

Research Summary of the CalNex-Bakersfield Study

Chair's Seminar, April 22, 2013

ARB Contracts #08-316 and #09-316
Professors Ronald Cohen & Allen Goldstein
University of California, Berkeley

California Environmental Protection Agency



Air Resources Board

Seminar Schedule

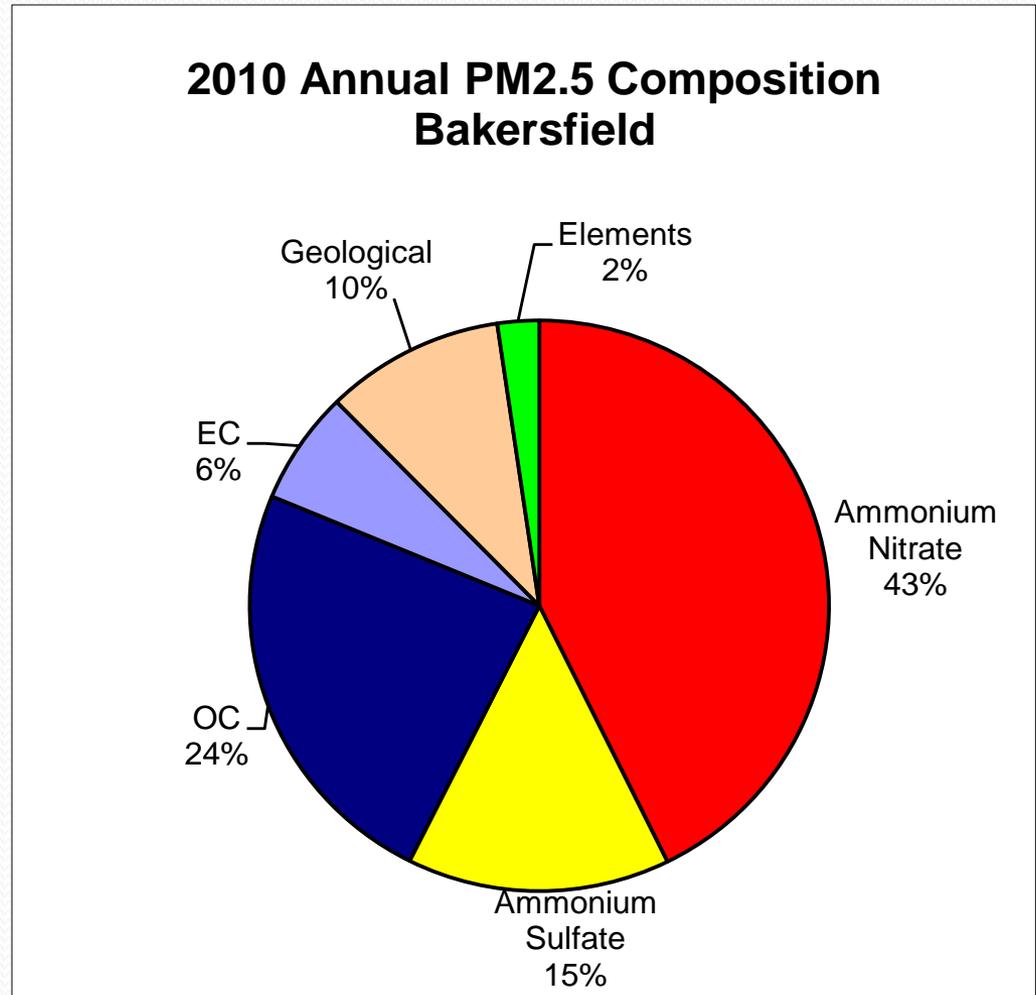
- 10:00 – 10:15** Introduction – *Leon Dolislager*
- 10:15 – 11:15** Atmospheric chemistry of the San
Joaquin Valley – *Prof. Ron Cohen*
- 11:15 – 11:30** Questions & Comments
- 11:30 – 1:30** Lunch
- 1:30 – 2:30** Deciphering the origins and
transformations of atmospheric organics
– *Prof. Allen Goldstein*
- 2:30 – 3:00** Questions & Comments

Project Background

- **Poor air quality in southern San Joaquin Valley**
 - **Extreme Non-attainment of O₃ & PM_{2.5} standards**
 - **Highest 8-hr O₃ and PM_{2.5} concentrations typically occur in Kern County**
 - **Kern County frequently exceeds AQ standards**

Project Background

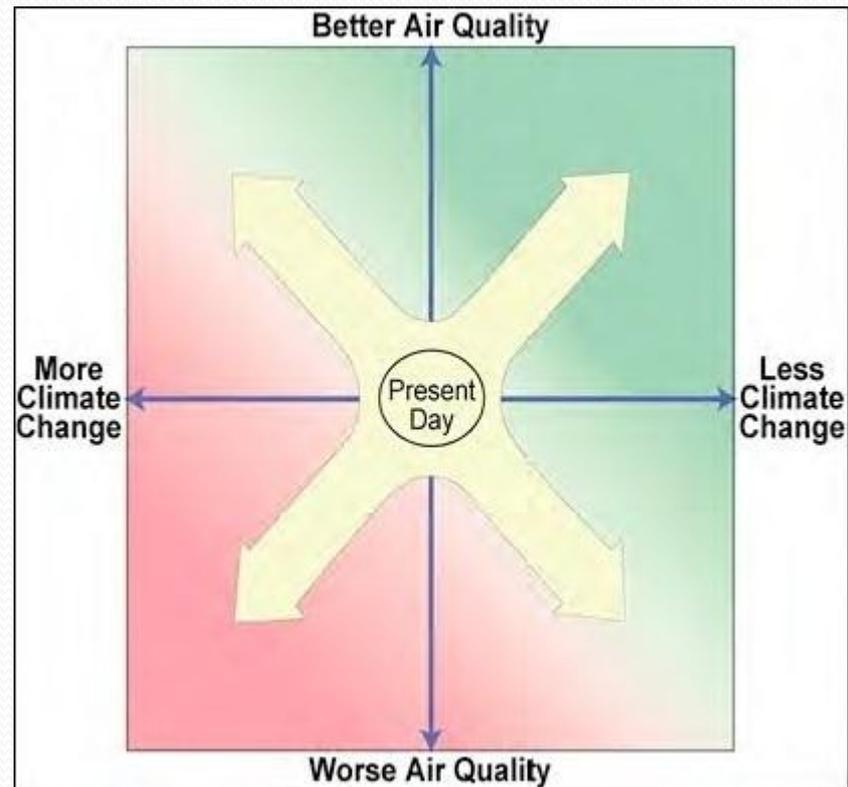
- First contract focused on O₃ & atmospheric photochemistry
- Second contract focused on organic carbon, which is the second largest contributor to PM2.5



