Harbor Communities Monitoring Study

Board Overview

January 25, 2007

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Thank you Ms. Witherspoon. Good morning Dr. Sawyer and members of the Board. Today we will present an overview of the Harbor Communities Monitoring Study, which begins next month in the communities of Wilmington, West Long Beach, East San Pedro, and South Carson.

Harbor Communities Monitoring Study (HCMS) Goals

Assess community exposure

- Find pollution "Hot Spots"
- Test low-cost easy-to-use monitors
- Determine impacts of local versus regional sources
- Establish baseline for control program effectiveness

The overall goal of the Harbor Communities Monitoring Studies is to develop improved technical tools for assessing exposure in California communities. Traditional fixed site monitoring stations are expensive to operate and as a result, they are widely spaced and not suitable for finding pollution hot spots. We are testing easy-to-use sampling devices that can be cheaply deployed in a community for this purpose. When we find hot spots, we hope to separate the influence of local and regional emission sources. Our study will also establish current pollution levels in these communities which we can revisit to determine the effectiveness of the Goods Movement Emission Reduction Plan adopted by the Board.

Study Design

- **Harbor Communities**
  - **Wide range of pollution sources**
  - **Residential neighborhoods impacted**
- **Complementary monitoring tools**
  - **Fixed "passive" monitors**
  - **Particle counters**
  - **Mobile monitoring platform**
- **Measure over entire year**
  - **PM2.5 health effects driven by annual average**
  - **Air toxic cancer risk based on long-term exposure**
  - **Meteorology varies by season**

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The Harbor Communities were selected as our area of focus because the it contains a wide variety of pollution sources. The Harbor Communities area is adjacent to the Ports of Los Angeles and Long Beach, as well as several freeways, and contains several industrial facilities. Community involvement was an important aspect in our study design as I will discuss in a later slide. The Harbor Communities Monitoring Studies consists of three projects: a passive monitoring network, a particle counter network, and a mobile monitoring platform. These studies will proceed concurrently over the course of an entire year. Year-long monitoring is important as PM2.5 health effects are driven by the annual average exposure, and air toxics cancer risks are also based on long-term exposure. A full year of monitoring also allows us to evaluate seasonal differences.

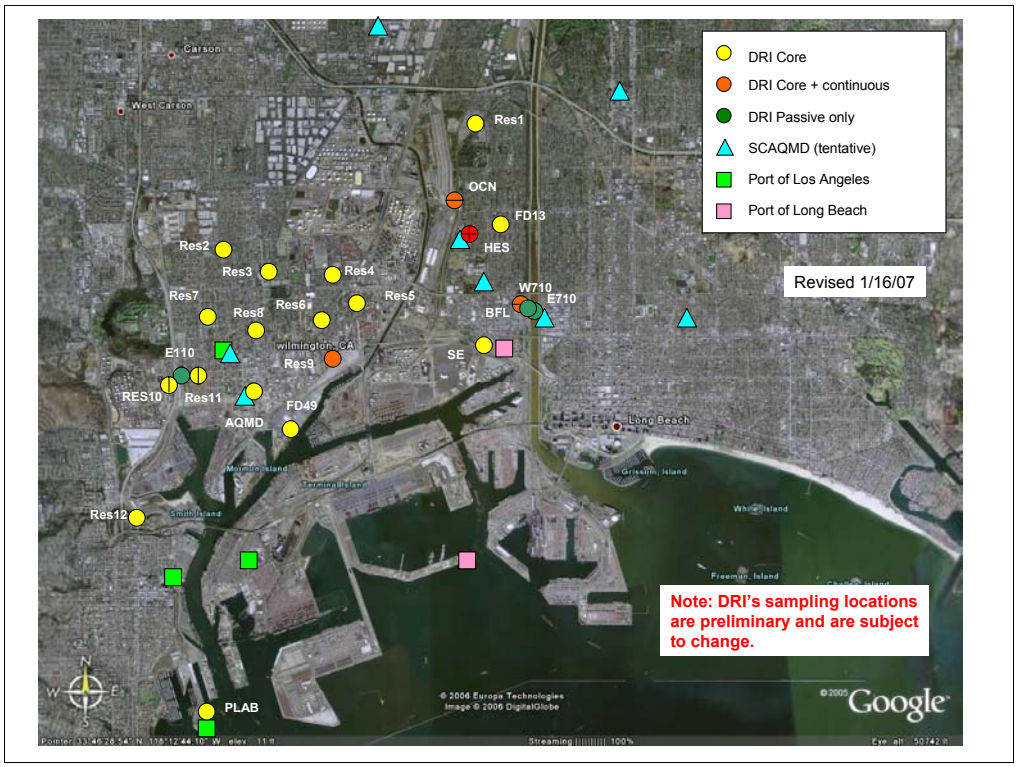
Passive Sampler Network: "Saturation Monitoring"

