AQMD Near Roadway Monitoring Studies

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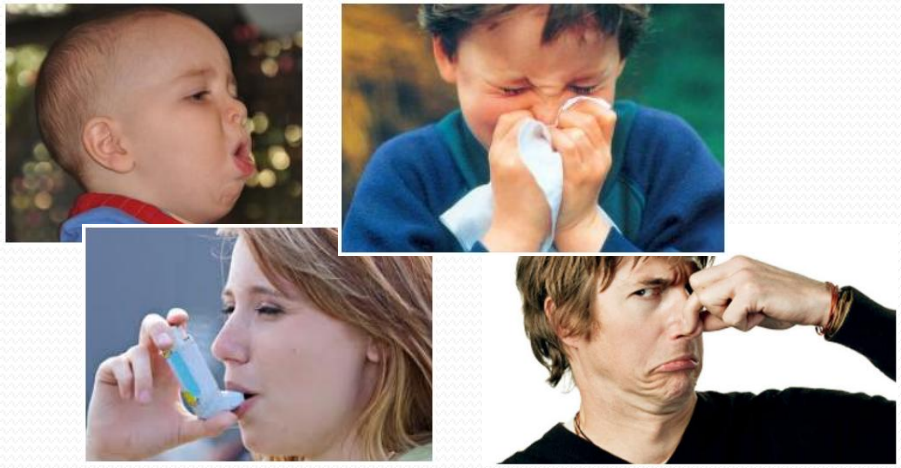
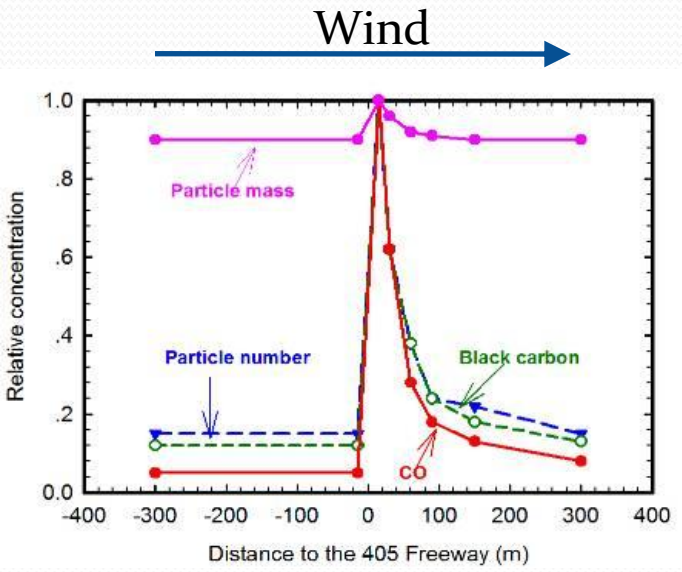
BACKGROUND

- Motor-vehicle emissions consist of a complex mixture of particulate and gaseous pollutants such as $PM_{2.5}$, UFPs, metals, OC, BC, VOCs, NOx and CO

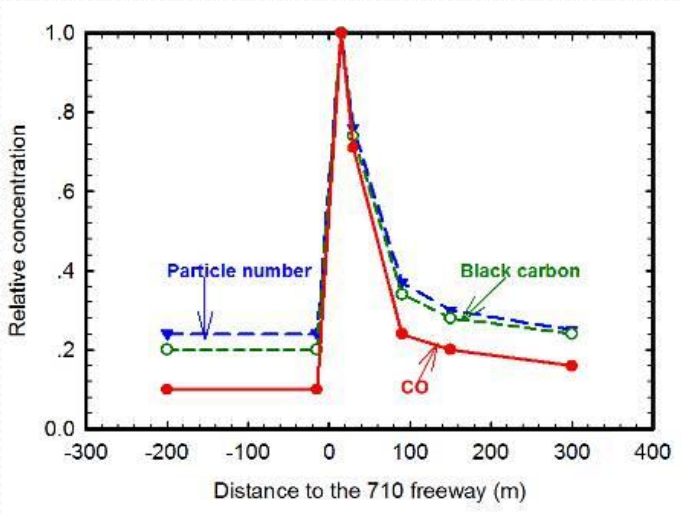
- Living near major roadways has been identified as a risk factor for respiratory and cardiovascular problems, including:
  - Asthma and allergic disease
  - Reduced lung function growth
  - Increased risk of adverse birth outcomes
  - Cardiac effects
  - Respiratory symptoms
  - Premature mortality
  - Lung cancer



