Baldwin Hills Air Quality Study: Draft Work Plan

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Sonoma Technology, Inc.
Petaluma, California

Presented to Baldwin Hills CSD Community Advisory Panel
Los Angeles, CA
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Air Quality Research and Innovative Solutions

912024-5451

We have done air quality work in the LA Basin for 40 years. We perform scientific studies that influence the health of the public.

Atmospheric Environment Vol. 11, pp. 803–812. Pergamon Press 1977. Printed in Great Britain.

ON THE NATURE AND ORIGINS OF VISIBILITY-REDUCING AEROSOLS IN THE LOS ANGELES AIR BASIN

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(*First received 26 July 1976 and in revised form 21 December 1976*)

Abstract—Simultaneous measurements of the light-scattering coefficient and chemical composition of ambient aerosols were made during selected smog episodes in the Los Angeles air basin. These data are statistically analyzed to determine the effective scattering efficiencies of the major secondary aerosol species. The individual scattering efficiencies are then used to estimate the contributions of major sources of reactive gases to the reduction of visibility in Los Angeles.

Sulfate and nitrate compounds appear to have scattered more light at a given mass concentration than did other chemical fractions of the aerosol. The observed relationship of SO_2 and NO_x concentrations to the concentrations of tracers for major source types was consistent with existing inventories of SO_2 and NO_x emissions in the basin. Because of the high scattering efficiency of sulfates, the estimated contribution of large stationary sources of SO_2 to the reduction of visibility was comparable with that of the automobile.

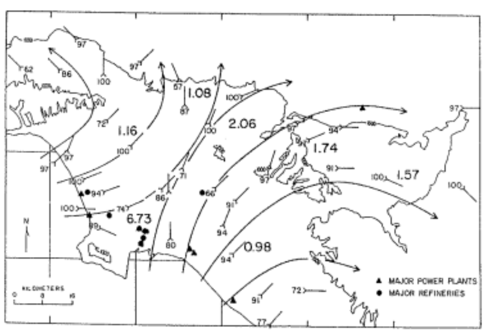

Fig. 4. Patterns of pollutant transport in afternoon. Arrows show most frequent surface wind directions on 16-point compass, with percent frequency of three adjacent directions given by numbers at tails. (One-hour readings 1200–1800 PDT, collected from APCD's and National Weather Service by Meteorology Research, Inc.) Bold numbers give ratios 100 Ni/Pb. (From average Ni and Pb in 2 h aerosol samples taken 1200–1800 PDT at ACHEX mobile van and satellite stations.)

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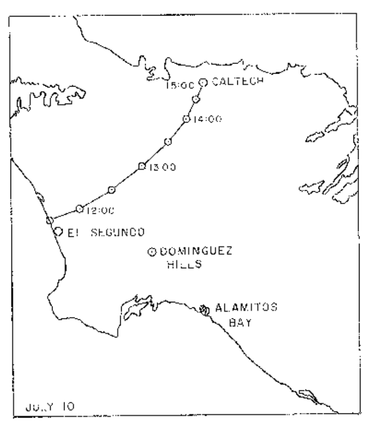


Figure B.5 Trajectory for 1500 PST Arrival at Caltech, July 10, 1973

CDC

MMWR

Morbidity and Mortality Weekly Report

Weekly April 23, 2004 / Vol. 53 / No. 15

Carbon Monoxide Poisonings Resulting from Open Air Exposures to Operating Motorboats — Lake Havasu City, Arizona, 2003

During February 1997–August 2002, two fatal and six nonfatal cases of carbon monoxide (CO) poisoning occurred in vacationers who were wading in or boating near the Bridgewater Channel of Lake Havasu (Lake Havasu City [LHC], Arizona) (*1*). The vacationers were near operating motorboats, primarily in the channel area, where large numbers of boaters congregate during holiday weekends (Figure). One person had a carboxyhemoglobin (%COHb) level of 40% on autopsy. To evaluate CO exposure among municipal employees working in the channel, CDC and the Havasu Regional Medical Center Emergency Department (HRMCED) conducted an initial investigation during Labor Day weekend 2002 (August 31–September 1). CO concentrations in channel air exceeded all short-term exposure criteria*; four of 12 patients reporting to HRMCED because of

*The National Institute for Occupational Safety and Health (NIOSH) ceiling limit for CO exposure is 200 parts per million (ppm), which should not be exceeded at any time. The American Conference of Governmental Industrial Hygienists (ACGIH) excursion limit for CO is 125 ppm (or five times the threshold limit value time-weighted average [TLV-TWA]), which should not be exceeded under any circumstances. The Environmental Protection Agency National Ambient Air Quality Standard for 1-hour CO exposure is 35 ppm.

Summary

- We will measure prioritized air toxics species
  - to assess Oil Field emissions
  - to assess community risk from Oil Field emissions
- Multiple methods are needed
  - black carbon (BC) as a surrogate for diesel particulate matter (DPM) at four sites for one year
  - Metals (e.g., arsenic, cadmium) at two sites, two months
  - Volatile organic compounds and carbonyls (e.g., benzene, acrolein) for two weeks at one or two sites
- Analysis will demonstrate Oil Field contributions to local concentrations and associated health risks
  - Oil Field contributions versus other emissions sources
  - Comparison of concentrations to short- and long-term California health benchmarks and to other parts of Los Angeles

Baldwin Hills Air Quality Study

- Study objectives
- Summary of technical approach
- Toxicity ranking of oil field emissions
- Proposed measurement methods
- Critical factors: frequency, siting, duration
- Quality control and quality assurance
- Oil field operational activity data
- Data analysis
- Project management
- Project schedule
- Discussion

