

State of California  
AIR RESOURCES BOARD

Resolution 05-37

July 21, 2005

Agenda Item No.: 05-7-3

WHEREAS, the Air Resources Board has been directed to carry out an effective research program in conjunction with its efforts to combat air pollution, pursuant to Health and Safety Code sections 39700 through 39705;

WHEREAS, a research proposal, number 2586-248, entitled "A Study to Quantify Health Benefits of Incremental Improvements in Air Quality", has been submitted by the University of California, Berkeley;

WHEREAS, the Research Division staff has reviewed and recommended this proposal for approval; and

WHEREAS, the Research Screening Committee has reviewed and recommends for funding:

Proposal Number 2586-248 entitled "A Study to Quantify Health Benefits of Incremental Improvements in Air Quality" submitted by the University of California, Berkeley, for a total amount not to exceed \$175,000.

NOW, THEREFORE BE IT RESOLVED, that the Air Resources Board, pursuant to the authority granted by Health and Safety Code section 39703, hereby accepts the recommendation of the Research Screening Committee and approves the following:

Proposal Number 2586-248 entitled "A Study to Quantify Health Benefits of Incremental Improvements in Air Quality" submitted by the University of California, Berkeley, for a total amount not to exceed \$175,000.

BE IT FURTHER RESOLVED, that the Executive Officer is hereby authorized to initiate administrative procedures and execute all necessary documents and contracts for the research effort proposed herein, and as described in Attachment A, in an amount not to exceed \$175,000.

I hereby certify that the above is a true and correct copy of Resolution 05-37, as adopted by the Air Resources Board.

---

Lori Andreoni, Clerk of the Board

## ATTACHMENT A

“A Study to Quantify Health Benefits of Incremental Improvements in Air Quality”,  
to augment Contract 01-346, “A Pilot Study to Quantify Health Benefits of Incremental  
Improvements in Air Quality”

### **Background**

For more than 25 years, the Air Resources Board (ARB) has been promulgating ambient air quality standards at levels which are protective of human health. The standards are based in part on epidemiological and toxicological evidence demonstrating that ambient air pollution is significantly associated with serious adverse health effects. The ARB and air pollution control districts have been implementing aggressive control measures to reduce emissions of pollutants to reach the goal of clean, healthy air established by the standards. These efforts have contributed to significant reductions in ambient air pollution that would be expected to significantly reduce occurrences of adverse health effects. A wide range of evidence suggests that these expectations of health benefits are plausible, and the economic values of these expected benefits are predicted to be large.

However, long-term health data from a large population exposed to decreasing levels of air pollution have not previously been analyzed to determine whether measurable improvements in the population's health can be quantified. Air pollution in the South Coast Air Basin (SoCAB) has decreased significantly since 1980. The original study was a pilot project (Contract 01-346) for methodology development to investigate trends in the occurrence of some major respiratory and cardiovascular health endpoints in the SoCAB since 1980 and determine whether or not these trends can be related to the improvements in air quality. To this end, the investigators: 1) assembled and integrated the required exposure, demographic and health outcome data for years 1980-2000; 2) established spatial units within the South Coast Air Basin (SoCAB); 3) established metrics for air pollutants and meteorological variables that are relevant for the health analyses; 4) produced descriptive data on spatial and temporal changes in patterns of ambient air pollution, population demographic and the distribution of potential confounders; and 5) began to apply statistical methods for causal inference to determine if there are unconfounded, causal relationships between decreases in the levels of individual and specific groups of diseases that have been repeatedly associated with ambient levels of air pollution. The investigators developed analysis techniques that would account for changes in a large number of socioeconomic, behavioral, and medical factors associated with cardiovascular and respiratory health. To summarize, the pilot study was successful in producing useful data sets and developing analysis techniques for establishing causal relationships between reducing air pollution levels and health benefits. The data collection, theoretical development, and programming of the analysis techniques required more time than originally anticipated. Hence, the investigators were able to demonstrate the usefulness of the methodology for one health endpoint and one air pollutant only.

For this augmentation, the investigators will apply the methodology that they had developed to more pollutants. Specifically, they plan to complete the additional theoretical and programming work, and fully apply the analysis techniques to evaluate long-term effects of reductions in various air pollutants on health.

### **Objective**

The objective of this project is to quantify the extent to which changes in the health of the population of the SoCAB over the period 1980-2000 are associated with the significant decreases in air pollution during this period. The pollutants and health indicators that will be evaluated using newly developed techniques are:

- 1) Two pollutants (ozone and PM)
- 2) Three hospital discharge outcomes (pneumonia/bronchitis, asthma, chronic obstructive pulmonary disease [COPD])
- 3) Up to five mortality outcomes (pneumonia/influenza, at least three different cardiovascular endpoints, and COPD).

The investigators will carry out conventional statistical analyses in parallel with the new techniques and compare inferences between the two approaches.