(Professor Eric Fujita, Desert Research Institute)

Objective: Test whether affordable, non-pump driven "passive" samplers are sensitive and accurate enough for community level use

- **Can they detect gradients?**
- **Can they accurately predict yearly averages from small sets of one- or two-week samples?**

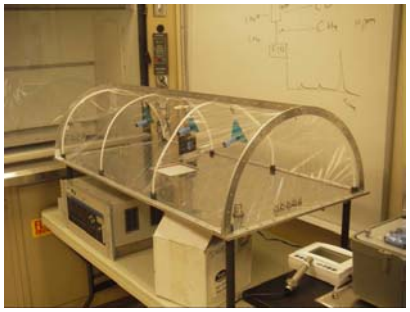
The passive monitoring network, or "saturation monitoring project" is being conducted by Professor Eric Fujita of the Desert Research Institute (DRI). This project will involve placing passive samplers in 23 locations throughout the community to test if they are sensitive and accurate enough to detect pollution concentration gradients and if they are suitable to use to predict yearly averages. Passive samplers require no pumps so they are easy to site and may be a useful measuring tool for community groups. A photograph of a passive sampler is shown on the right hand of this slide. It measures about two inches long and does not require a pump to sample air. Measurements include about a dozen different air pollutants.



This map of the study area shows locations of the passive monitoring sites. Included in this map are fixed site ambient monitors run by the Ports of Los Angeles and Long Beach, and the South Coast Air Quality Management District. Some passive monitoring sites will be co-located with South Coast AQMD sites for comparison purposes. Otherwise, sites were selected specifically to look for gradients from sources such as the freeways and Ports and were also informed by measurements taken by the mobile platform. Cooperation with the community was required to place the passive samplers and many have volunteered space on their property.

Initial Results from Laboratory and Field Evaluations of the Passive Samplers

- Reproducible precision:
  - NO_2 and NO_X
  - SO_2
  - formaldehyde
  - acetaldehyde
- Still under evaluation:
  - benzene, toluene, ethylbenzene, xylene
  - 1,3-butadiene
  - hydrogen sulfide
  - acrolein



Initial results from laboratory and field evaluations of the passive samplers showed that several passive samplers demonstrated good precision. This was the case for nitrogen dioxide (NO_2), nitrogen oxides (NOx), sulfur dioxide (SO_2), formaldehyde, and acetaldehyde. However, results for other air toxics are still in the process of being evaluated. Lab and field set ups for testing the passive monitors are shown in the photographs on the right

Particle Counter Network
(Dr. Katharine Moore and Professor Constantinos Sioutas, USC)

- **Network of 13 particle counters**
  - Particle number dominated by “ultrafine” particles (<0.1µm)
  - Ultrafine particles are a good indicator of combustion
  - 3 months each in winter and summer seasons
- **Objective**
  - Determining local versus regional influences, weather and seasonal impacts, etc.

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The Particle Counter Network is being conducted by Dr. Katharine Moore and Professor Constantinos Sioutas from the University of Southern California. A network of thirteen particle counters will be placed in the Harbor Communities area. Particle number is dominated by “ultrafine” particles that have diameter of <0.1µm, about 1000 to 10000 times smaller then that of a human hair. Thus, ultrafine measurements do not correlate well with PM mass. Ultrafine particles are also a good indicator of combustion sources and have been linked to death and disease. The goal of the particle counter network is to determine local versus regional source contributions and how weather and seasonal changes influence particle number concentrations. The study will be conducted for three months in the winter and summer seasons in the Harbor Communities area.

