Planned Air Pollution Research

FY 2010-2011

Today's Proposed Action

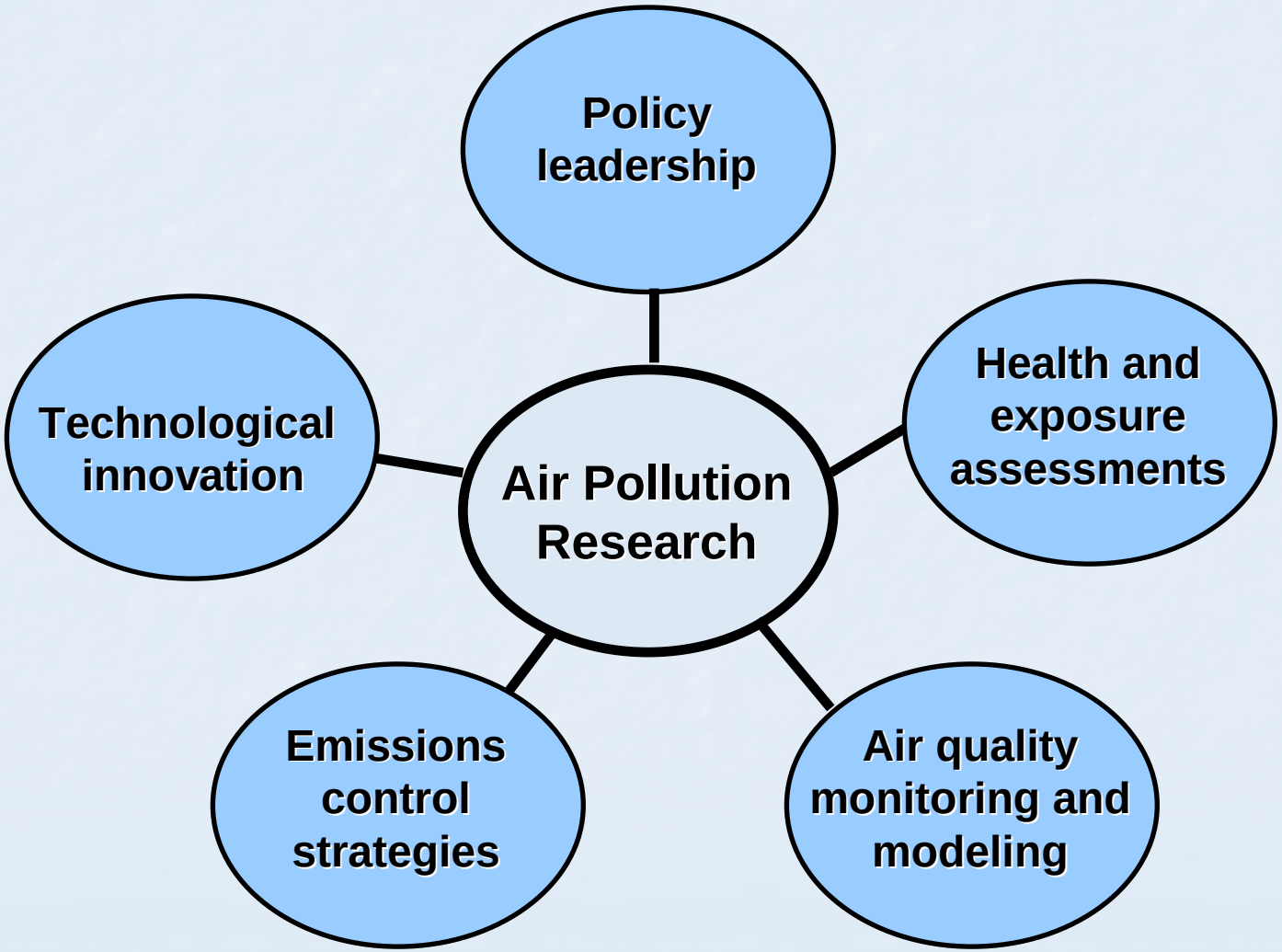
Approval of FY 2010-2011 Annual Research Plan

- Plan comprises 25 research concepts
- Full proposals to be developed from each concept
- Research portfolio totals ~$6.4M

Mission of ARB's Research Program

- Address causes, effects, and solutions to California's air quality and climate change issues
- Support regulatory and policy priorities
- Identify and explore critical research questions
- Utilize State-funded universities, where possible

ARB's Research Program Supports Science-Based Policy



Outline of Presentation

- Historical Highlights
- Research Planning Process
- Research Plan, FY 2010-2011

