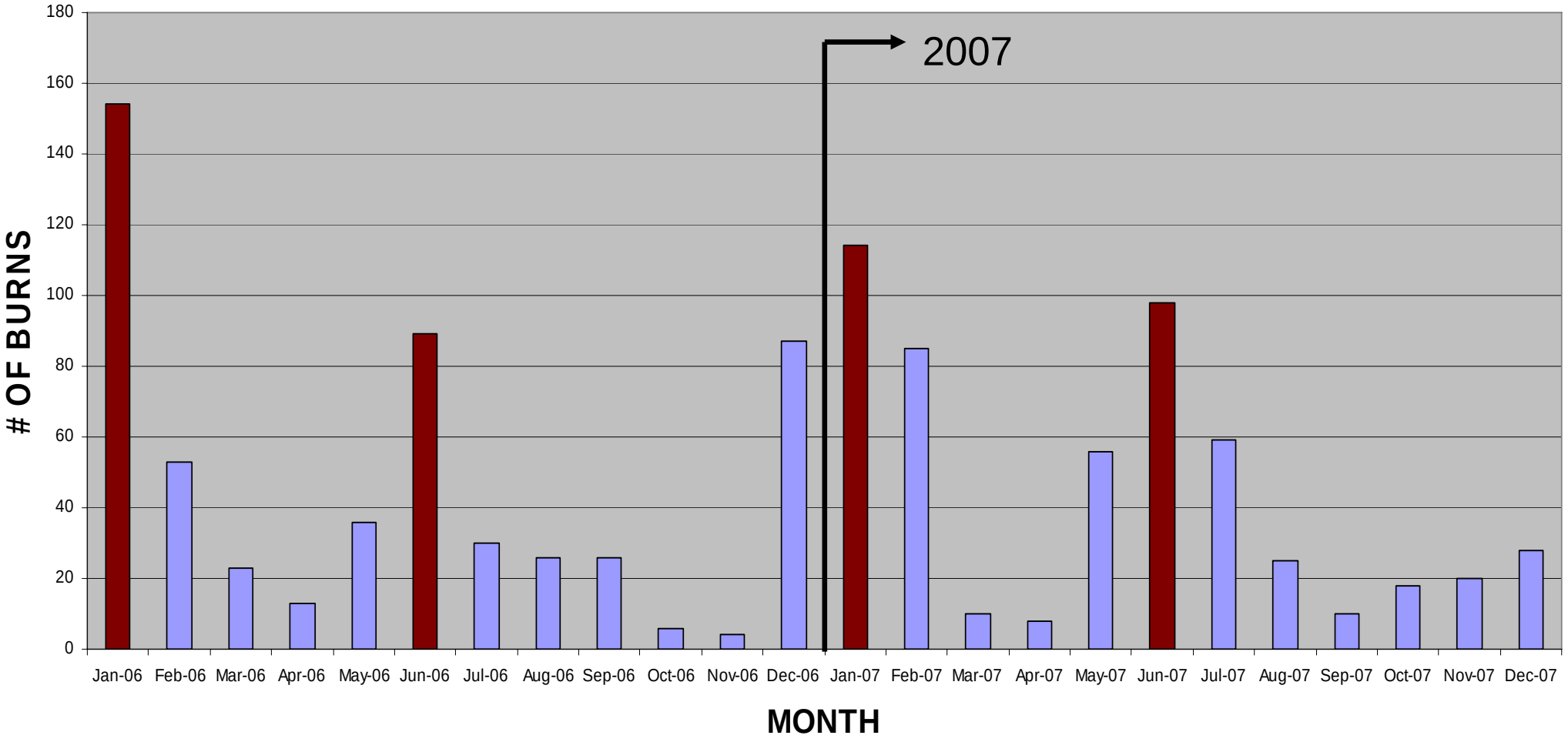
- Agricultural burning is not the only contributing factor to poor air quality
  - **Other contributors: cross border goods transport, unpaved roads, off-road recreational vehicles, Salton Sea debris, feedlots**

- Bases on a 2001 statewide report, Imperial County has the highest frequency of field burning with about 55,000 acres burned annually.
  - **It has decreased to 35-40,000 acres annually in recent years, but the county is still a top burner**

Image from: http://www.atvriders.com/images/honda.jpg and http://www.epa.gov/region8/images/feedlot.jpg

Why Imperial County?

