Air Quality Impacts of Recreational Beach Fires: Preliminary Assessment

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Outline

- Health Effects of Wood Smoke
- Preliminary Monitoring Data
  - Gradient Surveys
  - Fixed-site Monitoring
  - Other Results

Wood Smoke

- Source of fine particulate (PM2.5)
- Source of carcinogenic toxic pollutants
  - Benzene, Formaldehyde, Polycyclic Aromatic Hydrocarbons (PAH)
- Contains respiratory irritants
  - Acrolein, NOx
- Wood burning can affect indoor and outdoor air quality
- Multiple studies showing health effects:
  - In communities with high levels of wood combustion
  - During large wildfire events

Studies in Communities with Significant Biomass Burning

- Daily particulate matter levels associated with:
  - Respiratory symptoms in children with asthma
  - Visits to emergency rooms for asthma episodes
  - Hospital admissions related to respiratory symptoms

Naeher, L. et al. Woodsmoke Health Effects: A Review. Inhalation Toxicology, 19(1): 67 – 106, 2007

Studies During Southern California Wildfires - 2003

- Increased symptoms in children exposed to smoke
  - Eye, nose and throat irritation
  - Cough, wheezing, asthma attacks
  - Medication use and physician visits
- Increased respiratory-related hospital admissions
  - Strongest associations noted among those over 65 and those 1-4 years of age

Kunzli, N. et al. Health Effects of the 2003 Southern California Wildfires on Children. Am J Respir Crit Care Med Vol 174: 1221–1228, 2006;
Delfino, R. et al. The relationship of respiratory and cardiovascular hospital admissions to the southern California wildfires of 2003. Occup. Environ. Med. 66:189-197, 2009

Agency Position on Wood Smoke

- California Air Resources Board
  - Wood smoke a serious threat to public health
  - Aggravates lung and heart disease
  - Can cause 10% increase in children's hospital admissions for respiratory symptoms
- U.S. Environmental Protection Agency
  - Wood smoke can affect everyone
    - Children, persons with existing health conditions most vulnerable
  - Health risks can be reduced by switching to gaseous fuels

PM Health Guidance

- National Ambient Air Quality Standards for PM2.5:
  - Annual Average: 12 µg/m³
  - 24 Hour Average: 35 µg/m³
- Guidance for Public Health Officials for Wildfire Smoke
  - Recommended protective measures based upon shorter term PM exposure
  - Includes Time frames as short as 1 to 3 hours for both PM2.5 and PM10:
    - 89 - 138 µg/m³ - Unhealthy for Sensitive Groups (USG)
    - 139 - 351 µg/m³ - Unhealthy – "consider canceling public events, based on public health and travel considerations"
    - 352 - 526 µg/m³ - Very Unhealthy

Lipsett, Michael and Barbara Materna, *Wildfire Smoke A Guide for Public Health Officials*, 2008.

Revising the Air Quality Index and Setting a Significant Harm Level for PM2.5, OAQPS Issue Paper for Discussion at National Air Quality Conference, U.S. Environmental Protection Agency, OAQPS, 2007.

Beach Fire Pit Emissions

- Assessed the emissions of a single fire ring for one evening
  - One fire event assumed to burn 2 bundles of wood (approx. 32 lbs total)
  - Assumed CARB fireplace emission factor
  - Compared emissions to that of an average on-road 2013 Heavy Duty Diesel Vehicle (HDDV)
- **One fire pit in one evening estimated to emit as much PM2.5 as one Heavy-Duty Diesel Truck driving 564 miles**

SCAQMD Monitoring Studies

- Purpose
  - Assess potential for human exposure to wood smoke from beach fires
- Approach
  - Deploy a combination of monitoring technologies and sampling strategies
- Other Considerations
  - Shifting meteorology, variable activity levels, technology limitations

Gradient Surveys

Objective:

Assess the PM impacts of the Beach Fires at multiple locations downwind over the course of an evening