NEAR-ROADWAY STUDIES: Steep fall-off with distance

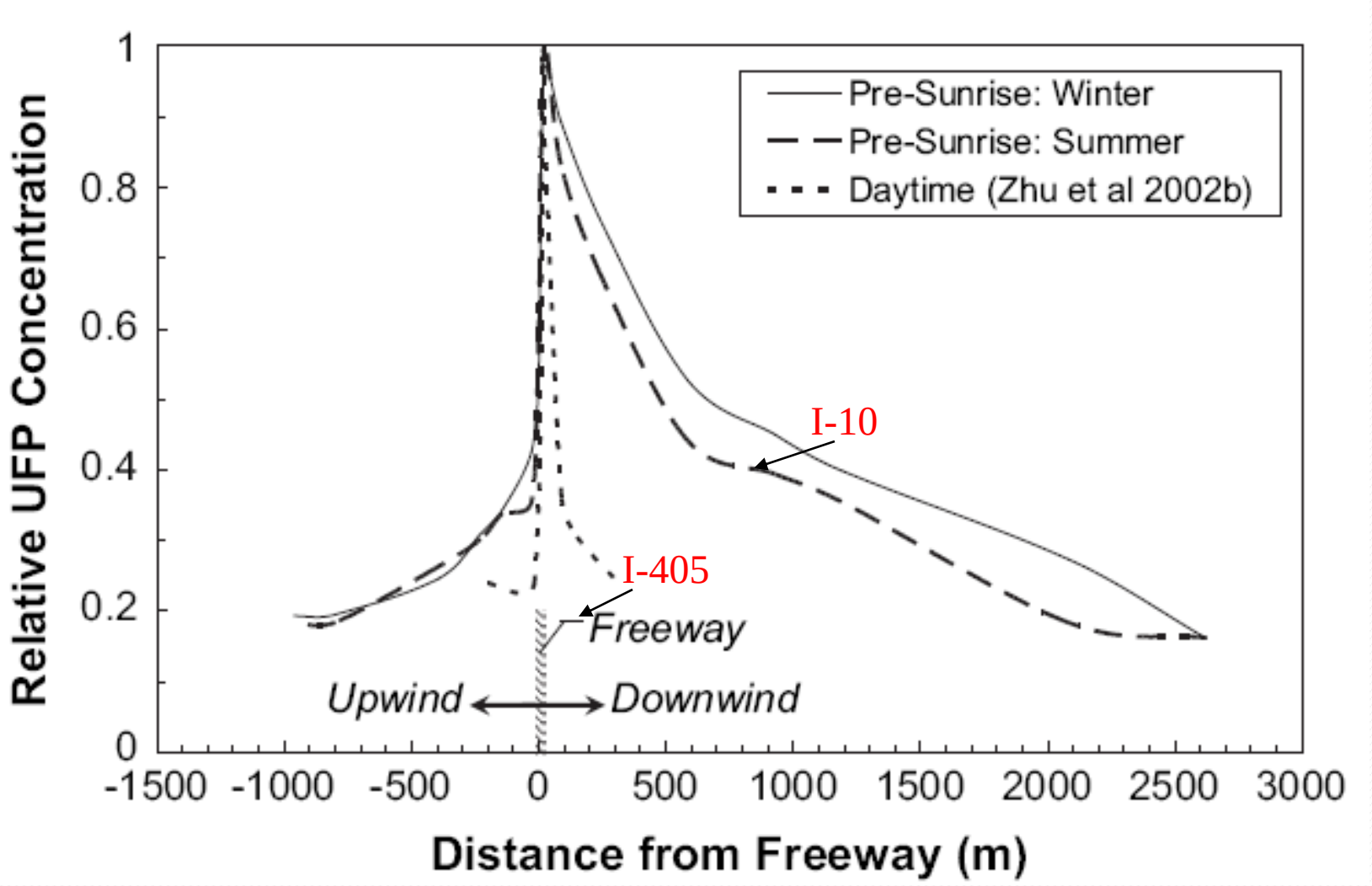


Zhu et al., JAWMA, 2002



Zhu et al., Atm. Env., 2002

NEAR-ROADWAY STUDIES: Meteorology affects fall-off



Hu, et al., 2009

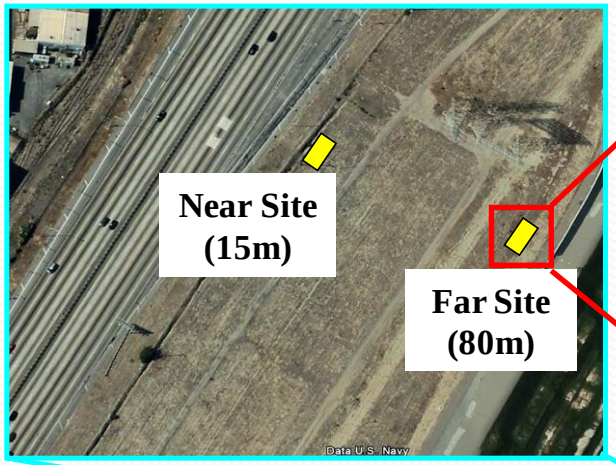
NEAR ROADWAY MONITORING OBJECTIVES

- Gather additional data
- Potential NAAQS implications (e.g. CO, NO_2, Pb, PM)
  - Near roadway monitoring requirements
  - Maximum pollutant concentrations
- Other potential objectives:
  - Trends sites to evaluate control strategies and fuel changes
    - Accountability of regulatory programs
    - SIP development
  - Monitoring data to evaluate dispersion models used for local assessments
    - Environmental Impact Assessments (e.g. CEQA, NEPA)
    - Emission factor development and evaluation
    - Urban and land use planning
  - Community-scale monitoring
    - Evaluate concentrations near transportation sources
    - Support health studies/determine population exposures
    - Evaluate mitigation measures