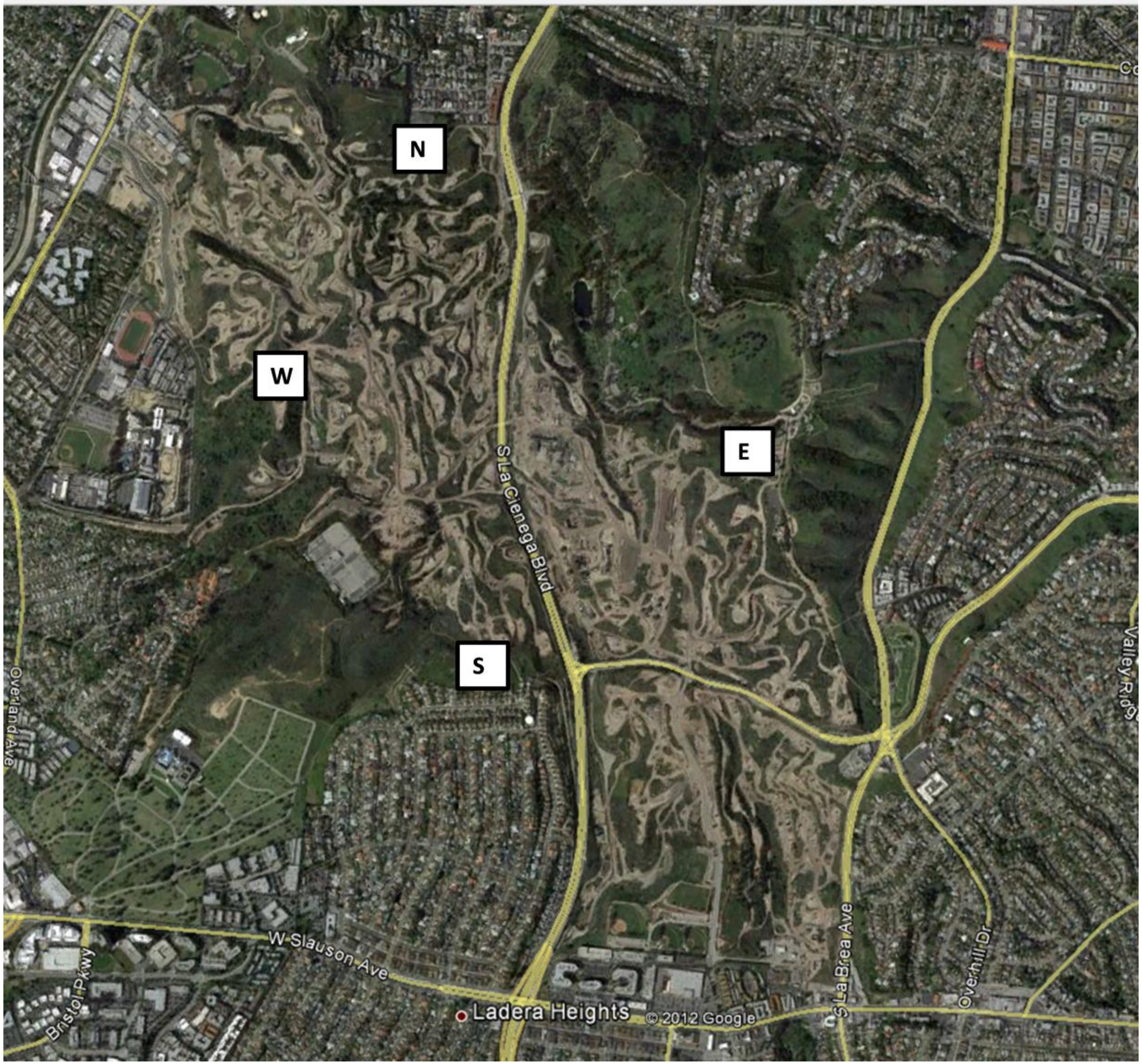
AQ Study Objectives from LA County

- Primary objectives
  - Quantify the air toxics emissions from the Inglewood Oil Field operations, including drilling and well work-overs.
  - Assess the health risk of both acute and chronic exposure to air toxics emissions from Oil Field operations.

Secondary objectives

- To the extent feasible, determine and distinguish the major sources of toxic air emission within the areas surrounding the Oil Field.
- To the extent feasible, assess the Oil Field's contribution to the overall acute and chronic health risk in the areas surrounding the Oil Field.

What toxic emissions are from the Oil Field and how do they affect the surrounding community?



AQ Study Technical Approach

- Prioritize among pollutants from the Oil Field.
- Select the most appropriate measurement methods for the highest priority pollutants.
- Select the measurement sites.
- Plan the analysis of the measurement data in order to meet project objectives.
- Perform the measurements and then data analysis.
- Report results.

Prioritize Among Pollutants from the Oil Field

Weight the oil field emissions (from the Baldwin Hills Community Standards District EIR) in relation to acute and chronic health benchmark screening levels:

- Chronic cancer potency risk factors
- Chronic and acute Reference Exposure Levels (RELs)
- REL is the exposure level below which adverse health impacts are not expected over a lifetime

Key Pollutants and Oil Field Emissions

Pollutant	Total Lb/Year	Fraction from Drilling and Well Workovers
Diesel Exhaust PM	1326.8	0.99
Cadmium	4.8	1.00
Formaldehyde	547.9	0.76
Nickel	15.3	1.00
Chlorine	41.6	1.00
Manganese	4.8	1.00
Mercury	3.6	1.00
Acrolein	14.7	0.70
Lead	5.1	1.00
Arsenic	0.6	1.00
Benzene	340.9	0.17
PAHs	16.9	0.79
Acetaldehyde	215.9	0.96

PM: Particulate matter
PAHs: Polycyclic aromatic hydrocarbons

Emissions from 2005-2006 Environmental Impact Report

Emissions X Toxicity = *Prioritizable values*

Toxicity = short- or long-term health effects

Toxicity values are from California OEHHA; see work plan for detailed calculations.

37 toxics considered, but all the rest (ammonia, hydrogen sulfide, etc.) had lower risks.

Prioritized Pollutants

Pollutant	Total Lb/Year	Fraction from Drilling and Well Workovers	Cancer Rank	Chronic REL Rank	Acute REL Rank
Diesel Exhaust PM	1326.8	0.99	1	2	–
Cadmium	4.8	1.00	2	3	–
Formaldehyde	547.9	0.76	5	6	1
Nickel	15.3	1.00	4	1	6
Chlorine	41.6	1.00	–	4	9
Manganese	4.8	1.00	–	7	2
Mercury	3.6	1.00	–	5	3
Acrolein	14.7	0.70	–	8	4
Lead	5.1	1.00	–	10	–
Arsenic	0.6	1.00	6	9	5
Benzene	340.9	0.17	3	11	8
PAHs	16.9	0.79	7	–	–
Acetaldehyde	215.9	0.96	8	12	7

We need to measure, in order of priority:

- Diesel particulate matter (DPM)
- metals
- carbonyls
- volatile organic compounds (VOCs)

37 toxics considered, but all the rest (ammonia, hydrogen sulfide, etc.) had lower risks.