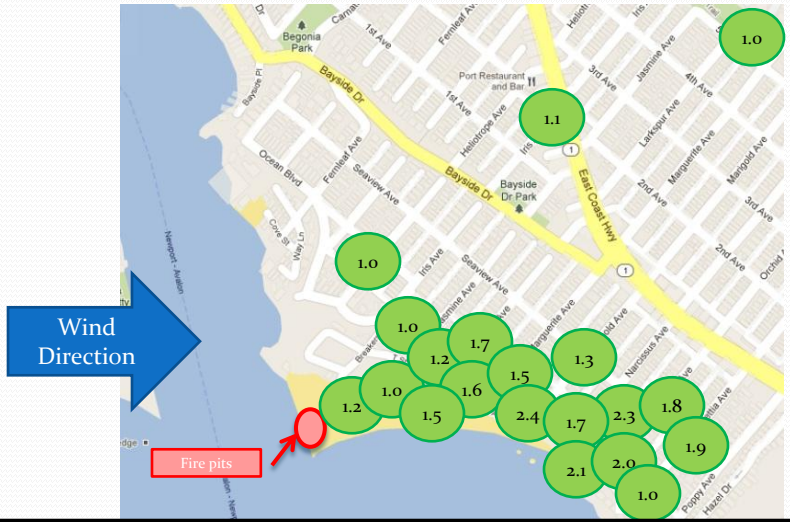
Methods:

TSI Inc. DustTrak DRX – Measures PM1, PM2.5, PM10 on a second-by-second basis

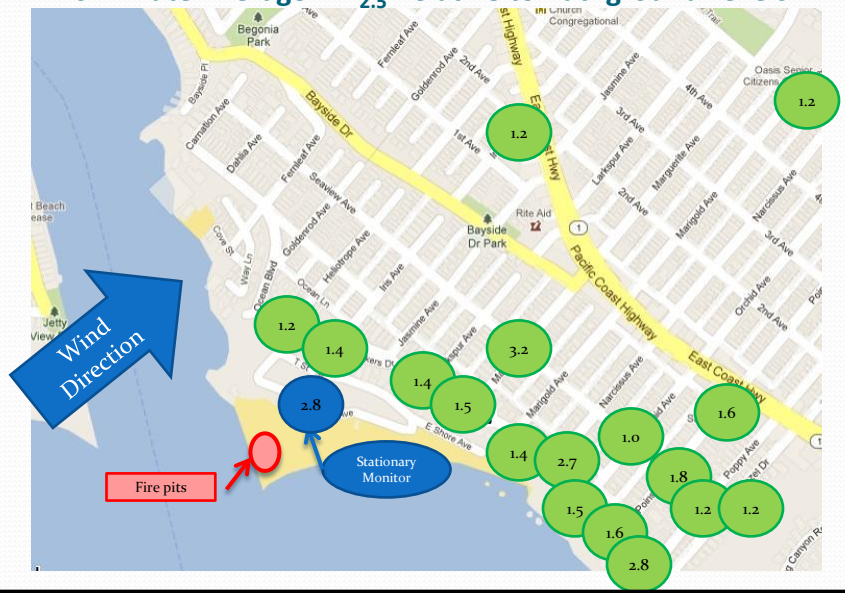
Advantages: small, portable, high time resolution, good survey tool for relative measurements

Limitations: not certified to federal reference method criteria. A drying inlet implemented to remove humidity effects

