Air Quality Impacts of Recreational Beach Fires: Preliminary Assessment

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

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


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


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

Wind Direction

Fire pits

Stationary Monitor

Ratios to Lowest Observed Measurement

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

Wind Direction

Fire pits

Stationary Monitor
Preliminary Results: Balboa Beach 3/23/13
10 Minute Average PM$_{2.5}$ Relative to Background

Mobile Measurements: 10 minute averages
Measurements: 7pm to 10pm average

Mobile Measurements: Relative Ratio to lowest observed measurement

Preliminary Results: Balboa Beach 3/23/13
10 Minute Average PM$_{10}$ Relative to Background

Measurements: 7pm to 10pm average
Mobile Measurements: Relative Ratio to lowest observed measurement
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 PM$_{2.5}$ Ratio to Background

PM$_{2.5}$ Factor above background
Preliminary Results: Huntington Beach 4/13/13
10 Min Average PM$_{2.5}$ Relative to Background

Preliminary Results: Huntington Beach 4/27/13

Predominant Wind Direction
Preliminary Results: Huntington Beach 4/27/13

Estimated PM2.5 Relative to Background Level

Distance from Beach (m)

- Gradient 1
- Gradient 2
- Gradient 3

Preliminary Results: Huntington Beach 5/4/13
10 Min Average PM2.5 Relative to Background

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

- Corona Del Mar PM2.5 (ug/m3)
- Balboa Beach PM2.5 (ug/m3)
- Corona Del Mar PM2.5 B (ug/m3)
- Unhealthy 1 to 3 hour (ug/m3)
- Unhealthy 1 to 3 hour (ug/m3)

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 Stationary Site

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

<table>
<thead>
<tr>
<th>Date/Time</th>
<th>EBAM 1</th>
<th>E-BAM 5</th>
<th>USG 1 to 3 hour (ug/m³)</th>
<th>Unhealthy 1 to 3 hour (ug/m³)</th>
</tr>
</thead>
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USG = Unhealthy for Sensitive Groups
Unhealthy = “consider canceling public events, based on public health and travel considerations”
Preliminary Data: Huntington Beach 4/27 to 5/1
PM2.5 Hourly Average Time Series

Hourly Average PM2.5 (ug/m3)

Date/Time

EBAM 1
E-BAM 5
USG 1 to 3 hour (ug/m3)

Evening Hours

USG = Unhealthy for Sensitive Groups

Preliminary Results: Maximum Hourly PM2.5 Concentration Comparison

Maximum Hourly PM2.5 Concentration (ug/m3)


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