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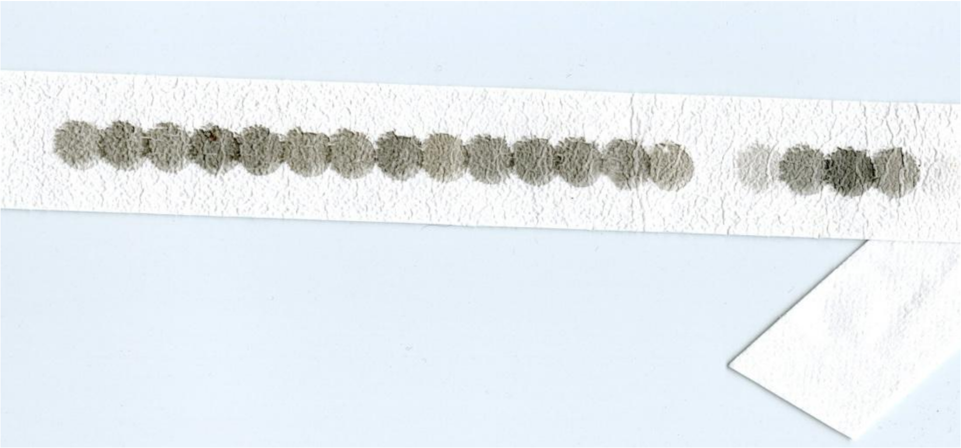
Selection of the Most Appropriate Monitoring Methods

- Separate measurement technologies needed for DPM, metals, VOCs, carbonyls
- Confounding factors of multiple regional sources nearby (e.g., LAX, I-10, I-405, etc.)
- Multiple methods available for some pollutants
- Consider using surrogate species (e.g. black carbon for DPM)
- Consider cost/benefit of methods available for each pollutant

Black Carbon Measurements

- Diesel particulate matter (DPM) – there is no direct or official measurement method for DPM
- We will use Aethalometer measurements of black carbon (BC) as a surrogate for DPM
- 5-minute measurements at four monitoring sites around the Oil Field for a full year



Example of Collected Filter

PM collected on 1″ wide filter tape; note different degrees of black

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Metals Measurements

Element	Atomic Weight	LOD	Element	Atomic Weight	LOD	Element	Atomic Weight	LOD
Sulfur	16	3.7	Iron	26	0.759	Bromine	35	0.185
Potassium	19	0.837	Cobalt	27	0.317	Rubidium	37	0.344
Calcium	20	0.319	Nickel	28	0.226	Strontium	38	0.447
Scandium	21	0.55	Copper	29	0.267	Silver	47	4.37
Titanium	22	0.38	Zinc	30	0.231	Cadmium	48	5.748
Vanadium	23	0.29	Germanium	32	0.121	Barium	56	0.945
Chromium	24	0.288	Arsenic	33	0.114	Mercury	80	0.189
Manganese	25	0.283	Selenium	34	0.141	Lead	82	0.218

XACT 625 semi-continuous X-Ray Fluorescence (XRF) spectrometer
LOD is Limit of Detection in nanograms per cubic meter at standard temperature and pressure.
For a one hour sample collection and analysis period.

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VOC, Carbonyl, and PAH Measurements

Compound	Sources
Formaldehyde	Photo-oxidation, vehicle emissions, diesel generators
Acetaldehyde	Photo-oxidation, vehicle emissions, diesel generators
Acrolein	Butadiene photo-oxidation, vehicle emissions, diesel generators
Benzene	Vehicle emissions, oil and gas extraction, gas stations, industrial
Toluene	Vehicle emissions, oil and gas extraction, gas stations, industrial
Xylenes and ethylbenzene (isomers)	Vehicle emissions, oil and gas extraction, gas stations, industrial
1,3-Butadiene	Vehicle emissions, industrial, diesel generators
Methyl ethyl ketone	Photo-oxidation
Decane	Vehicle emissions
Naphthalene	Vehicle emissions
Trimethylbenzenes	Vehicle emissions
Phenol	Vehicle emissions
Butenes	Refineries, vehicle emissions

Proton Transfer Reaction Time-of-Flight Mass Spectrometer (PTR-TOFMS)

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Critical Measurement Factors

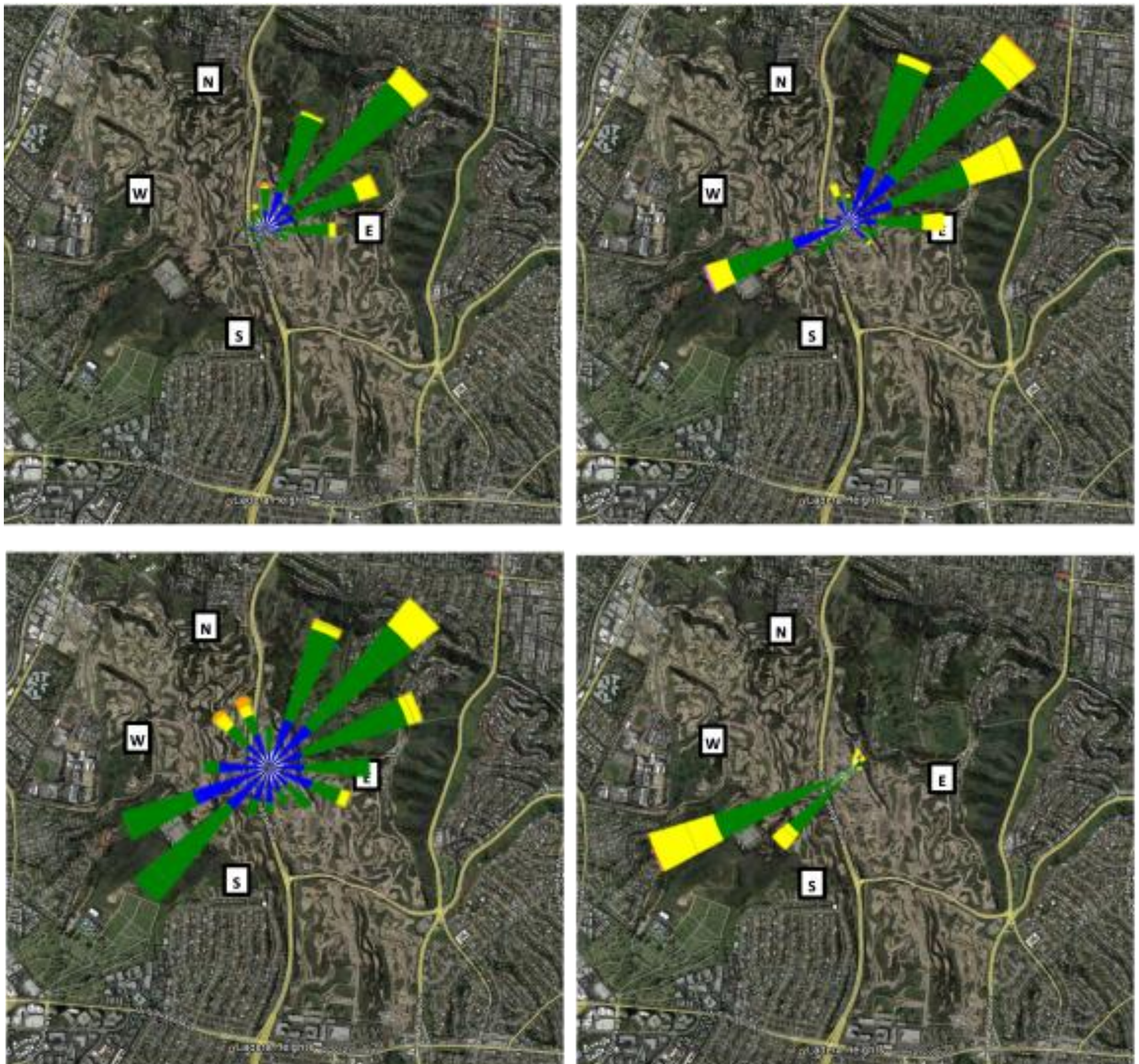
- Averaging time for data collection
- Site locations
- Monitoring period