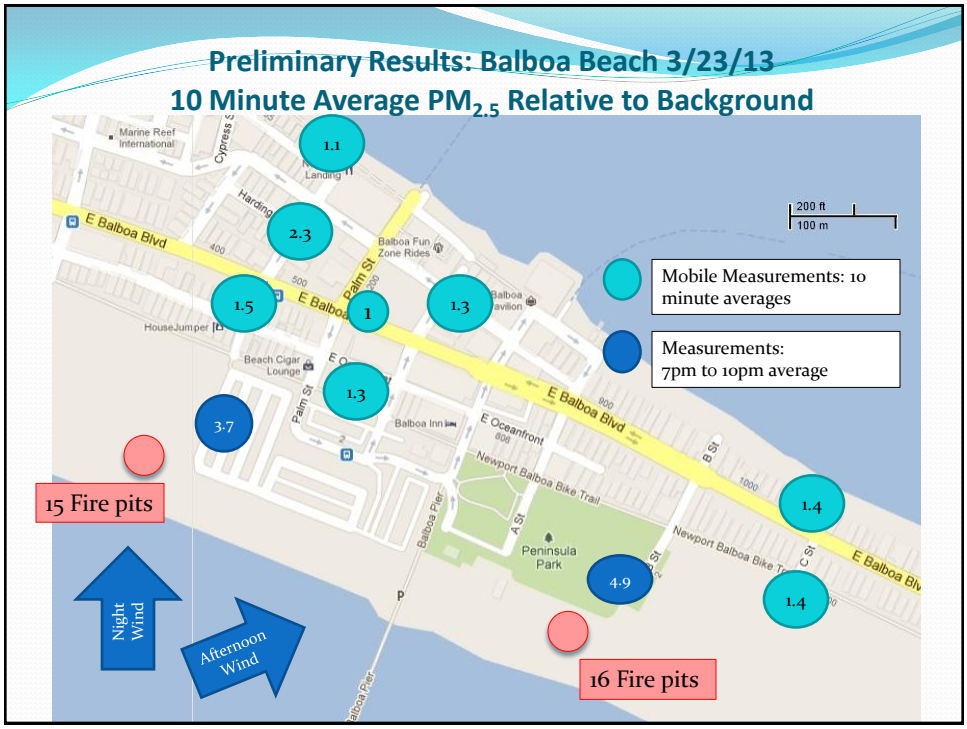
Preliminary Results: Corona Del Mar 3/19/13
10 Minute Average $PM_{2.5}$ Relative to Background Levels

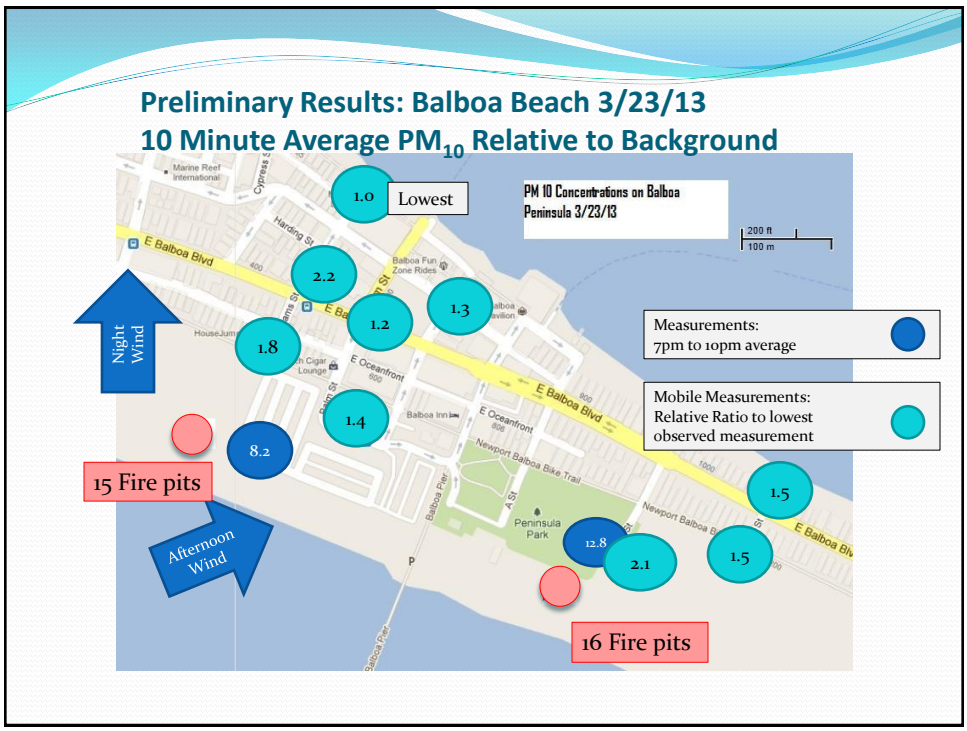


Preliminary Results: Corona Del Mar 3/30/13
10 Minute Average $PM_{2.5}$ Relative to Background Levels