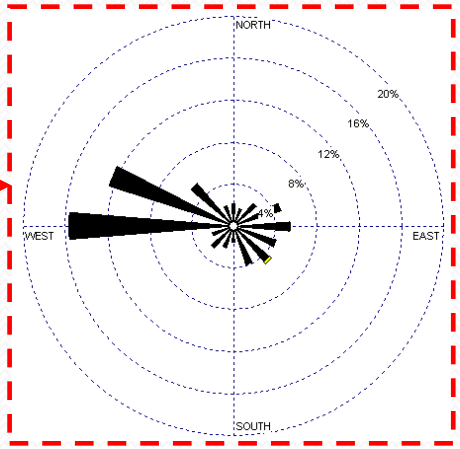
AQMD's I-710 STUDY

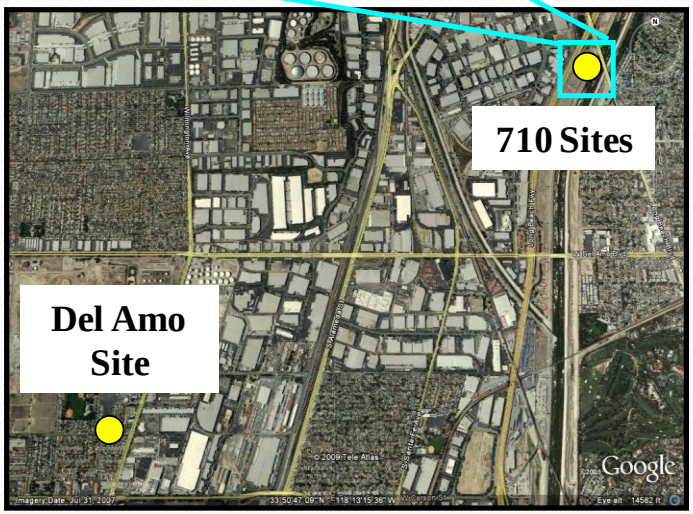
- One-month intensives
  - February - March 2009 (winter campaign)
  - July – August 2009 (summer campaign)
- I-710 - three sites
  - Nearest downwind of freeway(15 m)
  - Further downwind of freeway (80 m)
  - Upwind/background (Del Amo)
- Measurements
  - Continuous particle number, BC, $PM_{2.5}$ mass, NO_X, CO, WS, WD, T and RH
  - PM_{10} mass, OC and EC (24-hr samples; 1-in-2 day)
  - $PM_{2.5}$ mass (24-hr FRM samples; daily)
  - TSP Lead (24-hr samples; 1-in-2 day)
  - VOC Air Toxics (4 samples per day; 5am-9am, 9am-3pm, 3pm-7pm, 7pm-5am; 1-in-2 day)