Typical Wind Speeds and Directions During November and August 2011

Inglewood Oil Field
November
711 1-hr values

Inglewood Oil Field
August
741 1-hr values

Diurnal Wind Patterns During November 2011

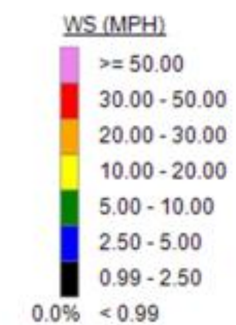


Upper left:
11/1/11-12/31/11
00:00-06:00
425 1-hr values

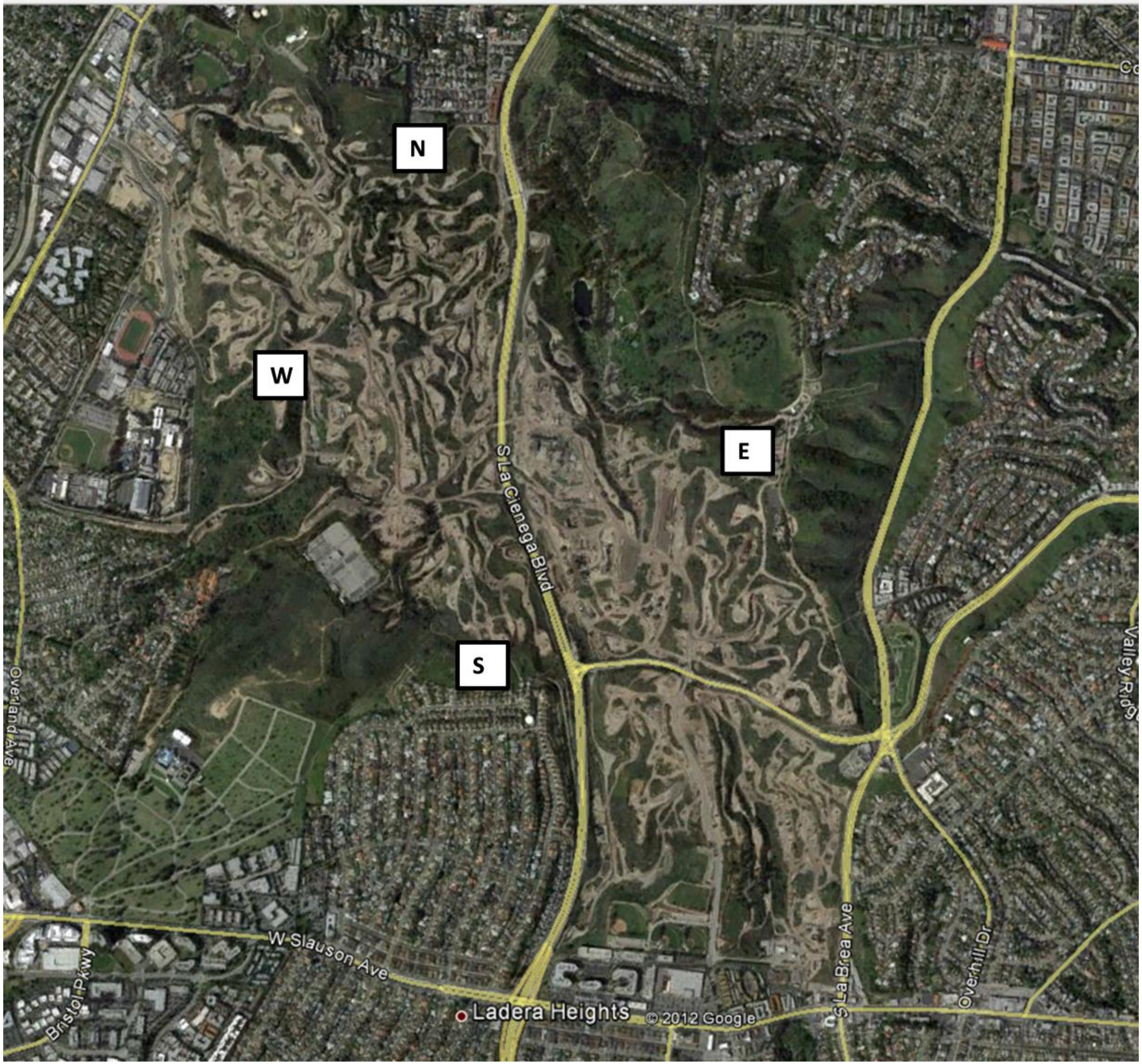
Upper right:
11/1/11-12/31/11
07:00-12:00
360 1-hr values

Bottom right:
11/1/11-12/31/11
13:00-18:00
363 1-hr values

Bottom left:
11/1/11-12/31/11
19:00-23:00
304 1-hr values



Proposed Monitoring Locations



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Quality Control/Quality Assurance

QC and QA are separate components of the Data Quality Control Plan.

- QC consists of operational techniques and activities, such as on-site instrument maintenance and verification procedures.
- QA incorporates systematic activities to provide confidence that the requirements for quality are fulfilled, e.g., field audits, measurement comparisons, and post-processing data validation protocols.

Major QC and QA Activities

Quality Control/Quality Assurance Protocol	Instrument/Parameter					
	Teledyne-API 633 Black Carbon Monitors	XACT 625 Metals Monitor	PTR-MS VOC monitor	Meteorological Sensors	Passive BTEX/Carbonyl	Shelter Temperature
Daily review of data and diagnostics, clock checks	✓	✓	✓	✓		✓
Periodic flow checks against NIST-traceable reference	✓	✓	✓			
Standardized reference checks (hourly, daily)		✓	✓			
Routine monthly maintenance (e.g., visual inspection, tape changes, inlet cleaning, pump maintenance)	✓	✓	✓	✓		✓
Documentation by manual log notes (each site visit)	✓	✓	✓	✓	✓	✓
Meteorological sensor audits (at install, 6 months, removal)				✓		
Co-located intercomparison of the four T-API Model 633 Aethalometers	✓					
24-hr 1-in-6 day VOC sampling			✓		✓	