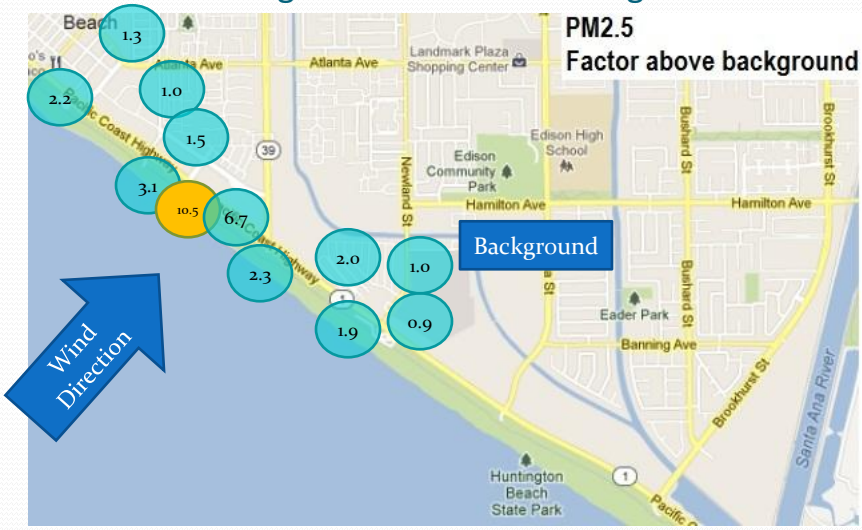
Preliminary Results: Corona Del Mar 3/30/13
10 Minute Average PM_{10} Relative to Background Levels


Preliminary Results: Balboa Beach 3/23/13
10 Minute Average PM2.5 Relative to Background
1.1
2.3
1.5
1
1.3
1.3
3.7
1.4
4.9
1.4
200 ft
100 m
Mobile Measurements: 10 minute averages
Measurements: 7pm to 10pm average
15 Fire pits
16 Fire pits
Night Wind
Afternoon Wind
E Balboa Blvd
Palm St
Balboa Pier
A St
Peninsula Park
Newport Balboa Bike Trail
E Oceanfront
Balboa Inn
Balboa Fun Zone Rides
Balboa Pavilion
Beach Cigar Lounge
HouseJumper
Marine Reef International