Ground-Breaking Approach to Reduce Ozone & PM Pollution: NO_X Controls

- **1952**: Professor Haagen-Smit discovers nature of smog
- **1971**: Research program established by Legislature
- **1971**: ARB first agency to control NO_X from motor vehicles
- **1972**: First field study of ozone and PM in Los Angeles
- **1991**: NRC recognizes effectiveness of ARB NO_X control
- **2010**: ~75% ozone and PM2.5 reduction from BAU

Field Studies: Real World Data Verifies Policy and Refines Models

- ARB's field research targets critical air quality issues
- Field research verifies strategies, improves models

Southern California - Smog and PM

ACHEX (1972-3), SCAQS (1987), SCOS-NARSTO (1997), HCMS (2007)

San Joaquin Valley - PM and Ozone

SJVAQS/AUSPEX (1990), IMS (1995), CRPAQS (2000), CCOS (2000)

Statewide - Air quality and climate change

ARCTAS-CA (2008), CalNex (2010), Methane network (2010+)

Vulnerable Populations Research: Children's Health Study

- Landmark study by USC of health impacts of air pollution on over 5,000 California children
- Funded by ARB, currently supported by NIEHS
- Major findings:
  - Combustion pollution associated with permanent lung deficits
  - Air pollution worsens asthma
  - Ozone exposure linked to asthma onset

- Basis for legislation requiring toxics prioritization and reassessment of standards to protect children's health

Direct Policy Impact: Research on Indoor Air Quality and Exposure

Over 40 studies since Indoor Program started in 1986

- Pioneering studies in homes, schools, commercial buildings and vehicles
- Measurements include air pollutants, toxics, asthma triggers and noise

Major Impacts on State Policy and Regulations

- ARB limits on formaldehyde from composite wood products
- State school construction & maintenance policies, school district actions
- Regulation of ozone from indoor air cleaners
- Support of stronger State Green Building Code for building materials

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Annual Research Process

1. Identify research priorities.
2. Publicly solicit research concepts.
3. Conduct technical review with independent reviewers.
4. Select top concepts based on technical merit, cost-effectiveness, and policy priority.

Research Screening Committee

Health and Exposure:	Dan Costa, Ph.D., US EPA Rachel Morello-Frosch, Ph.D., MPH, UCB Irva Hertz-Picciotto, Ph.D., UCD
Indoor Air Quality:	Tracy Thatcher, Ph.D., Cal Poly SLO
Atmospheric Processes:	Steven Japar, Ph.D., Ford Motor Co., *retired* Chung Liu, D.Env., SCAQMD Suzanne Paulson, Ph.D., UCLA
Climate Change:	Matthew Kahn, Ph.D., UCLA Charles Kolstad, Ph.D., UCSB
Emissions Control:	Harold Cota, Ph.D., Cal Poly SLO, *chair* Forman Williams, Ph.D., UCSD

Other Technical Experts

Air Pollution Control Districts

Bay Area Air Quality Management District
South Coast Air Quality Management District

State Agencies

California Department of Resources Recycling and Recovery
California Department of Transportation
California Energy Commission
California Public Utilities Commission
Office of Environmental Health Hazard Assessment

Federal Agencies and Agencies in other States

National Oceanic and Atmospheric Administration
New York State Energy Research and Development Authority
U.S. Environmental Protection Agency

Independent Research Funding Agencies

Coordinating Research Council
Health Effects Institute

Cost-Effective Research

75% of ARB research funds stay in California

Significant leveraging secured annually:

- FY 2010-2011 plan: approximately $1 in externally leveraged resources per $1 of State funds
- $3 in external leveraging per $1 State funds, past 10 years

Contracts require lowest available overhead rates:

- 10% from UCs
- 25% from CSUs

Strategic Planning

Challenges

- 4-6 year research cycle
- 1-2 year regulatory development cycle

Opportunities

- Coordination with other research & funding agencies at the state and national level
- Increase in-house resources dedicated to following external research
- Including external experts and Board members in ongoing dialogue of anticipating research needs

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Research Program Areas, FY 2010-2011

- Health Effects and Exposures
- Air Quality and Emissions Reductions
- Economic Analysis
- Climate and Energy Efficiency

Health Effects & Exposures
Recent and Ongoing Research

PM2.5

- Seed funding for PM2.5 Research Centers in Los Angeles and SJV
- Mechanism for cardiovascular health effects

Ozone

- Decreases linked to reduced cardiac mortality
- Associated with childhood asthma hospitalizations

Traffic

- Children exposed to significantly elevated air pollution in diesel school buses
- Traffic-related pollution can double local exposures
- Daily commute can dominate long-term pollution exposures

Health Effects & Exposures

Recommended Research, FY 2010-2011

PM2.5

- What sources and components of PM cause adverse health effects?
- What biological responses are induced by traffic-related air pollution?