Oil Field Operational Data Needed

Times and locations of operating drill rigs and well work-over rigs

- Start and end date/time of activity
- Location of activity

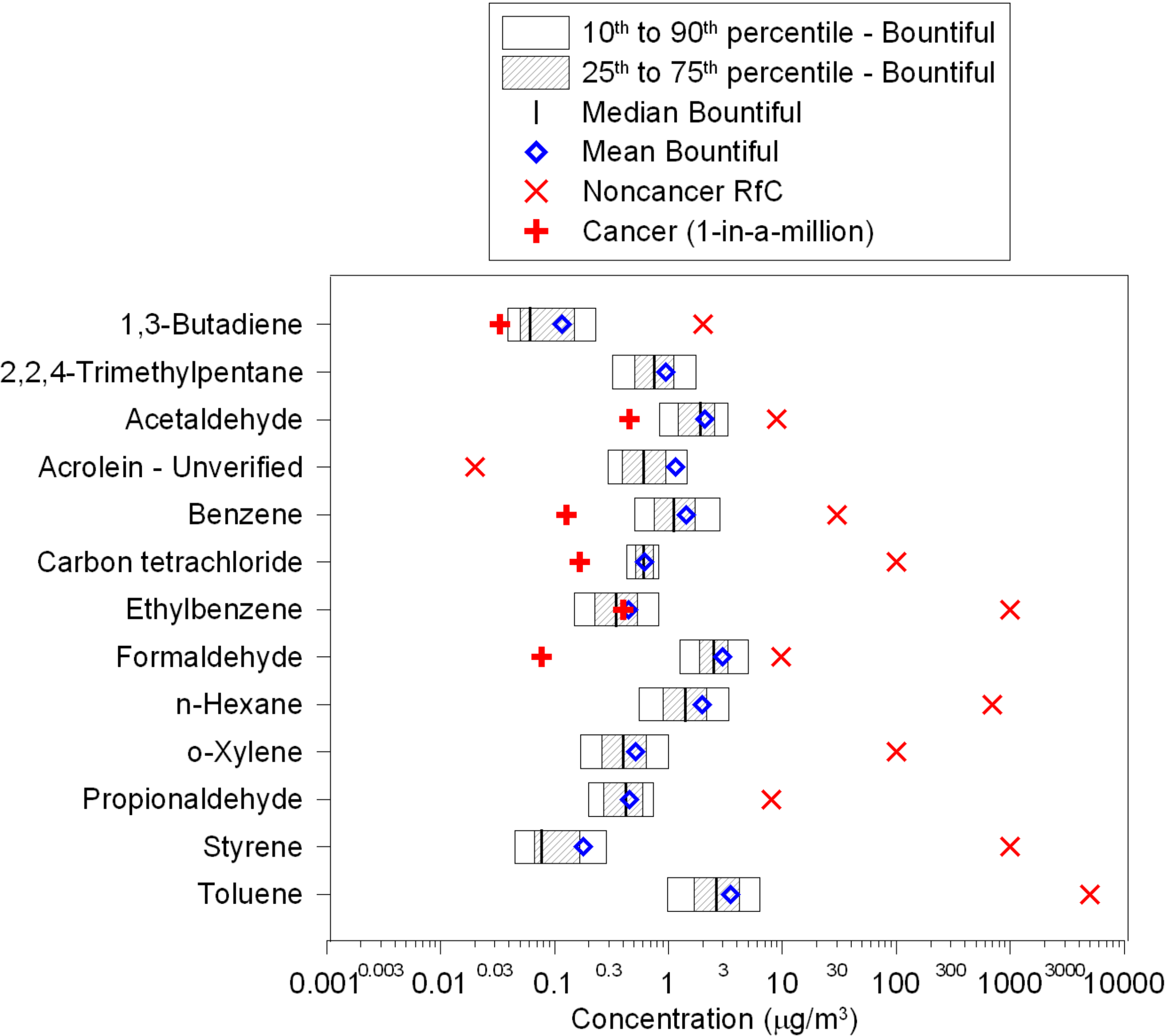
Will correlate with wind and pollutant data to

- Identify sources of measured pollutant concentrations
- Determine relative contributions of oil field sources to measured concentrations

Data Analysis (to meet study objectives)

- **Risk characterization**
  Compare measured toxics concentrations to health screening levels.
- **Emissions source characterization**
  Separate measured toxics concentrations into contributions from source ‘fingerprints’.
- **Spatial and temporal characterization**
  Evaluate measured toxics concentrations binned by wind direction and wind speed. Estimate oil field contributions by (downwind concentration – upwind conc.).

Risk Characterization Example

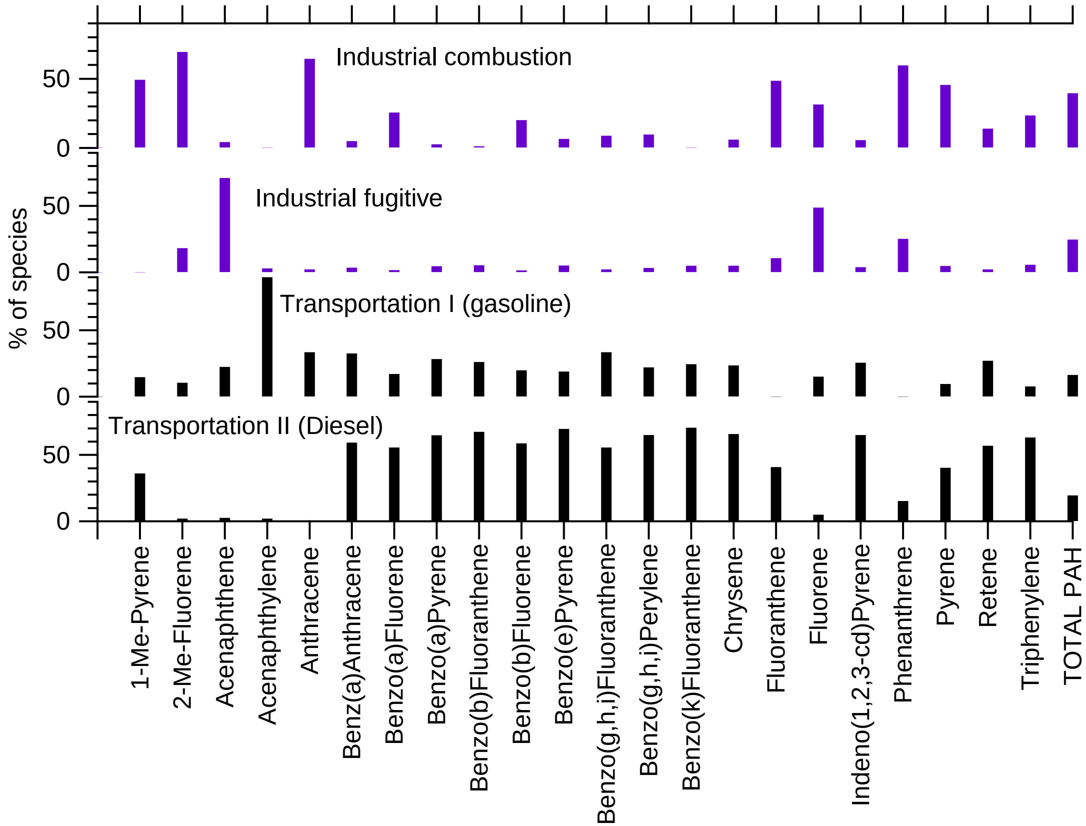


Pollutant concentration ranges will be compared to California acute and chronic health screening levels.