USC Equipment

Free-standing weather-proof shelter with tripod on top (for weather station)

Particle counter

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The photograph on the left shows a picture of a particle counter, which is the size of a large shoe box. The photograph on the right shows the air conditioned shelter which houses it. In addition to particle counts, meteorological measurements will be taken at these shelters as well. Cooperation from community members was also required to place these shelters, which require power and take up a large amount of space. Particle counter locations will be co-located with DRI, South Coast AQMD, and Port monitoring sites whenever possible.

Mobile Monitoring Platform

(Kathleen Kozawa, UCLA; Dr. Scott Fruin, ARB; Professor Arthur Winer, UCLA)

- **Toyota RAV4 EV, zero-emission vehicle**
- **Measure gradients and find pollution "hot spots"**
- **Objective**
  - Spatial and temporal resolution with real-time and near real-time instrumentation

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The final component of the Harbor Communities Monitoring Project is the Mobile Monitoring Platform. This project is being conducted by myself and Professor Arthur Winer at UCLA, and Scott Fruin from ARB's Research Division. The mobile platform is a zero-emission vehicle equipped with real-time and near real-time instrumentation and I would like to acknowledge Toyota Motor Corporation for their generous loan of a RAV4 electric vehicle. The mobile platform can cover large areas in a short period of time providing good spatial and temporal resolution that can help identify areas of pollution "hot spots" in the Harbor Communities area.

Measurement Parameters

- **Particles**
  - PM2.5 mass
  - black carbon
  - number and size distribution
  - particle-bound polycyclic aromatic hydrocarbons
- **Gases**
  - carbon monoxide (CO)
  - carbon dioxide (CO_2)
  - nitrogen oxides (NO_X)
  - total and speciated volatile organic compounds (VOC)
  - hydrogen sulfide (H_2S)
- **Meteorology**
- **Traffic documentation and location**

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The following is a list of air pollutants and other parameters measured or recorded by the mobile platform. Particle measurements include PM2.5 mass, black carbon and particle-bound polycyclic aromatic hydrocarbons, both good indicators for diesel particulate matter, particle count and particle size distribution. Carbon monoxide, carbon dioxide, and nitrogen oxides are key vehicle-related pollutants while VOCs and hydrogen sulfide measurements will be used to identify impacts from refineries and waste water treatment facilities.

Basis for Route Selection

- **Sources**
  - **Ports**
  - **Freeways**
  - **Refineries**
  - **Rail yards**
  - **Heavy-duty diesel truck traffic on surface streets**
- **Route Development**
  - **Source locations, prevailing winds**
  - **Community input**
  - **Low-income neighborhoods**
  - **Traffic counts**
  - **Dispersion modeling**
  - **Electric vehicle range, road access**

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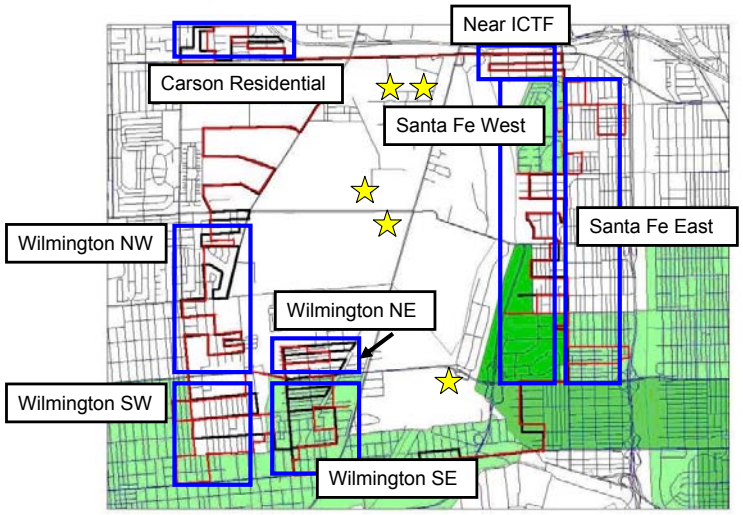
Measurements were taken on fixed routes in the Harbor Communities area. Five routes were mapped for the Wilmington pilot study and each route was designed to measure impacts from ports, freeways, refineries, rail yards, and heavy-duty diesel truck traffic on surface streets. Potential pollution “hot spots” were investigated while driving in residential areas. Several factors were considered when developing these routes. First, areas often downwind of sources were emphasized, particularly if residential. Second, input was provided by the community residents. Many of the suggestions from the community were regarding additions to routes that included certain schools, community centers, industrial facilities, and streets with heavy truck traffic (areas where exposures to children and residents may be high). Low-income neighborhoods were weighted more heavily than higher income areas. Traffic count data and modeling, results from dispersion modeling, electric vehicle range and road access were also considered when developing these routes.