Vulnerable Populations

- How do various pollutants and sources affect asthma in children?
- How does exposure to high PM concentrations during youth affect long-term immunity and lung function?

Indoor Air Quality

- What levels of pollutants are emitted by "new technology" indoor air cleaners? Do they warrant additional or refined regulation?

Proposed Health Research:

What sources and components of urban pollution cause asthma symptoms in children?

- Asthma research is an ARB priority (Children's Health Study, Huntington Park Study, Fresno Study)

- Clarify impacts of:
  - primary PM2.5
  - secondary PM2.5
  - traffic-related pollution
  - ozone

Air Quality & Emissions Reductions

Recent and Ongoing Research

Verify Benefits of Regulatory Strategies

- Field studies that demonstrate emissions reductions

Model Refinements

- Effects of PM, NO_X, and VOC on ozone chemistry
- Impacts of climate change on air quality

Evaluation of New Technologies

- Effects of advanced exhaust aftertreatment for motor vehicles on non criteria pollutants

Air Quality & Emissions Reductions

Recommended Research, FY 2010-2011

Particle Chemistry

- Is particle surface chemistry particles an important source of reactive oxygen species?
- How should model represent aerosol volatility at low concentrations?
- What are the sources of organic aerosol, and how is it transformed?
- What is the secondary aerosol formation potential from ammonia emitted from vehicles with Selective Catalytic Reduction?

Instrumentation for Emissions Measurements

- What is the relationship between SO_2 and sulfate tailpipe emissions?
- Quantify PM emissions from low-emitting vehicles

Low Emissions Technology Research

- Develop a zero-emissions portable off-road power source

Air Quality & Emissions Reductions

Recommended Research, FY 2010-2011

Vehicular Emissions Reductions

- How effective are various configurations with multiple aerodynamic fairings in reducing emissions from the current heavy duty fleet?

Emissions Inventory

- How much methane is emitted from various sources, including biological sources and the fossil fuel industry?
- How do various strategies affect emissions of methane?

Agriculture

- How can we reduce emissions of VOC from dairy cow feed?
- Model California's agricultural greenhouse gas emissions

CalNex: Field Research to Inform Policy

- What are the implications of the CalNex 2010 field study on policy to improve air quality and contend with climate change?

Proposed Air Quality Research

CalNex 2010 *Synthesis*

Translate scientific findings into policy recommendations

CalNex 2010

- Research on air quality, climate change, and emissions inventories
- Field phase successfully completed this summer

Research Platforms

- **Air:** Two research aircraft
- **Land:** Two "supersites" in Los Angeles and Bakersfield
- **Sea:** Research Vessel Atlantis

Economic Analysis
New Fellowship Program

Recent Research

- Models to predict impact of regulatory strategies on California's economy
- Studies of job creation from air pollution regulation and climate change strategies

Fellowship Program

- External expert to identify methodology needs
- Access to top economists throughout California
- Results will improve forecasting methods

Climate and Energy Efficiency

Recent and Ongoing Research

Climate

- Inventory improvements to support rule development for non-CO_2 greenhouse gases
- Climate change makes ozone standards more difficult to attain
- Diesel control has already reduced black carbon emissions and reduced regional climate forcing

Energy Efficiency

- Building ventilation and indoor air quality
- Energy use and pollutant emissions from office equipment and appliances
- Results supported stronger State Green Building Standards

Climate and Energy Efficiency
Recommended Research, FY 2010-2011

Built Environment

- What are the climate-related benefits of cool roofs?
- Can land use planning reduce residential energy consumption?
- Can building occupants be kept cool and comfortable using air motion instead of compressive air conditioning?
- How does feedback from commercial buildings impact energy conserving behaviors at work and at home?

Voluntary Emissions Reductions

- How can communication of real-time residential energy usage affect energy and costs?
- How effective are behavioral change strategies that make use of CoolCalifornia.org in several communities in California?

Proposed Climate Change Research
Cool Roofs in California

- Cool roofs cool the planet by reflecting sunlight back to space
- Assess California-specific climate impact due to cool roofs
- In collaboration with the California Energy Commission
- Supports national policy issued by Department of Energy

Cool roofs are available in a variety of architectural styles

Proposed FY 2010-2011 Research

- **Direct linkages to policy priorities**
- **Foster research tailored to California's needs**
- **Highly leveraged, low overhead**

Recommended Action

Approval of the Planned Air Pollution Research Fiscal Year 2010-2011