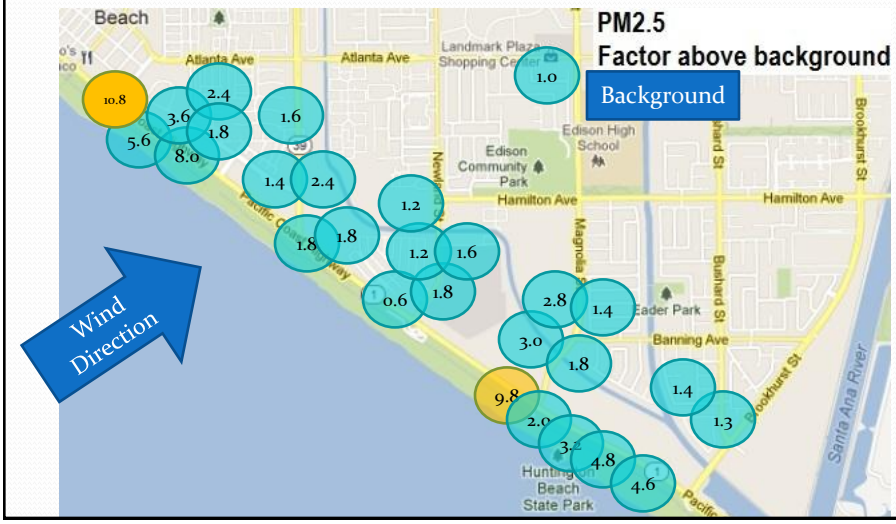

Preliminary Results: Balboa Beach 3/23/13
10 Minute Average PM10 Relative to Background
1.0
Lowest
PM 10 Concentrations on Balboa Peninsula 3/23/13
200 ft
100 m
2.2
1.3
1.2
1.8
1.4
8.2
1.5
12.8
2.1
1.5
Measurements: 7pm to 10pm average
Mobile Measurements: Relative Ratio to lowest observed measurement
15 Fire pits
16 Fire pits
Night Wind
Afternoon Wind
E Balboa Blvd
Palm St
Balboa Pier
A St
Peninsula Park
Newport Balboa Bike Trail
E Oceanfront
Balboa Inn
Balboa Fun Zone Rides
Marine Reef International

Preliminary Results: Dockweiler State Beach 4/20/13
10 Minute Average $PM_{2.5}$ Relative to Background

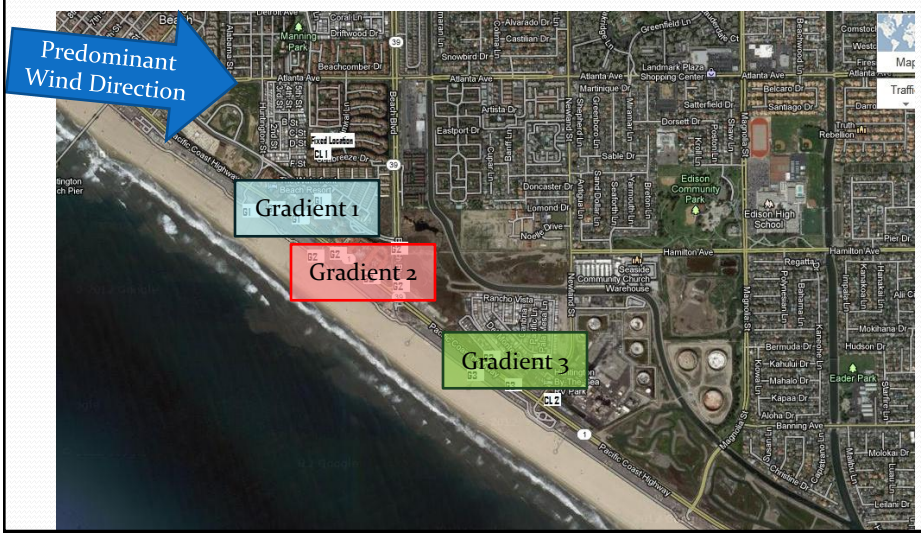
Huntington Beach Preliminary Data: 4/06/13
10 Min Average PM2.5 Ratio to Background



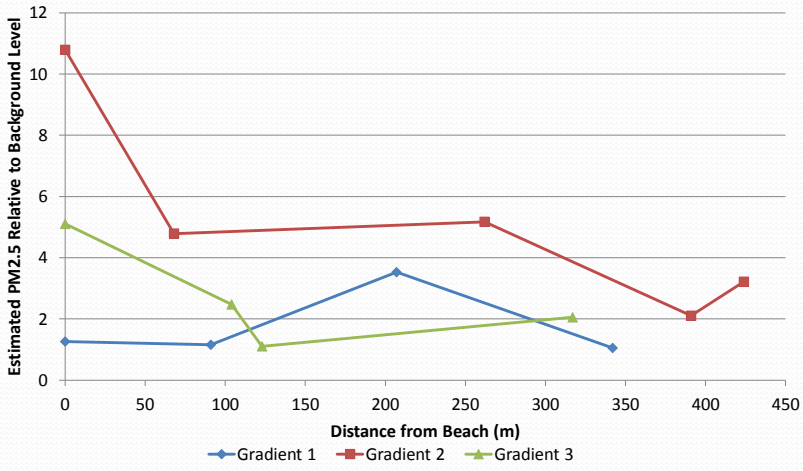
Preliminary Results: Huntington Beach 4/13/13
10 Min Average $PM_{2.5}$ Relative to Background