- Agricultural burning occurs throughout year with peaks in January and June



Agricultural Burning as a Public Health Project

- Goal: Protect public health by reducing exposure to smoke and other toxic air pollutants released during agricultural burning.
- In line with the Border 2012 Program and CA-Baja CA 2008 Priorities
  - Goal #4: Improve Environmental Health
    - Air Quality and Impacts on Human Health
- EHIB staff previously demonstrated an association between rice field burning and asthma hospitalizations (1983-1992)

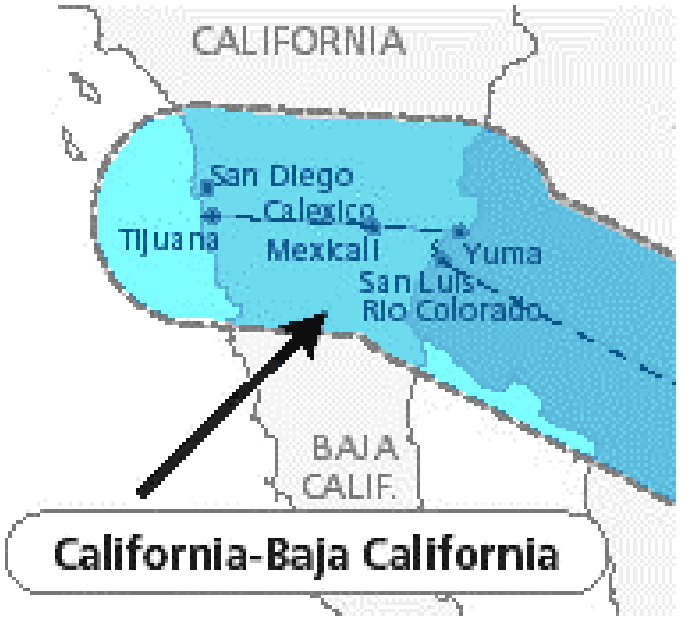


Image from: http://www.epa.gov/border2012/images/border2012-workgroup-map.gif

A Concern for Community Organizations

- Comite has small community projects in place to address agricultural burning
  - Non-profit organization that has worked with local and state agencies to bring awareness to environmental issues in Imperial County with the help of Promotores (outreach workers)

- The CA Clean Air Initiative had designated agricultural burning as a priority topic
  - An organization that works to improve the air quality in the Imperial County and the Mexicali border region through education, advocacy, and support

Image from: http://www.eurobodallabiz.com.au/community.jpg

Binational Environmental Health Taskforce (BEHT)

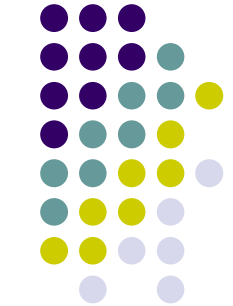
- Coalition of state, local, tribal, health, and environmental agencies
  - Identify and address binational environmental factors that pose high health risks for exposure reduction
  - Increase collaboration between environmental and public health entities
  - Provide stakeholders the opportunity to participate in environmental health initiatives
    - Stakeholders include: individuals, communities, institutions, organizations, and occupational groups.

Community Engagement Approaches

- Propose agricultural burning project concept to the BEHT to apply for an EPA grant
  - Brainstorm about priorities, interests, possible contribution of resources
    - Is agricultural burning a priority?