Residential Route: Identifying Pollution "Hot Spots"



= Low Income Areas = Petroleum Refinery

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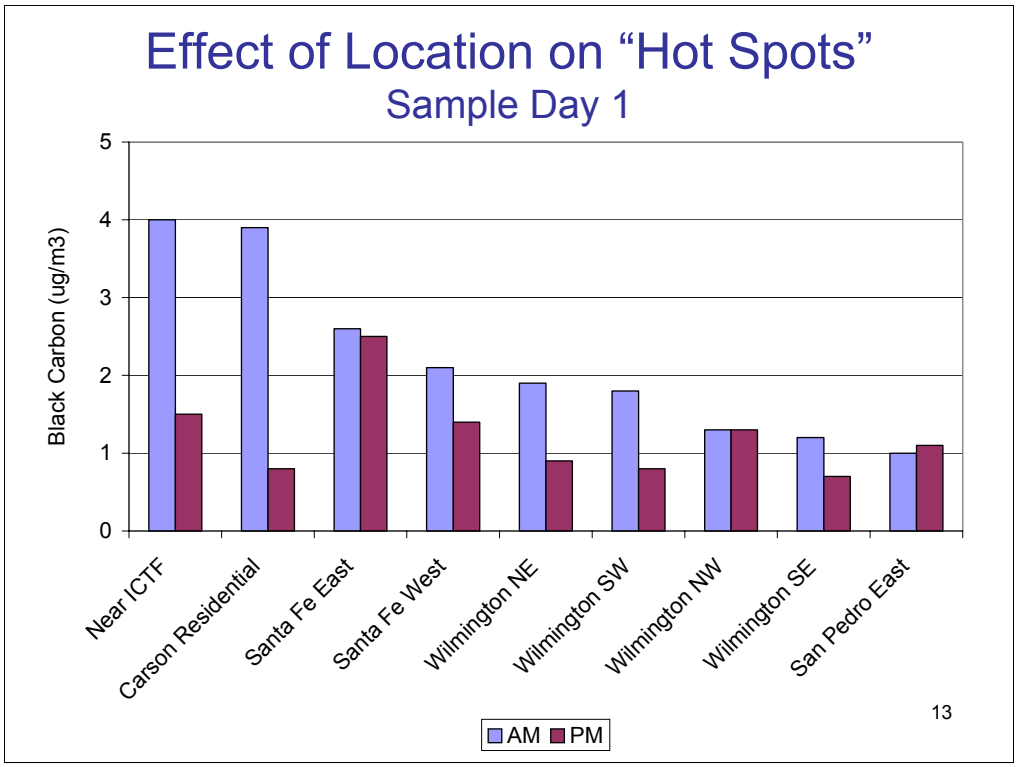
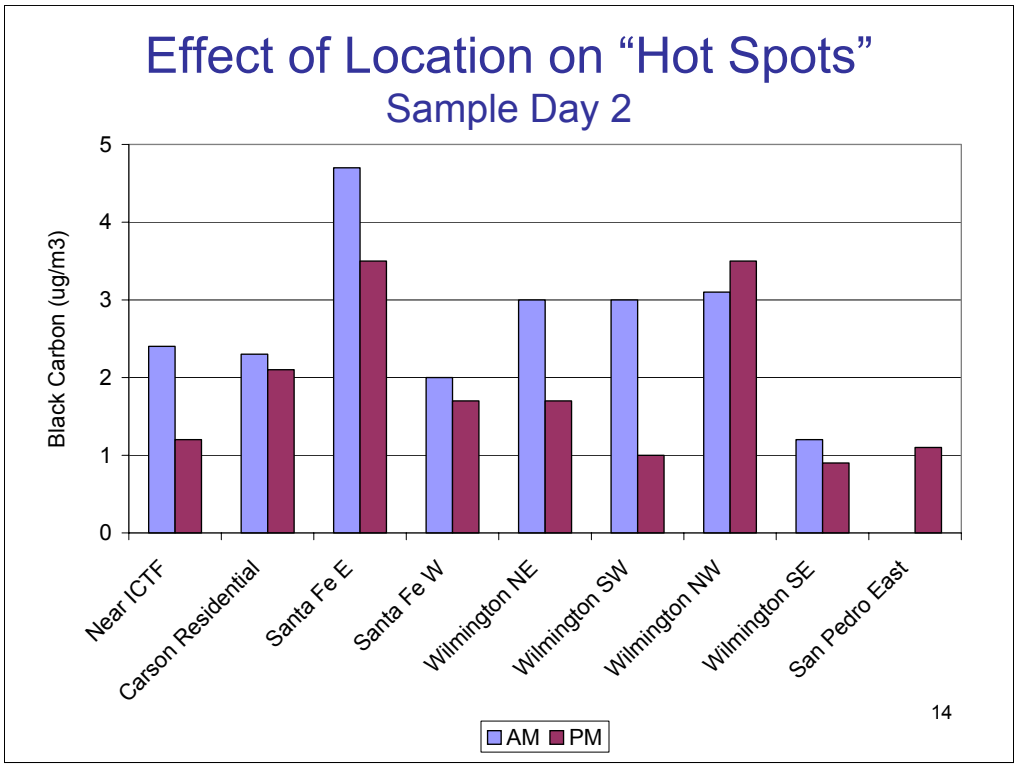
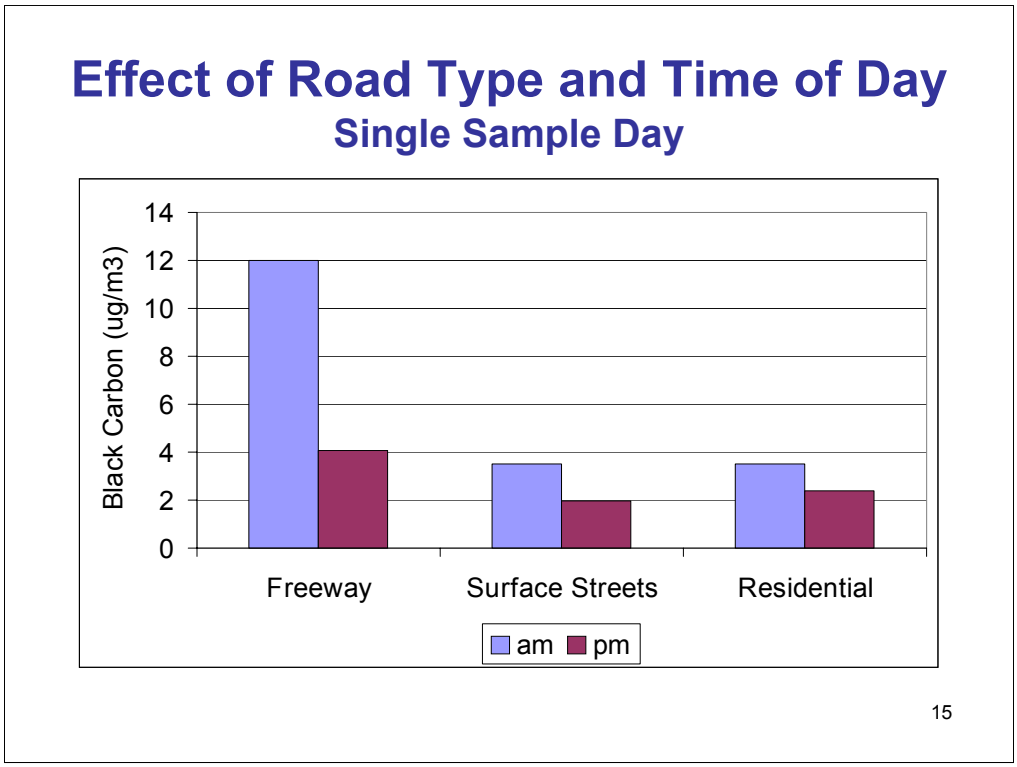
Here is an example of a route to determine if some areas are more heavily impacted by sources compared to others -- pollution "hot spots' that are not being identified by traditional monitoring sites. We used this residential route in our pilot study. We divided the residential portions of this route into eight separate sections as seen on this map. Data from each of these sections were compiled for two sampling days for morning and afternoon runs and the results were as follows.