I-710 STUDY: Sampling Sites

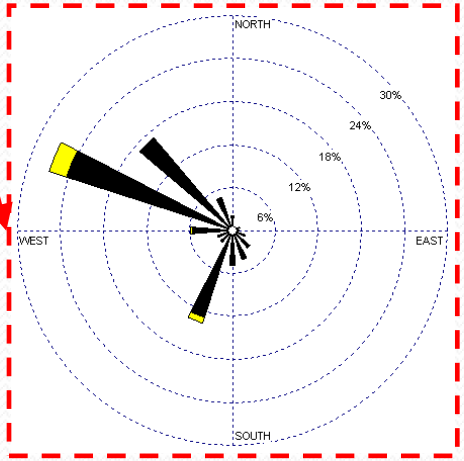


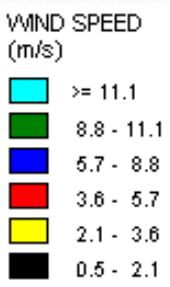
01/28/09 to 03/20/09



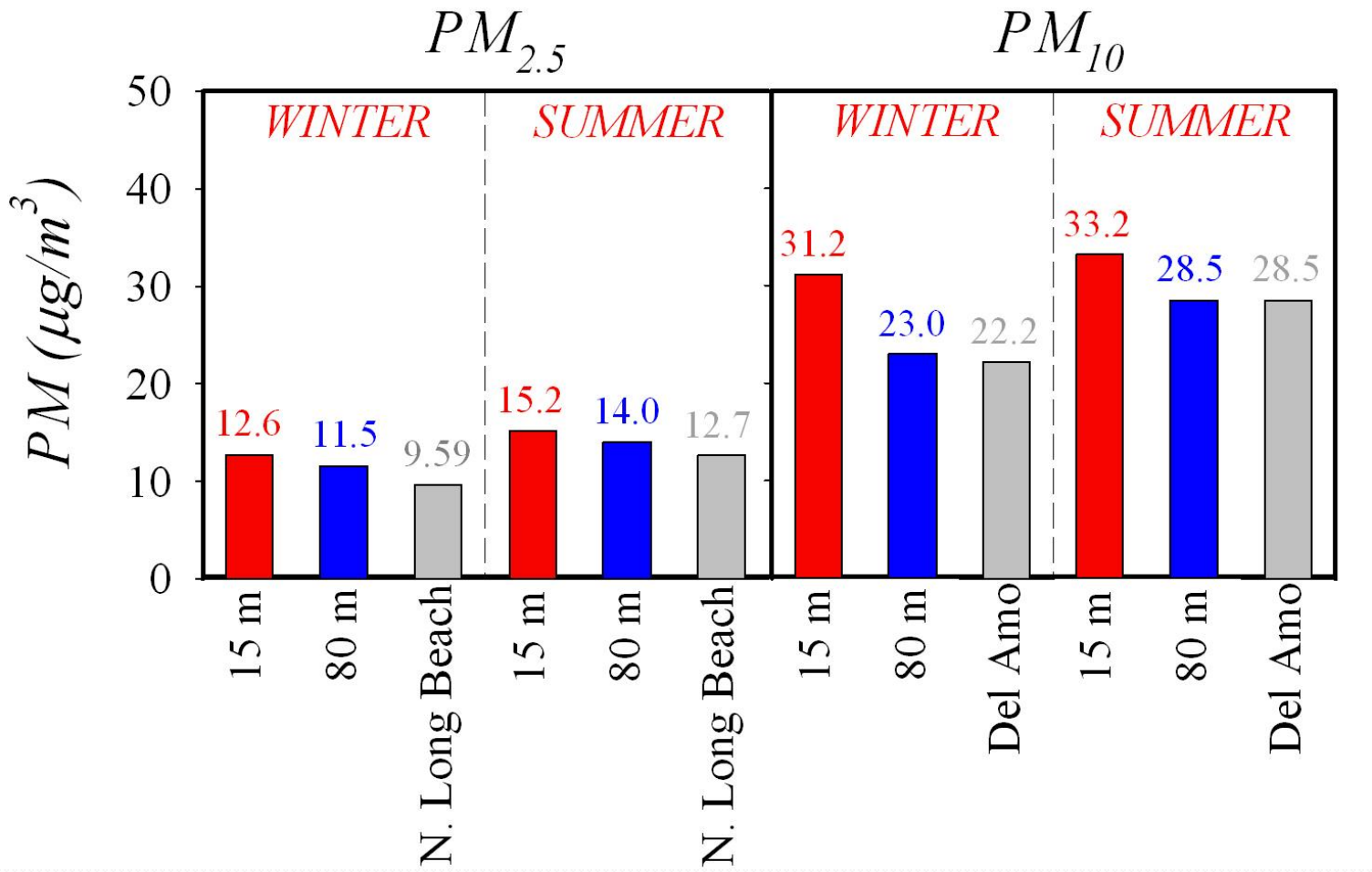


07/10/09 to 08/19/09



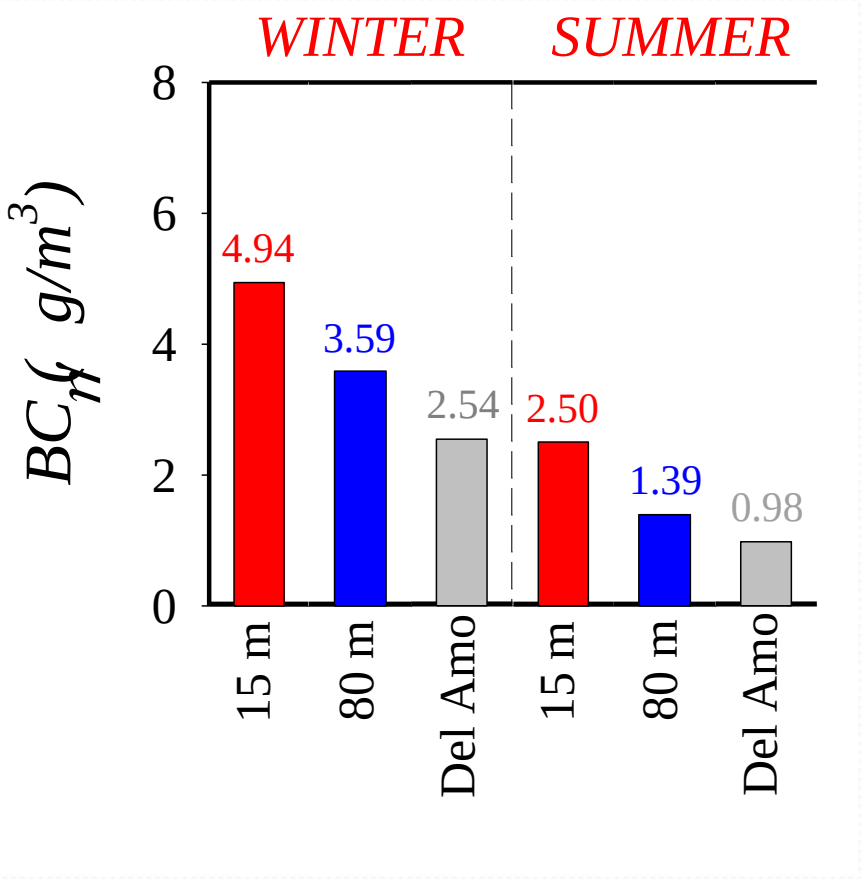


I-710 STUDY: Results