- Begin development of project plan based on BEHT input. Contributors include:
  - Comite, Imperial County Air Pollution Control District (APCD), Imperial County Public Health Department, CA Clean Air Initiative, CA Binational Border Health Office, CA EPA

Submission of EPA Grant Proposal

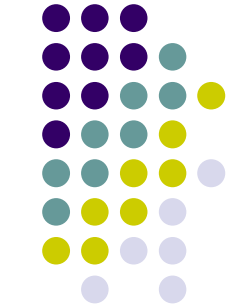


- May 2008: EHIB/EHLB and collaborators submit preliminary proposal to BECC (US EPA fiscal intermediary).
- August 2008: Proposal accepted.
- September 2008: Detailed work-plan submitted.
- November 2008: QA/QC plan submitted to BECC.
- January 2009: Air sampling initiated after US EPA reviewed and accepted the QA/QC plan.
- March 2009: Air sampling concluded and data analysis initiated (still in progress).
- May 2009: Begin development of exposure reduction recommendations.

Objectives of Ag Burn Project

- Assess the exposure of residents in Imperial County to smoke from agricultural burning by monitoring the outdoor air near burning agricultural fields.
- Identify educational needs, assets, and opportunities related to agricultural burning and public health.
- Develop scientifically and culturally valid exposure reduction recommendations.
- Raise awareness about ways to reduce exposure.

Project Components



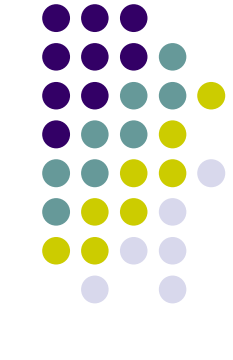
1. Assessment of needs, assets, and opportunities through Key Informant Interviews

2. Exposure Assessment through air monitoring

3. Exposure Reduction Outreach and Education

4. Coordination and Collaboration
   - California-Baja California effort

1. Needs Assessment



- Objective: Assess community awareness & outreach and ongoing activities related to agricultural burning. Identify gaps in awareness and coordination of efforts.

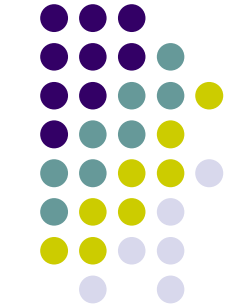
- Process: Key Informant Interviews
  - 25 Community members and leaders were interviewed
    - A short list includes: Teachers, residents, farmers, and leading agencies and organizations such as the APCD, and the Farm Bureau.

A draft report summarizing findings is in progress.

2. Exposure Assessment

- Historical burn acreage data collection
  - Compile daily agricultural burn data on GoogleEarth
    - Determine peak burn season, “hot spots” for burning, and general burning patterns.
- Air quality and meteorology data abstraction
  - Examine daily PM data and meteorology conditions corresponding to burn dates
    - Study wind patterns to determine the best methods of air sampling

2. Exposure Assessment: Air Monitoring Site Selection

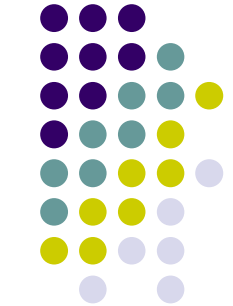


- Identify wind and burn patterns for January ’06 &’07 to predict January 2009 burn events
  - Identify potential monitoring sites using this data.

- Air monitoring for burn events: January 2009
  - 12 potential air sampling locations throughout the valley were pre-identified by:
    - using GoogleEarth maps of historical burn locations and meteorology data
    - Target places of public access: schools, community areas like churches
    - Soliciting suggestions from local collaborators.

- Consent to monitor on the property was obtained from property managers and school superintendents.

2. Exposure Assessment: Air Monitoring: January - March 2009



- Daily correspondence was maintained with the APCD to identify planned field burning locations
  - Daily burns depended on the weather, including the inversion layer and the wind direction
    - i.e. If the wind was blowing from a field towards a residential area or a road, then the burn would not be scheduled by the APCD

- With 2-3 days advanced notice, field staff was able to identify sampling locations near the field
  - At least 2 locations were identified downwind and within 2 miles of the field.
  - One upwind location was also identified.
  - Main sampling locations were taken from the pre-identified list. Additional sites were found in a “door-to-door” fashion