In this example, concentration ranges are shown as box plots showing range of values. Health screening levels are shown in red.

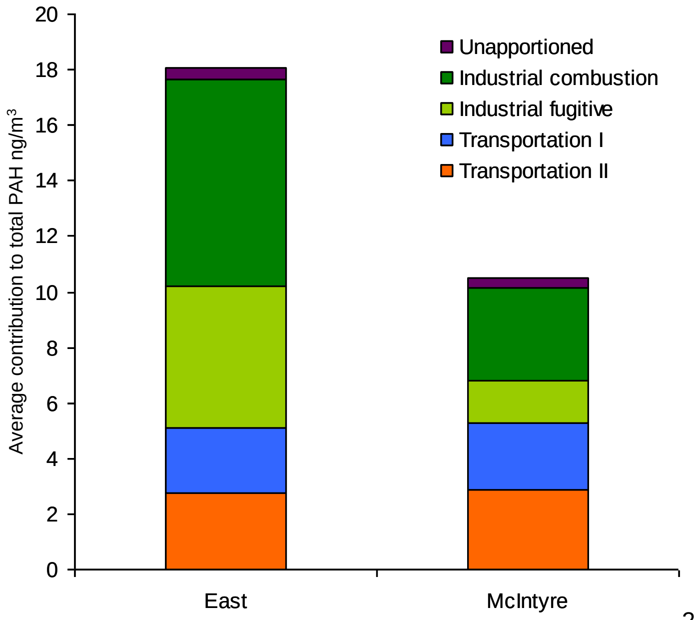
If boxes are to the right of the red symbols, concentrations are above levels of concern.

Emissions Characterization Using 'Fingerprints'



Emissions sources may be characterized by unique chemical signatures or "fingerprints". Data analysis can be performed to statistically identify these chemical signatures.

We expect to see oil and gas contributions and contributions from other local and regional pollution sources. Relative magnitudes of contributions can be compared.



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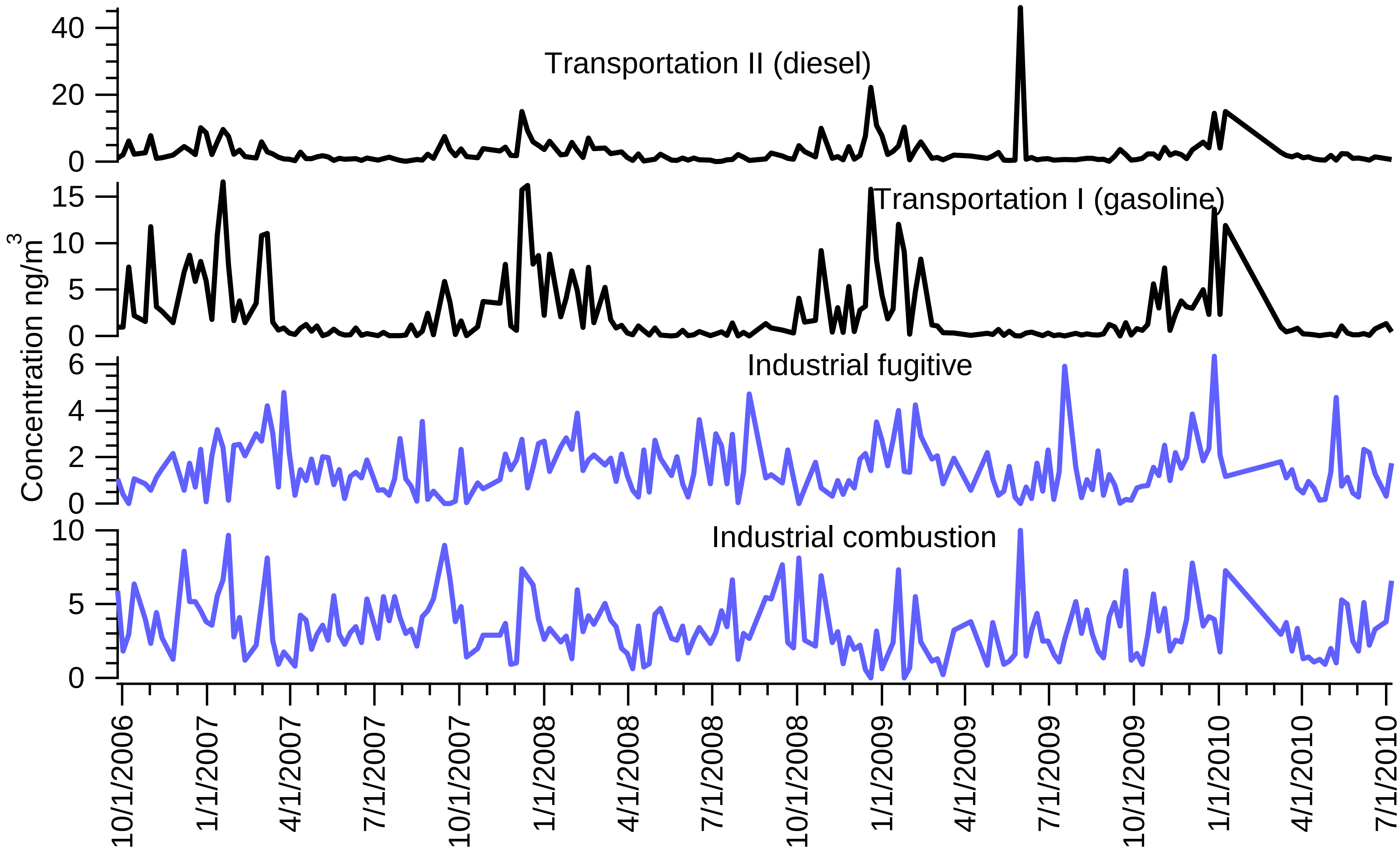
Time-Series of Emissions Source 'Fingerprints'