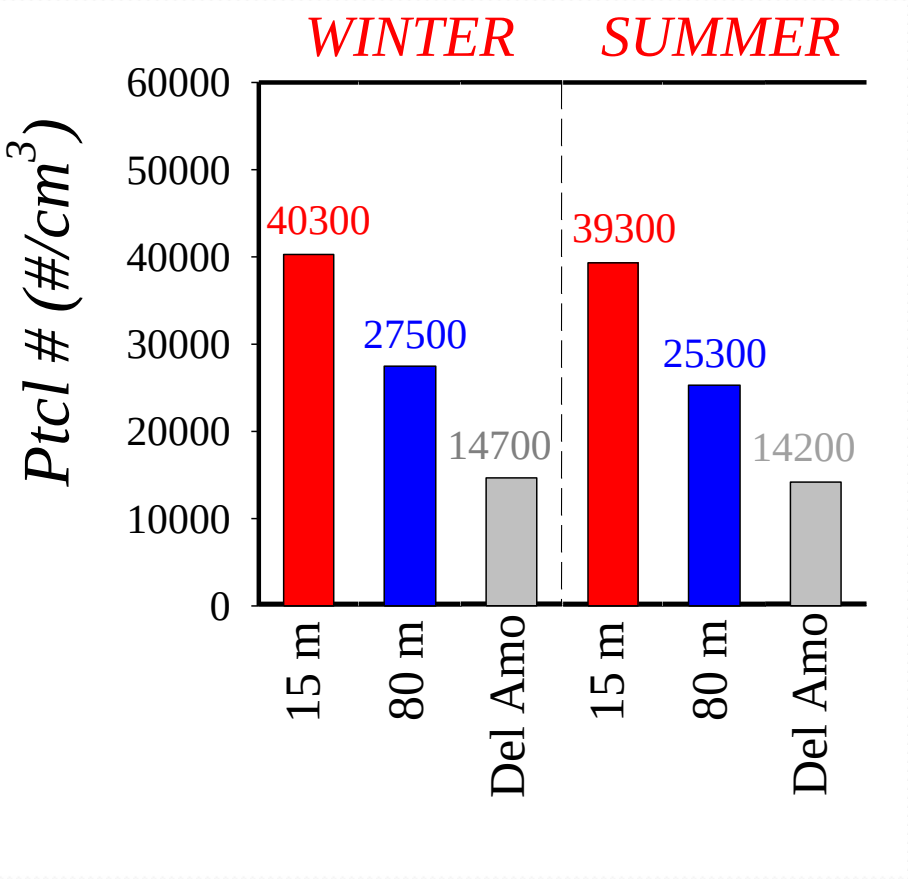


I-710 STUDY: Results

Diesel PM



Ultrafine Particles



EPA NAAQS FOR NO_2

- Annual Standard
  - 53 ppb
    - Annual mean
- One-hour Standard
  - 100 ppb
    - 98^{th} percentile of all daily max 1-hr concentrations in a year
    - Three year average
    - Suggested range for the NAAQS revision: 80-100 ppb
  - Requires monitors within 50 m of major roads
- NO_2 monitoring issues
  - Identifying maximum concentration locations
  - Cost and logistics of establishing and accessing sites