2. Exposure Assessment: Air Monitoring: January - March 2009

- Air monitoring during and following 4 burn events were conducted from January – March 2009 in Holtville, Brawley, and Imperial, CA.
  - Depending on availability of sampling locations, samples were collected at 3 to 8 locations surrounding the burn event
    - Usually at 2 locations within 2 miles of the burn event, 1 location upwind, and one co-located with an EBAM.
  - Samples were collected for 24 to 120 hours

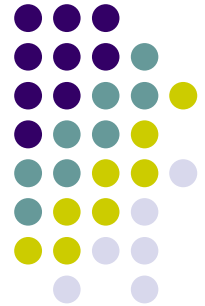
2. Exposure Assessment: Air Monitoring: January - March 2009

- In addition, one special burn event was monitored on Jan 27th.
  - 24-hour samples were collected at 3 telephone poles within 50 feet of and downwind of a burning field.
  - The samplers were visibly covered by a ground-level smoke plume.
  - Samples enable the laboratory to analyze samples that are high in concentration and will help insure that all measurements and instrument readings are accurate.

Before the burn

After the burn

2. Exposure Assessment: Air Monitoring: January - March 2009



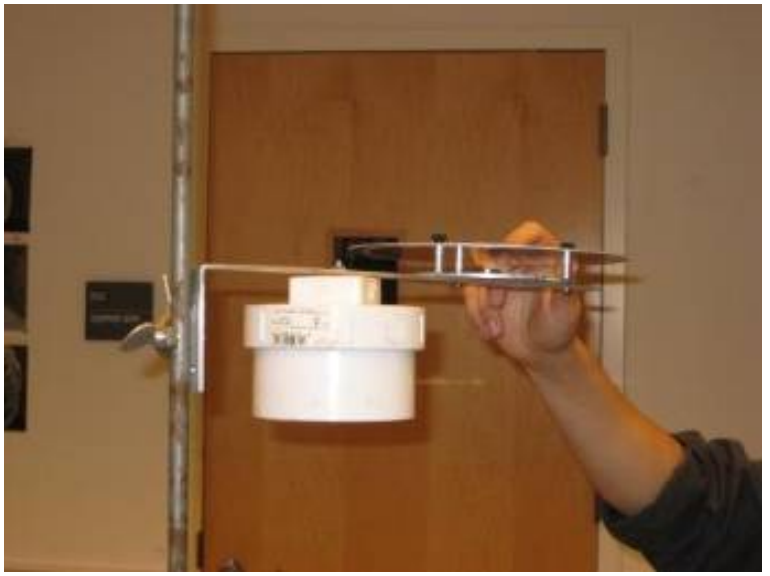
- California Air Resources Board installed EBAMs to report continuous hourly PM2.5 concentrations.
  - Set up at 4 locations throughout Imperial County for 3 months.
  - Data from EBAMS will provide valuable quality control comparisons for the samples collected by CDPH.

- Instrumentation: Combination of “real-time” instrumentation from SDSU and passive samplers sent to EHLB for laboratory analysis
  - Real-time instruments:
    - Aethalometers to measure real-time black carbon
    - pDRs to measure PM2.5 and overall PM
  - Passive monitoring instruments:
    - Passive sample badges for collecting naphthalene
    - UNC passive sample badges for collecting airborne PM