Preliminary Results: Huntington Beach 4/27/13



Preliminary Results: Huntington Beach 4/27/13



Preliminary Results: Huntington Beach 5/4/13
10 Min Average $PM_{2.5}$ Relative to Background

Fixed-Site Monitoring

Objective:

Assess the PM impacts of the Beach Fires at a fixed locations, continuously over time

Methods:

E-BAM – Measures PM2.5 on an hourly basis

Advantages: portable, low power, same measurement principle as a Federal Equivalent Method

Limitations: less accurate at low levels

Aethalometer – Measures Black Carbon, an indicator of combustion, on a continuous basis

Condensation Particle Counter (CPC) - Measures Ultrafine particles, indicative of nearby sources of combustion

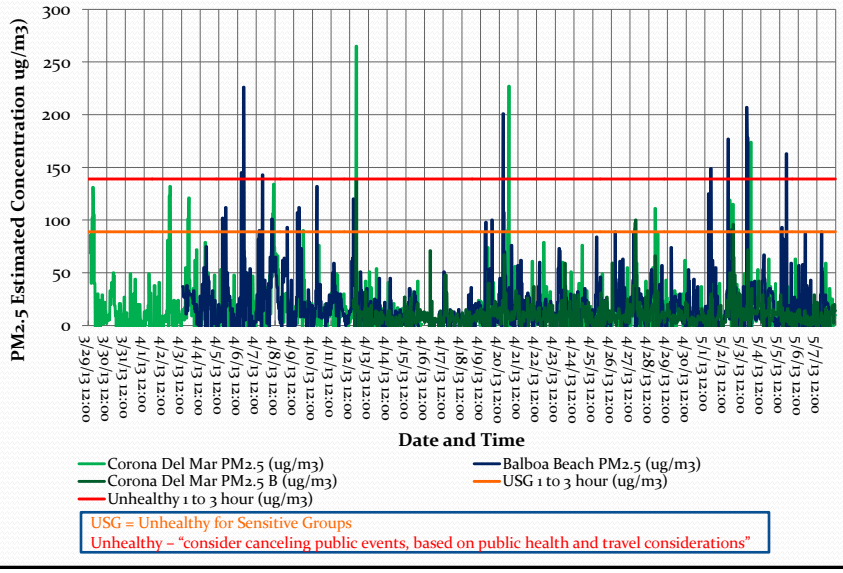
Fixed Site Monitoring: Corona Del Mar

- EBAM
- Aethalometer
- CPC
- PM2.5 Filter Sampling

Fixed Site Monitoring: Balboa Beach

- EBAM

Preliminary Results: Corona Del Mar and Balboa Beach PM2.5 Time Series

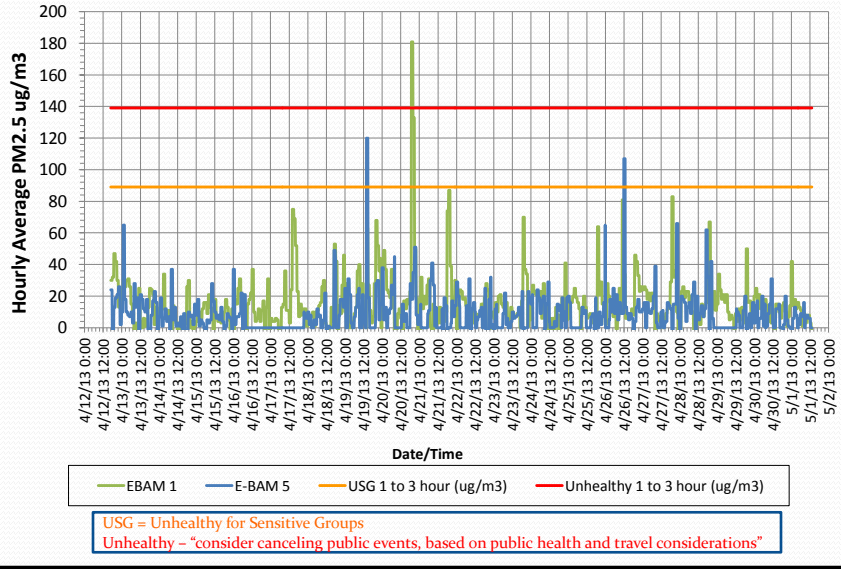


USG = Unhealthy for Sensitive Groups
Unhealthy – "consider canceling public events, based on public health and travel considerations"