I-710 STUDY: Results

- I-710 (15m) NO_2 – 1-hour
  - 98th %-ile (2010): 83.3 ppb
  - 98th %-ile (2011): 81.3 ppb
  - Below NAAQS of 100 ppb
- I-710 (15m) NO_2 - Annual mean
  - 2010: 29.1 ppb
  - 2011: 27.6 ppb
  - Below NAAQS of 53 ppb

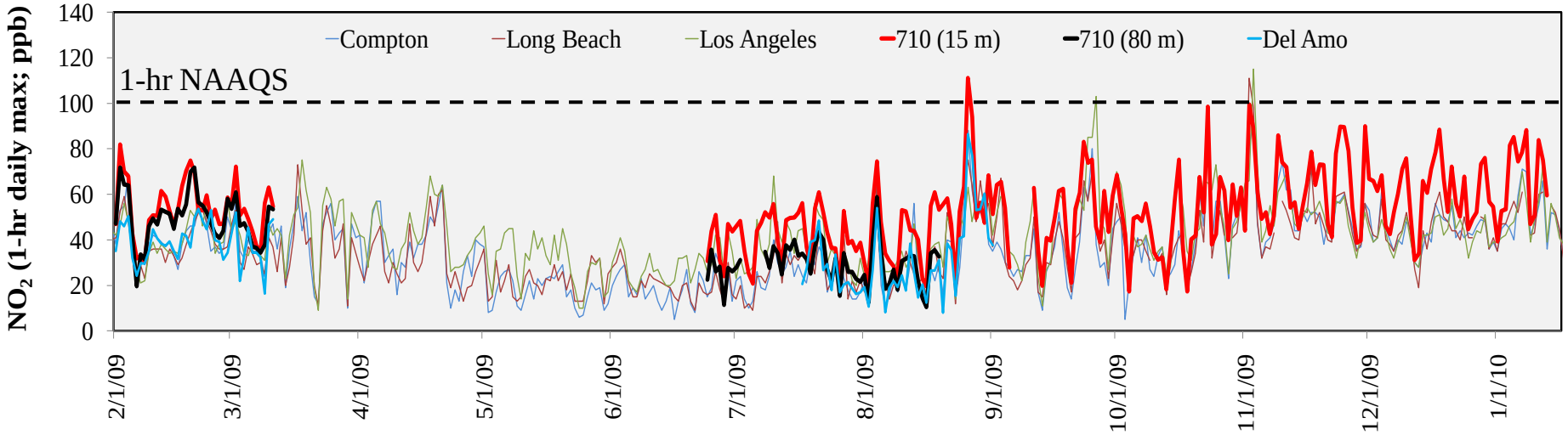
CO = Compton

LB = Long Beach

LA = Los Angeles

710 = Near and Far sites

DA = Del Amo

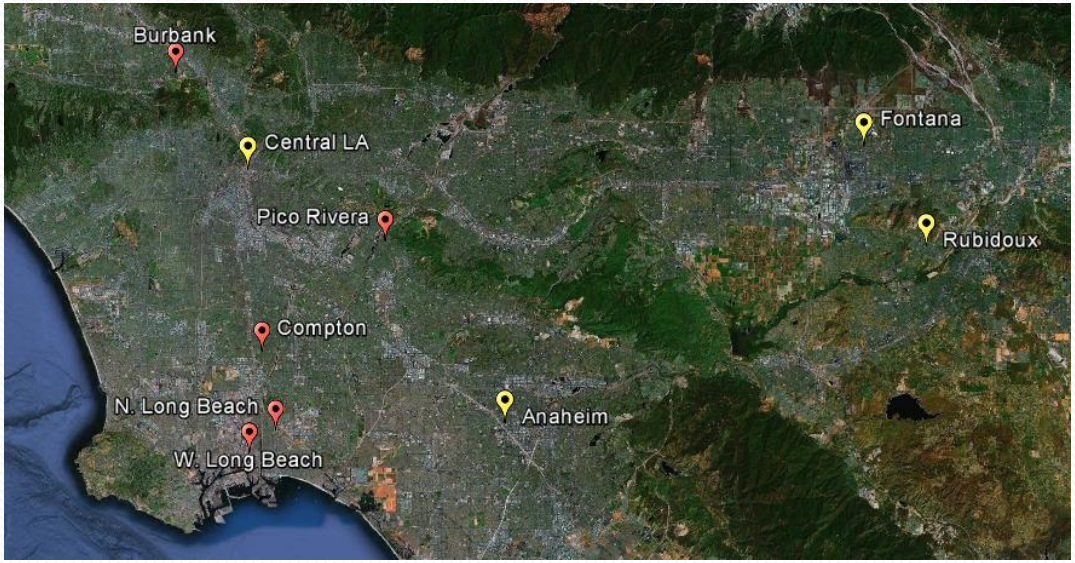


CURRENT AQMD ACTIVITIES

- Evaluation of new technologies for monitoring traffic-related pollutants
  - •Ultrafine Particles
  - •Black Carbon (indicator of diesel PM)

CURRENT AQMD ACTIVITIES

- Multiple Air Toxics Exposure Study (MATES) IV
  - Characterize carcinogenic risk caused by air toxics exposure in SCAB
  - Measure ambient concentrations of UFPs and BC in local communities, near airports, rail yards, freeways, warehouse operations, and other emission sources