2. Exposure Assessment: Air Monitoring: January - March 2009

Naphthalene badges

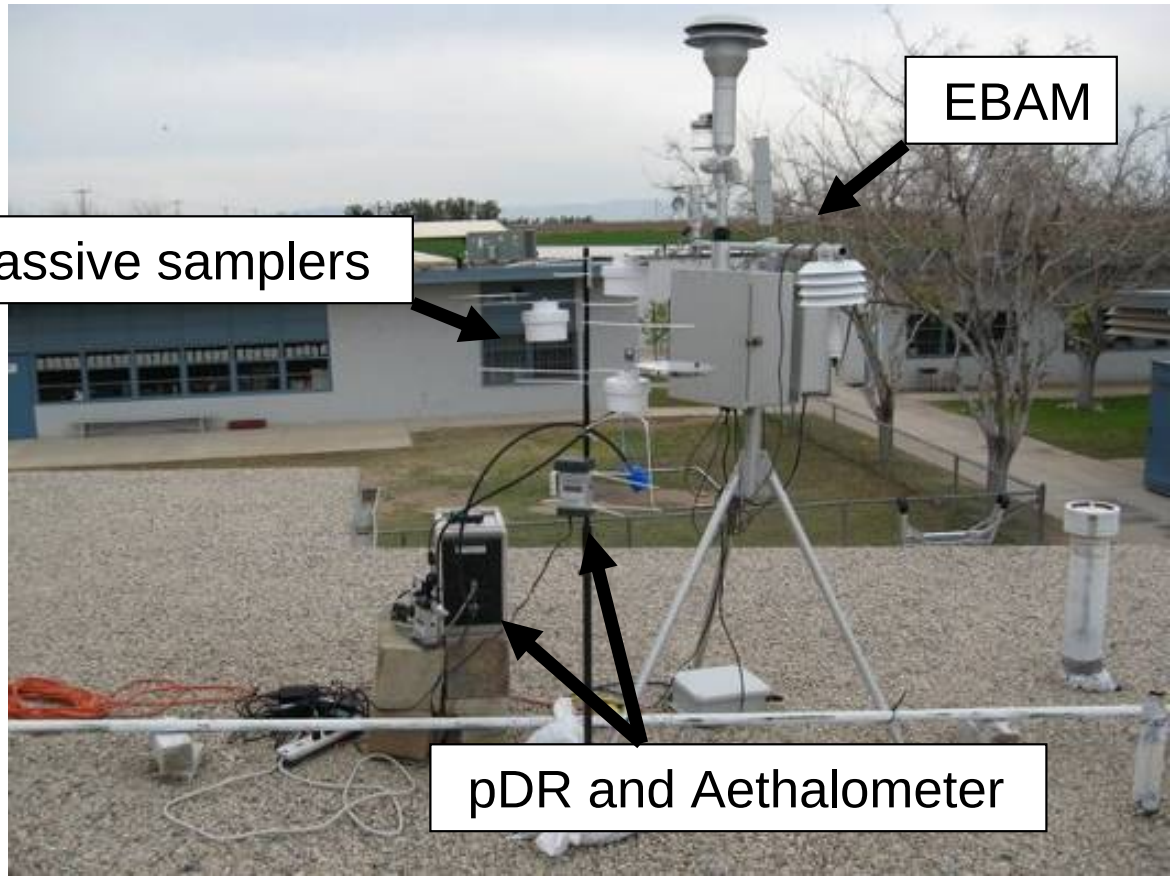
UNC Passive samplers



Shelter constructed to hold both samplers

- Laboratory analysis of passive samples are in progress including:
  - gas chromatography/mass spectroscopy (GC/MS) for naphthalene
  - scanning electron microscopy (SEM) with energy dispersive spectroscopy (EDS) to analyze PM samples and identify particle type.

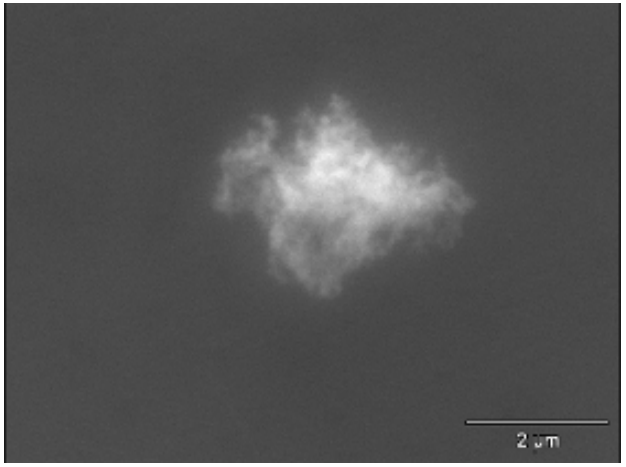
2. Exposure Assessment: Air Monitoring: January - March 2009



