Applications and Implications: Science-Based Policy Formation at the California Air Resources Board

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Los Angeles 50 Years Ago

- Unhealthy levels of lead, NO$_2$, SO$_2$, carbon monoxide, ozone, particulate matter, and air toxics
- Ozone:
  - Over 100 air pollution alerts annually
  - Over 200 days with unhealthy air annually
  - Peak ozone level of 490 ppb - five times allowable level
The Public Expects Clean Air

Highland Park Optimists Club (1954)
Courtesy of UCLA Library Special Collections - Los Angeles Times Photographic Archive
Understanding the Problem
Science-Based Air Quality Management

• California has two of the most polluted air basins in the U.S. (South Coast and San Joaquin)
• Emissions controls to attain NAAQS are expensive (~$10B) and must get them right the first time
• Air Quality Management in California has a strong scientific basis – multiple research-grade field campaigns
• CARB is a prominent and consistent provider of funding for basic/applied air quality research and conferences
Photochemical Modeling

Models are mathematical representations of our best current knowledge of atmospheric processes.
Chemistry Foundational To AQ Management

• The better the chemistry in the photochemical model, more defensible the control strategies derived with it
• CARB is committed to SAPRC chemistry (started in SAPRC90, now at SAPRC07, will move to SAPRC16)
• CARB has many chemistry-based regulatory programs besides photochemical modeling
• This conference is the foundation of CARB’s internal chemistry improvement effort
Chemistry at CARB

• CARB’s first chair, Dr. Arie Haagen-Smit, was a bioorganic chemistry professor at Caltech
• California Reformulated Gasoline (CaRFG) regulation (13 CCR 2250-2273.5) – Based on MIR
• Consumer Products Regulations (four of them) 13 CCR 94500-94555 – Based on MIR
• Reactivity Program - VOC Exemptions (VOCs that are not expected to meaningfully contribute to ozone formation due to their low reactivity in the atmosphere)
• Regulatory monitoring program
• Ocean-going Vessels program
• ….. (every program has some chemistry)
Decline in Peak Ozone Levels

Los Angeles - 70%
Decline in Annual PM2.5 Levels

Los Angeles

Annual Average PM2.5 Level (µg/m³)

- 50%
Reduction in Toxics Cancer Risk

Statewide - 68%
California’s Evolving Air Quality Priorities

**Criteria Pollutants**
1960s - forward

**Toxics Exposure**
1980s - forward

**Climate Change**
2000s - forward

**Community Exposure**
2017 forward

**Fundamental Science and Measurements**
AB 617: Community Air Protection

• Community focused framework and actions
  ✓ Build on existing successful programs
  ✓ Enhanced information on community level air pollution
  ✓ Community specific emission reduction programs
  ✓ Targeted incentive funding
  ✓ Focus on early actions
  ✓ Emphasis on community participation

• Collaborative process involving CARB, air districts, and community representatives
Identifying Communities

• Prioritize communities with highest exposure burdens:
  ✓ Deployment of community air monitoring
  ✓ Development of community emission reduction programs

• Focus on disadvantaged communities and sensitive receptor locations
Low-Cost Air Sensors

- Community air monitoring – low-cost air sensor networks can screen exposure
- Sensor availability is limited – no reliable sensors for VOC and air toxics
- Help from chemists are needed to design/build new low-cost sensors and interpret the results
- Have a separate CARB-sponsored conference on this (Air Sensor International Conference), but could also be a session in the next ACM
Science Drives California Policy
Success Through Collaboration

- USEPA
- CARB
- Air Districts
- Industry and Consulting
- Schools and Universities
- Citizens and Communities
Conclusions

• CARB is a world-renowned pro-active leader in AQ management.
• Chemistry is the bedrock of CARB’s science-based regulations
• CARB’s internal chemistry improvements benefit tremendously from this conference
• CARB needs help from this group on design/development of low-cost sensors, especially for VOCs and air toxics