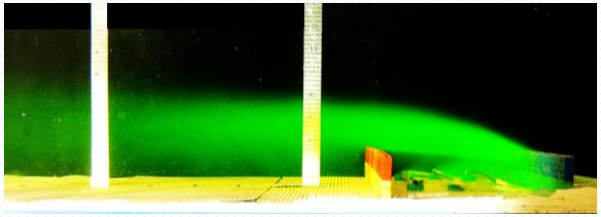
- Huntington Park Site not shown

CURRENT AQMD ACTIVITIES

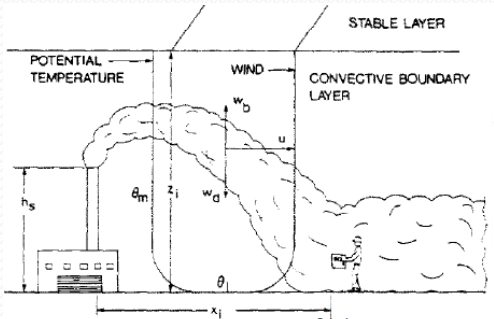
• Assessment of air quality impact and effectiveness of sound walls and vegetated barriers in the near roadway environment. Three main components:

Air pollution monitoring

Flow tank experiments



Dispersion modeling



$$C(x,0,0) = \frac{Q \cdot f(x)}{\sqrt{2\pi}\sigma_y \sigma_z . U}$$

$$f(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{p} \exp\left(-\frac{t^2}{2}\right) dt$$

$$p = \frac{\ln\left(\frac{x}{x_i}\right)}{\ln(s_g)} \quad where \quad x_i: \; F^{1/3} x_i^{2/3} - w_d x_i + h_s U = 0$$

$$\sigma_y = \frac{\sigma_v x}{U}, \sigma_z = \frac{\sigma_w x}{U} \qquad w_d = 0.5 w_*$$

CURRENT AQMD ACTIVITIES

- Installation of high-performance air filtration in schools

- Reductions close to 90% for UFPs, BC and $PM_{2.5}$