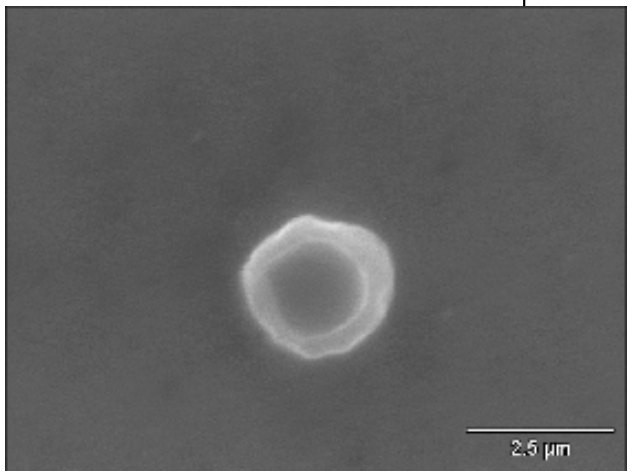
Sampling set-up at Meadows Elementary School in El Centro, CA.

- Co-location sampling
  - At the end of the sampling period, the team deployed passive samplers and pDRs at the 4 EBAM locations
    - 72-hour samples were collected in 3 waves, for a total of 12 co-location samples of each type.

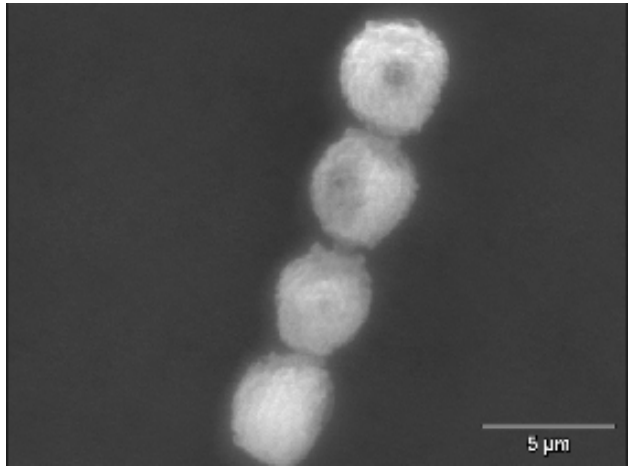
2. Exposure Assessment: Preliminary Results from GC/MS

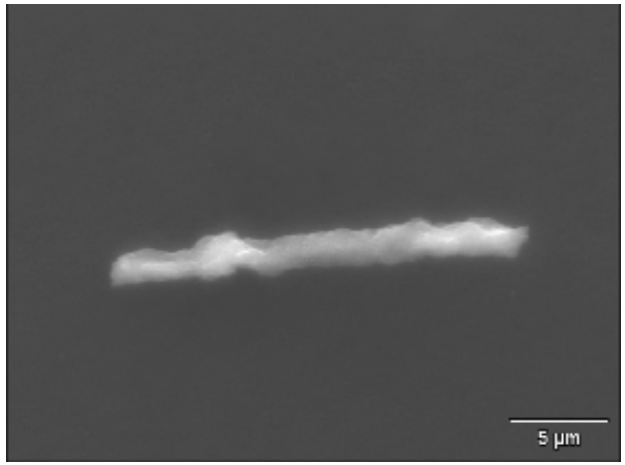


Combustion particle



Salt particle – Salton Sea debris?