Fixed Site Monitoring: Huntington Beach

- EBAM
- Aethalometer
- CPC
- PM2.5 Filter Sampling

Huntington Beach Preliminary Data: 4/13 to 5/1
PM2.5 Hourly Average Time Series



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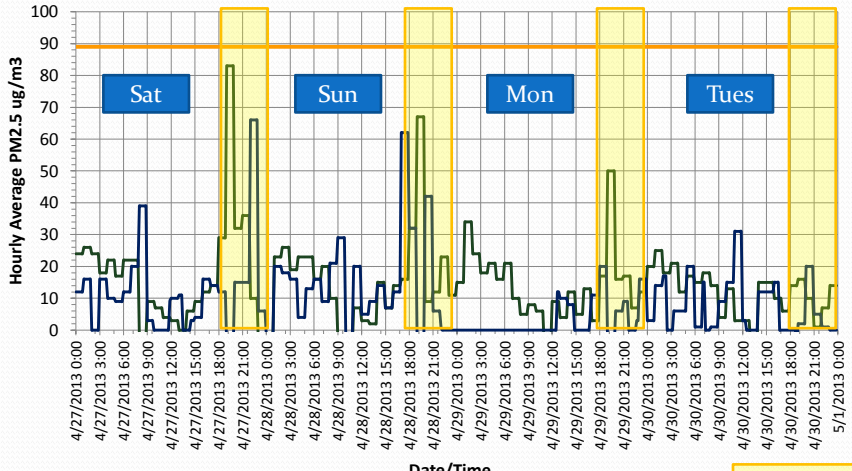
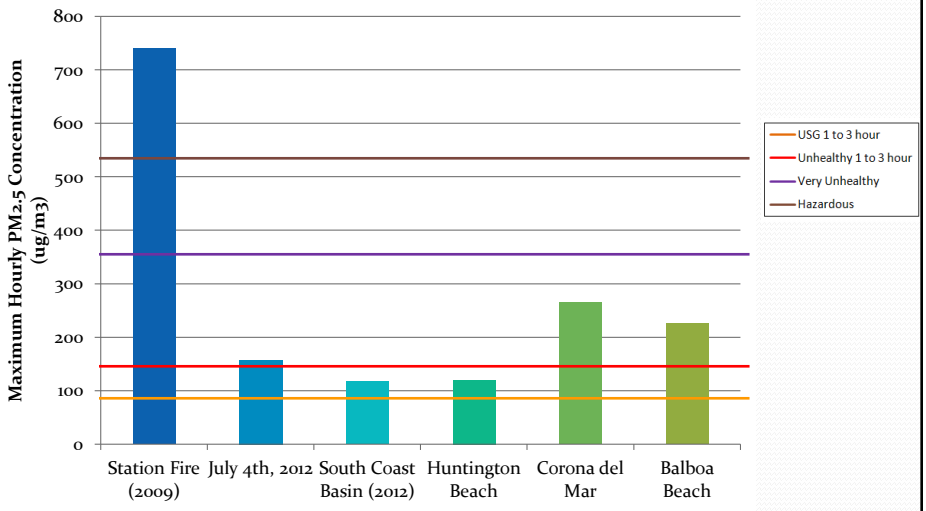
Preliminary Data: Huntington Beach 4/27 to 5/1 PM2.5 Hourly Average Time Series