Black carbon concentrations from a sampling day are shown in this figure. For reference, the average annual average concentration of black carbon for the Los Angeles area is 2 μg/m^3. The highest concentrations of black carbon observed on this sampling day were in the residential neighborhood near the intermodal container transfer facility, or ICTF, during the morning hours (4 μg/m^3). This area is likely impacted by diesel truck or diesel locomotive plumes from activities at the ICTF. In general, it appears neighborhoods near diesel engine sources (rail yard, freeway, or busy surface streets) are more impacted than those neighborhoods further from those sources. Morning concentrations are also generally higher for most residential sections shown here. However, some sections do not exhibit this pattern. Variables such as meteorology and source strength may explain deviations in the patterns we see between the morning and afternoon.



The next figure shows black carbon data from another sampling day. Although the same sections are shown here, they display a different pattern. The highest black carbon concentrations were observed in the Santa Fe East section (almost 5 $\mu g/m^3$), which is adjacent to the 710 freeway. The Wilmington sections saw an increase in black carbon, while the ICTF neighborhood and Carson residential sections saw decreases in black carbon compared to Sample Day 1. This illustrates the variability of data that is observed from day to day sampling, and points to the need for more days to be analyzed to establish patterns present in the Wilmington area.



The next figure illustrates the effect of road types and time of the day for black carbon. Here we show average black carbon concentrations for varying road types for morning and afternoon sampling times for a single sampling day. The data presented in this figure indicates there is a difference between road types, with freeways having the greatest concentrations of black carbon, an average of 12 $\mu g/m^3$, followed by surface streets and residential areas, which show similar concentrations for morning and afternoon sampling periods. Also, the trend of higher black carbon concentrations in the morning is seen in this figure as in the previous slides. Again, these results may be due to meteorological conditions such as low wind speeds or increased diesel truck traffic in the morning hours. More sampling needs to be conducted to verify these preliminary findings.

Summary of Preliminary Results

- **Easy-to-use monitors good for some pollutants**
- **Ultrafine particle counters will help determine regional vs. local influences**
- **Mobile platform can identify pollution "hot spots"**
- **Variability in pilot results illustrates need for measurements throughout year**

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In summary, the Harbor Communities Monitoring program will provide useful information on the impacts of pollution sources on residential communities near the ports of Los Angeles and Long Beach. We have found that easy-to-use monitors are good for some pollutants, which will allow communities to self-assess their risk to pollution sources. In addition, ultra-fine counters will help us to determine regional versus local influences of combustion sources. And lastly, the innovative mobile platform can identify pollution "hot spots" in communities. However, due to the significant variability in pilot study results, we need to continue monitoring in 2007.

Lastly, here are some important dates to remember for the three studies discussed today. The three studies are set to begin winter monitoring in Feb 2007. Monitoring in the spring, summer and fall seasons will also be conducted over the course of this year. Results are expected to be publicly available starting in early 2008 and we will be happy to provide the Board with an interim update.

Thank you for your attention, and I am ready to address any questions that the Board may have.