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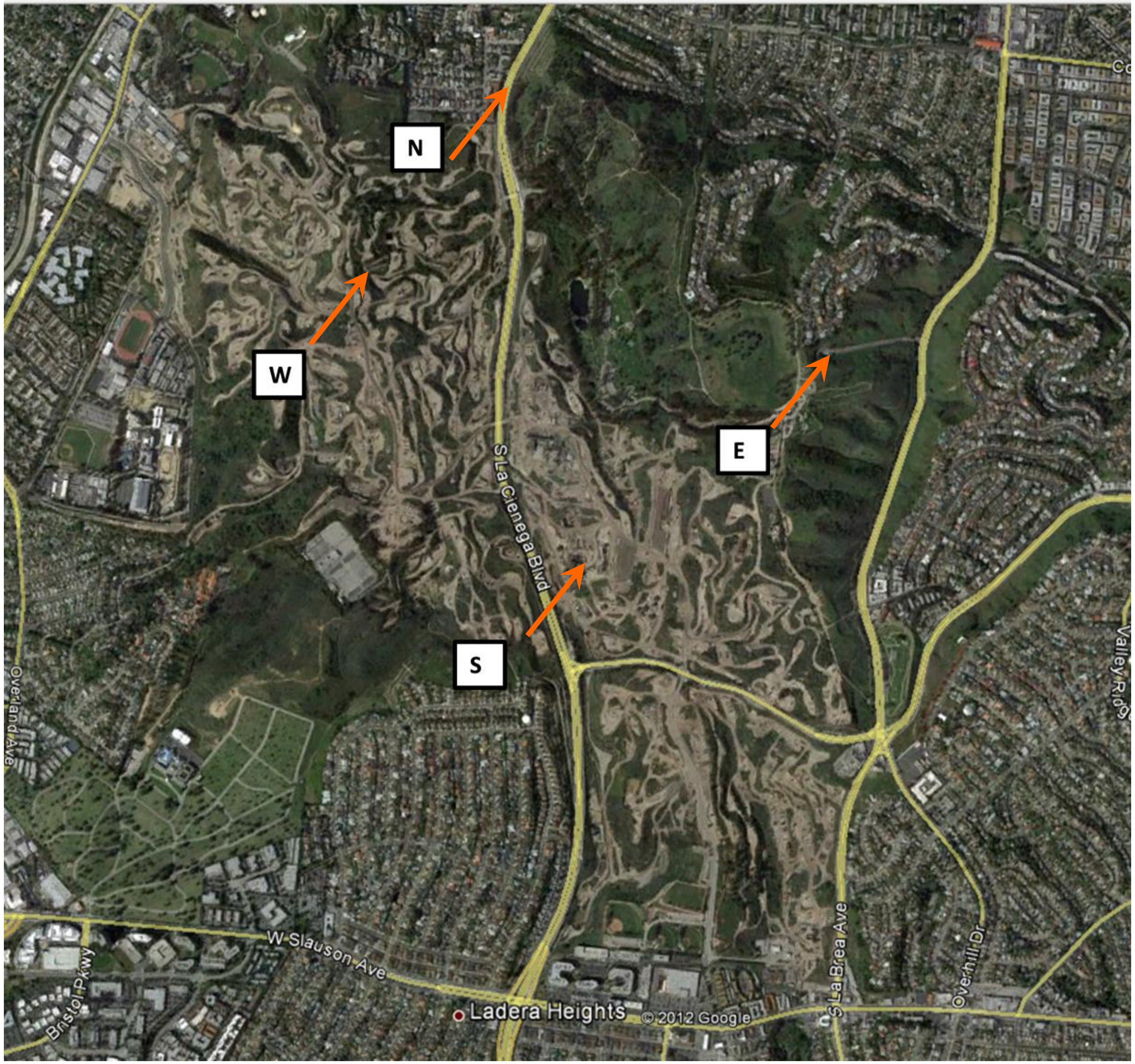
Spatial Characterization Example

- Winds predominantly blow from the southwest or northeast.
- When winds blow from the southwest, pair the sites W and N, and S and E.
- Compare [BC] at E (downwind) with [BC] at S (upwind); difference is contribution of oil field.



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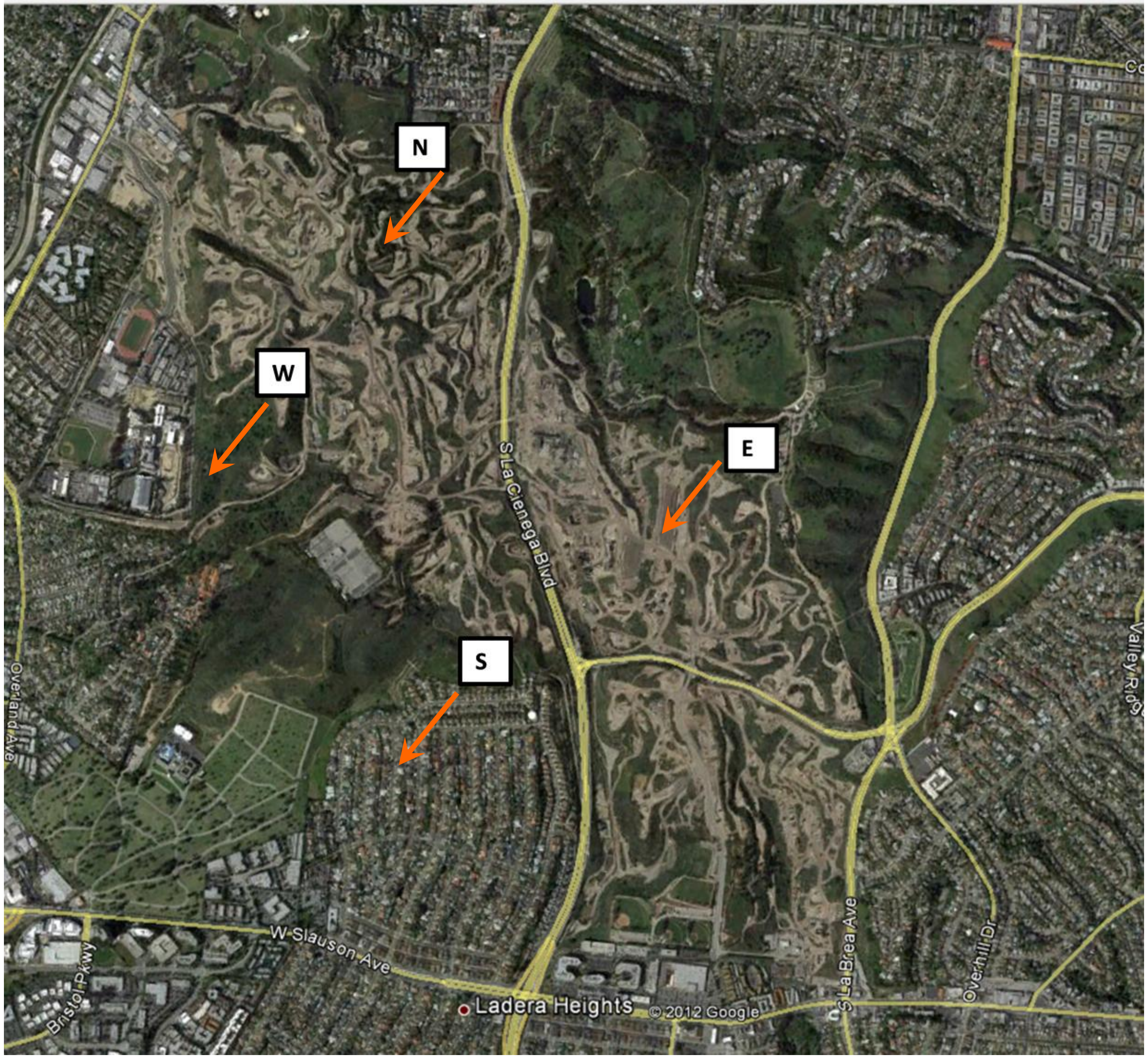
Spatial Characterization Example

- If winds flow from the northeast, now E is upwind and S is downwind.
- Compare BC concentrations at the sites upwind and downwind of the oil field; the difference will be an estimate of any contribution of the oil field.