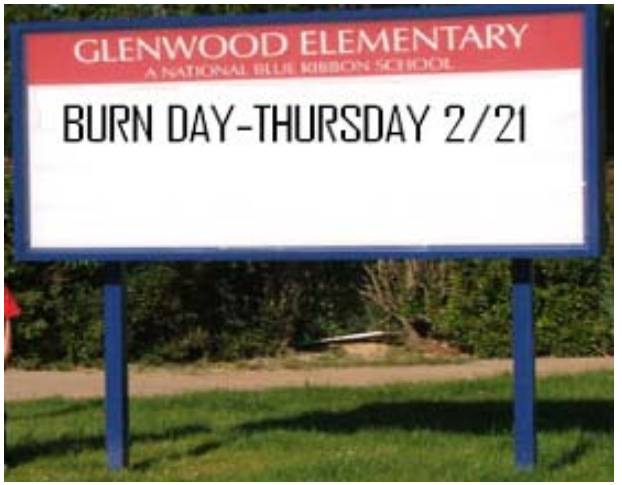
Inorganic particles – plant derived

Air Monitoring: Current and next steps

- CDPH anticipates that it will take up to 6 months to complete sample analysis.
- $PM_{2.5}$ data from the CARB EBAMs is almost final.
- CDPH hopes to statistically examine real-time and passive monitoring results in relationship to all burn events that occurred in Imperial Valley during Jan-March 2009.

3. Exposure Reduction Outreach

- Needs assessment and air monitoring results will be used to develop and draft *scientifically and culturally valid* exposure reduction recommendations



- Target groups:
  - Farmers,
  - Schools (teachers, students, parents)
  - Community at large
- A local outreach coordinator will develop a plan to disseminate information and conduct additional needs assessment if necessary
- Collaborator review of draft recommendations is scheduled for July 2009, following laboratory analysis of air samples and key informant interviews.

Picture from: http://iwww.westcoastsignworks.com/images/portfiolio_details/monument/glenwoodschool.jpg (West Coast Sign Works)

3. Health Education Materials Dissemination

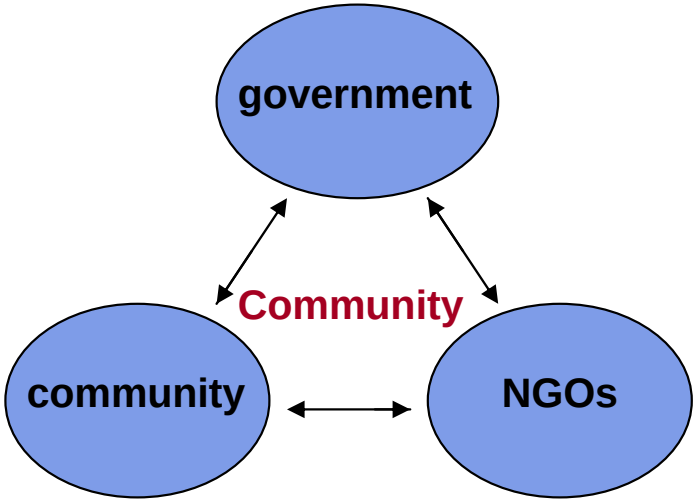
- Outreach implementation is planned for the next projected active burn season (Jan. 2010).
  - Collaborators will receive draft documents of all the materials developed and produced.

- Collaborate with the ICPHD and other community stakeholders for outreach:
  - Consider appropriate and relevant methods of outreach materials dissemination for the community:
    - Brochures, community forums, and posters
    - Post information on CDPH, county health, and APCD websites

- Final assessment: Community interviews at targeted locations to determine community awareness of recommendations and health information (Feb. 2010).

4. Coordination

- Enhance coordination among NGOs and governmental agencies addressing air quality and public health issues in Imperial County and Mexicali Municipality.
- Aim:
  - Avoid duplication of efforts
  - Better ensure more efficient and effective use of resources



Future & Sustainability

- Project results will provide the foundation for educational efforts such as forums, mass media, or *promotora* trainings.
- Developed methods will allow agencies in CA to be better equipped to respond to emergency events such as hay bale and wildfires.
- Provide a model for responding to burn events in Mexico and other areas of the US-Mexico border region

Acknowledgements

Martha Harnly (CDPH)

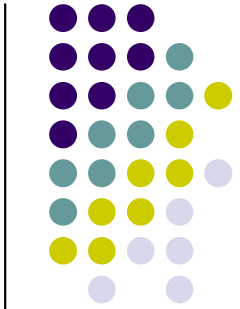
Tivo Rojas-Cheatham (CDPH)

Maura Mack (previously at COBBH)

Luis Olmedo (Comite Civico del Valle)

Stephen Wall (CDPH laboratory)

Jeff Wagner (CDPH laboratory)



Thank you!

Any Questions?