Project Background

- CalNex field study – research at the nexus of climate and air quality in California

- ~\$20m field study sponsored by NOAA and CARB during early summer of 2010 to address inter-related issues in the fields of air quality and climate change
- CalNex Synthesis Report coming this fall



Project Objectives

- **Better characterize atmospheric composition and atmospheric processes in the southern SJV**
 - #08-316 – Atmospheric chemistry
 - #09-316 – Organic aerosols

In conjunction with CalNex Study:

- **Improve emission inventories**
- **Improve air quality modeling performance**
- **Support future SIP development**

Project Results

- O_3 formation in southern SJV is NO_x -limited; O_3 air quality is poised to rapidly improve
- Night-time chemistry important in the formation of nitrate aerosols
- Secondary organic aerosols comprise ~75% of the total organic aerosols
- Several publications to advance air quality science and more to come
- On-going research with CalNex researchers

Project Publications

- S.E. Pusede and R.C. Cohen (2012) *On the observed response of ozone to NO_x and VOC reactivity reductions in San Joaquin Valley California 1995-present*, Atmos. Chem. Phys. Disc. 12, 9771-9811.
- Gentner, D., et al. (2012) *Elucidating secondary organic aerosol from diesel and gasoline vehicles through detailed characterization of organic carbon emissions*, www.pnas.org/cgi/doi/10.1073/pnas.1212272109.
- Liu, S., et al. (2012) *Secondary organic aerosol formation from fossil fuel sources contribute majority of summertime organic mass at Bakersfield*, J. Geophys. Res., 117, D00V26, doi:10.1029/2012JD018170, 2012.
- O'Brien, R.E., et al., *Molecular Characterization of Organic Aerosol Using Nanospray Desorption/Electrospray Ionization Mass Spectrometry: CalNex 2010 field study*, Atmospheric Environment, DOE: 10.1016/j.atmosenv.2012.11.056, Available online 6 December 2012.
- Rollins, A.W., et al. (2012) *Evidence for NO_x control over nighttime SOA formation*, Science, 337, 1210-1212, DOI: 10.1126/science.1221520.
- Worton, D.R., et al. (2012) *Thermal Desorption Comprehensive Two-Dimensional Gas Chromatography: An Improved Instrument for In-Situ Speciated Measurements of Organic Aerosols*, Aerosol Science and Technology, 46:4, 380-393.

Project Papers in Process

- Gentner, D., et al., *Evidence for emissions from petroleum operations in California's San Joaquin Valley*
- Gentner, D., et al., *Emissions of biogenic gas-phase organic carbon from agriculture and their implications for air quality*
- Gentner, D., et al., *Sources of alcohols and oxygenates in California's Central Valley*
- Gentner, D., et al., *Prevalence & emissions of selected halocarbons during CalNex*
- O'Brien, R., et al., *Probing Molecular Associations of Field-Collected and Laboratory-Generated SOA with Nano-DESI High-Resolution Mass Spectrometry*, J. Geophys. Res., CalNex Special Issue, In Press.
- Pusede, S.E., et al., *Observational Constraints on projections of the ozone response to NOx controls in the Southern San Joaquin Valley*
- Rollins, A.W., et al., *Gas/particle partitioning of total alkyl nitrates observed with TD-LIF in Bakersfield*

On-going Analytical Research of Data

- 1. Cohen group** - The coupling of VOC reactivity, temperature, nitrogen oxides, and O₃ production
- 2. Goldstein group** - Comparing the VOC sources in the San Joaquin and South Coast Air Basins
- 3. Brune group** - Understanding HO_x mechanisms
- 4. Keutsch group** - Small-oxygenated VOCs, VOC sources, O₃, and aerosol formation
- 5. Thornton group** - Peroxy nitrate chemistry in the SJVAB
- 6. Wennberg group** - Impacts of organic and nitric acids
- 7. Cooperation with other CalNex researchers**

CalNex-related Resources

- **NOAA** (<http://esrl.noaa.gov/csd/projects/calnex/>;
<http://tinyurl.com/CalNex-papers>;
CalNex Synthesis report available this fall)
- **ARB**
(<http://www.arb.ca.gov/research/calnex2010/calnex2010.htm>)
- **CalMex** (<http://mce2.org/en/activities/cal-mex-2010>)
- **CARES** (Carbonaceous Aerosols and Radiative Effects Study) (<http://campaign.arm.gov/cares/>)



Investigator

Presentations

- **Morning:** Atmospheric Chemistry – Prof. Ron Cohen
- **Afternoon:** Atmospheric Organics – Prof. A. Goldstein