Evening Hours

USG = Unhealthy for Sensitive Groups

Preliminary Results: Maximum Hourly PM2.5 Concentration Comparison



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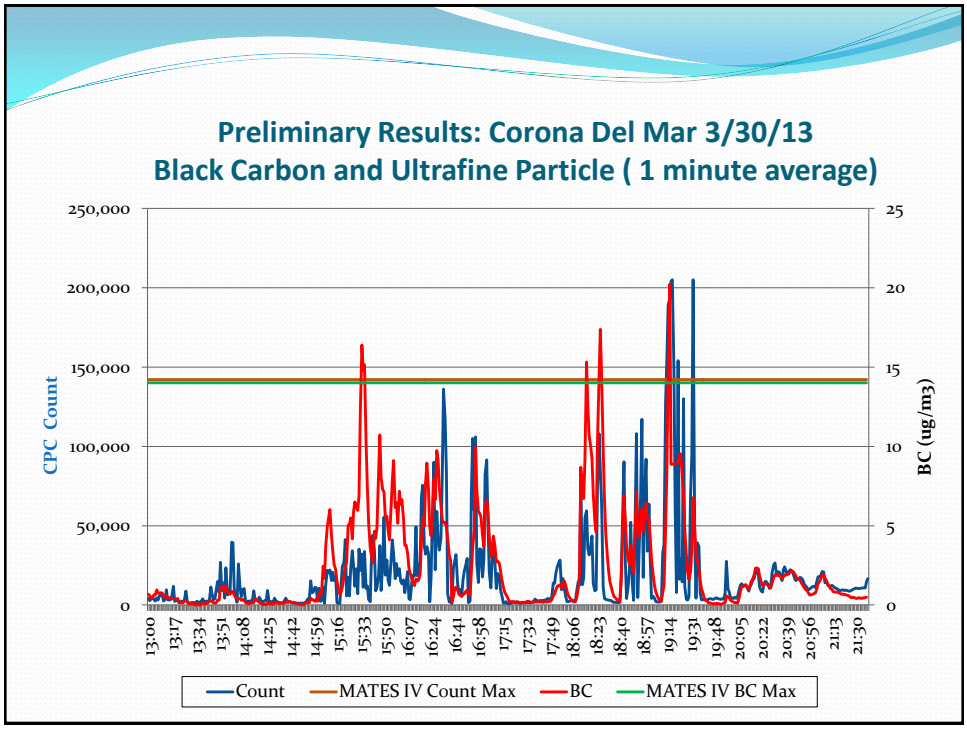

Filter analysis

Corona del Mar (3/30 to 4/19), Huntington Beach (4/24 to current)

- **PM2.5 Mass (24 hour average) – Daily Samples**
  - All below 12.5 ug/m3, under the 24 hour NAAQS level (35 ug/m3)
  - One day nearly 40 ug/m3, day had very high gusty winds
- **PM10 mass (4 hour sample, 4/6) - One Sample Only**
  - Sample collected from 5 to 9pm with burning activity shown to have PM10 mass concentration of 95 ug/m3.
  - 30% higher concentration than sample collected from 1 to 5pm
  - Elevated levels of Potassium, an indicator for wood smoke

Other analysis

Six Ash samples:

- Polycyclic Aromatic Hydrocarbons (PAHs): Very low levels
- Elemental Analysis: Compared to wood ash, samples had high presence of silicon and aluminum, indicative of sand content; most other elements consistent with wood ash concentrations.
- One sample had an elevated level of total Chromium compared to wood ash.

Five Sand samples:

- PAH: Below analytical detection

Preliminary Conclusions

- Beach fire activity is impacting PM2.5 levels at the beach and extending into neighboring communities
- Concentrations can be up to 10 times background levels for short periods of time in beach parking areas, up to 3 times background at residential locations
- 1-hour average PM concentrations can exceed public health guidance levels
- Some measurements are higher than observed across the Basin over a whole year

Next steps

- Continue field sampling
- Consider deployment of federal equivalent methods
- Continue to report findings to public as they become available
- Continue to work with potentially impacted cities and state parks
- Evaluate propane and natural gas options