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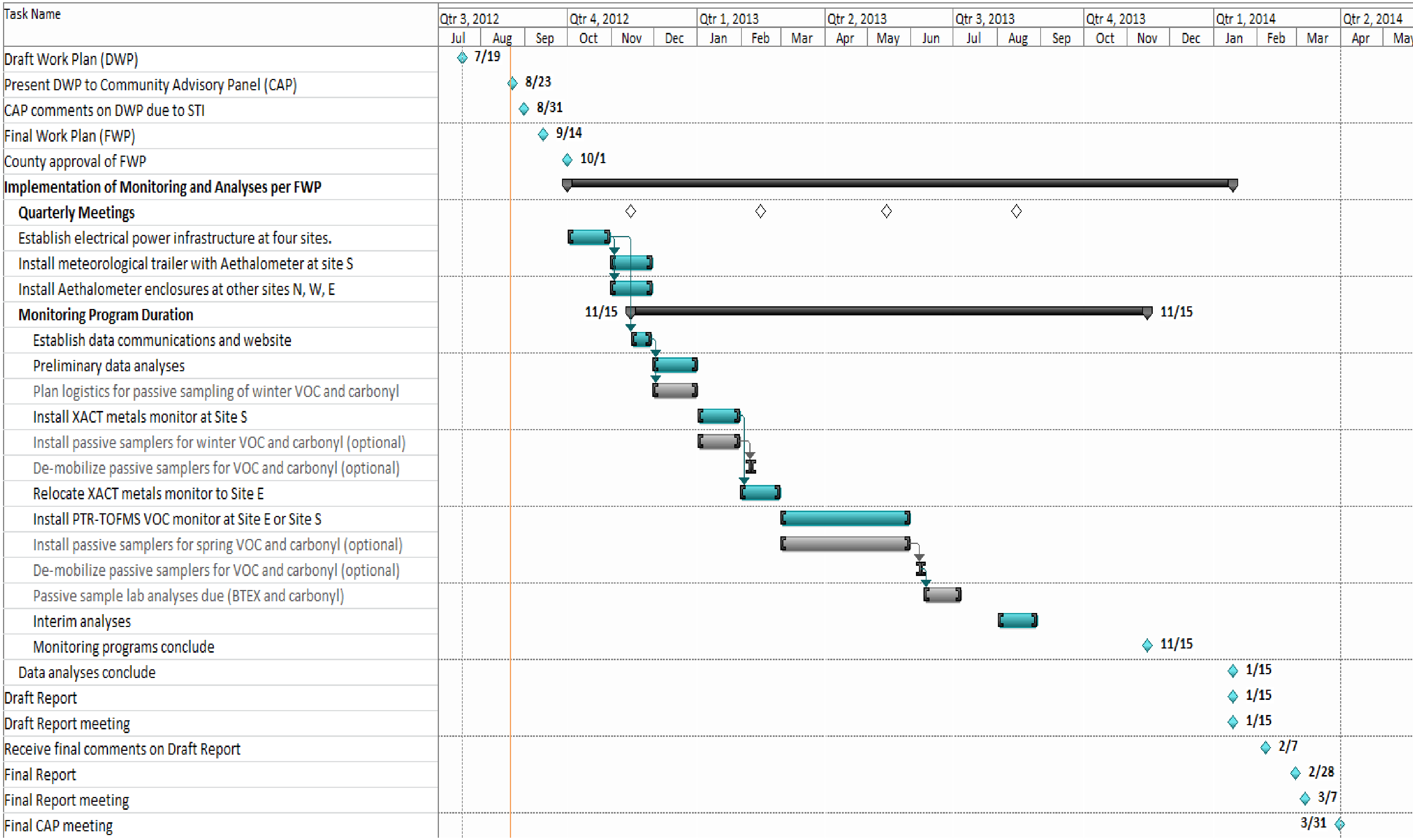
Project Management, Roles, and Qualifications

Name	Title / *Field of Expertise*	Project Role	Highest Degree / Yrs of Experience	So. Cal AQ Exp.
Sonoma Technology, Inc.				
Dr. Paul Roberts	Executive Vice President; Chief Scientific Officer; Corporate Quality Assurance Officer / *AQ/met monitoring, QA/QC*	Principal Investigator	Ph.D., Environmental Engineering Science / 33	✔
Mr. David Vaughn	Group Manager, Air Quality and Exposure Measurements / *AQ/met monitoring*	Project Manager, Monitoring Lead	M.S., Plant Sciences / 23	✔
Dr. Mike McCarthy	Senior Air Quality Analyst / *Exposure Assessment*	Data Interpretation Lead	Ph.D., Chemistry/ 8	✔
Mr. Clinton MacDonald	Group Manager, Meteorological Measurements and Analysis / *AQ/met monitoring and analysis*	Project Advisor for Meteorology	M.S., Atmospheric Science / 16	✔
Ms. Alison Ray	Field Technician / *Monitoring equipment maintenance*	Senior Field Technician	B.S., Business Administration / 21	✔
Mr. Kevin Smith	Field Technician / *Monitoring equipment maintenance*	Field Technician	B.A., Commercial Illustration / 11	✔
University of Massachusetts				
Dr. Rick Peltier	Assistant Professor / Ambient aerosols and human health	XACT 625 instrument support and data analysis	Ph.D., Atmospheric Chemistry / 10	✔
University of Wyoming				
Dr. Shane Murphy	Assistant Professor / Atmospheric Science	PTR-TOFMS 8000 instrument support and data analysis	Ph.D., Atmospheric Chemistry / 4	✔
Mr. Jeff Soltis	Associate Research Scientist/ Atmospheric Science	PTR-TOFMS 8000 instrument support and data analysis	M.S., Soil Sciences and Water Resources / 5	
Dr. Robert Field	Associate Research Scientist/ Atmospheric Science	PTR-TOFMS 8000 instrument support and data analysis	Ph.D., Atmospheric Chemistry / 17	

Project Schedule



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Acknowledgements

- AQ Study funded by LA County Department of Regional Planning
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- PXP for allowing placement of monitoring sites on their property, and for providing emissions activity information

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