### **Methods**

With previous funding, the investigators have: 1) assembled and integrated the required exposure, demographic and health outcome data for years 1980-2000, 2) established spatial 10 km by 10 km units within the SoCAB, 3) established metrics for air pollutants and meteorological variables that are relevant for the health analyses, 4) produced descriptive data on spatial and temporal changes in patterns of ambient air pollution, population demographic and the distribution of potential confounders, and 5) began to apply statistical methods for causal inference to explore the causal relationship between asthma-related hospital discharge among children less than 19 years of age and 1-hour ozone maximum concentrations. The results of the analyses by the innovative methods were compared to results from analyses by more standard methods.

In the proposed augmentation, the investigators will complete the analysis of the effects of ozone on hospital admissions for asthma, ages birth to 19 years by refining the innovative model and performing sensitivity tests (considering some alternate spatial allocation, alternate temporal allocation, and alternate historical PM analyses). Next, a similar analysis for PM will be undertaken, with additional measurement error issues addressed due to the PM estimation. All in all, the investigators propose to consider two pollutants (ozone and PM), three hospital discharge outcomes (pneumonia/bronchitis, asthma, COPD) and up to five mortality outcomes (pneumonia/influenza, at least three different cardiovascular endpoints, and COPD).

### **Expected Results**

Analyzing trends in the rates of air-pollution related diseases in the SoCAB and the associations of these rates with trends in air pollution will provide very useful confirmation of the benefits of air pollution control. The SoCAB is a promising area for

such analyses, because air quality in the Basin has been monitored intensively for more than 20 years, and satisfactory data for medical and socioeconomic variables and other factors associated with disease rates are available. The analysis plan for this project will provide quantification of the health benefits of improving air quality.

**Significance to the Board**

The project’s quantification of the health and economic benefits of decreased air pollution in a large population will significantly add to the ARB’s knowledge about the benefits of improving air quality in a region that has historically been exposed to high levels of pollution.

**Contractor:**

University of California, Berkeley.

**Contract Period:**

24 Months

**Principal Investigator (PI):**

Dr. Ira Tager

**Contract Amount:**

\$175,000

**Cofunding:**

None

**Basis for Indirect Cost Rate:**

The State and UC System have agreed to a ten percent indirect cost rate.

**Past Experience with this Principal Investigator:**

Dr. Tager is an experienced investigator with the School of Public Health at the University of California, Berkeley. He has worked extensively with the ARB and is currently the lead investigator for a large epidemiological study investigating the effects of air pollution on children with asthma. The expertise Dr. Tager brings to the project, along with that of the co-investigators, make him an ideal candidate to successfully perform this type of research project.

**Prior Research Division Funding to the University of California, Berkeley:**

Year	2004	2003	2002
Funding	\$1,021,876	\$715,194	\$0

# BUDGET SUMMARY

University of California, Berkeley

A Study to Quantify Health Benefits of Incremental Improvements in Air Quality

## **DIRECT COSTS AND BENEFITS**

1.	Labor and Employee Fringe Benefits	\$	105,980
2.	Subcontractors	\$	53,422
3.	Equipment	\$	5,000
4.	Travel and Subsistence	\$	0
5.	Electronic Data Processing	\$	0
6.	Reproduction/Publication	\$	0
7.	Mail and Phone	\$	0
8.	Supplies	\$	0
9.	Analyses	\$	0
10.	Miscellaneous	\$	<u>0</u>

Total Direct Costs \$164,402

## **INDIRECT COSTS**

1.	Overhead	\$	10,598
2.	General and Administrative Expenses	\$	0
3.	Other Indirect Costs	\$	0
4.	Fee or Profit	\$	<u>0</u>

Total Indirect Costs \$10,598

**TOTAL PROJECT COSTS** **\$175,000**

Attachment 1

**SUBCONTRACTORS' BUDGET SUMMARY**

Subcontractor: Sonoma Technology Inc.

Description of subcontractor's responsibility: STI will be responsible for several important tasks. In the pilot phase, STI helped UC Berkeley refine and finalize the work plan, created the exposure, demographic and air quality databases, managed missing data, and created exposure metrics. Furthermore, STI incorporated into the database the health outcome information from California State Fullerton and spatially and temporally allocated all information onto grids for the analyses. In the new proposal, STI will perform sensitivity analyses by considering alternate spatial and temporal allocation schemes, carry out additional data management and data analyses to support UCB's needs, and participate in writing the final report.

**DIRECT COSTS AND BENEFITS**

1.	Labor and Employee Fringe Benefits	\$	22,016
2.	Subcontractors	\$	0
3.	Equipment	\$	0
4.	Travel and Subsistence	\$	233
5.	Electronic Data Processing	\$	0
6.	Reproduction/Publication	\$	0
7.	Mail and Phone	\$	0
8.	Supplies	\$	0
9.	Analyses	\$	0
10.	Miscellaneous	\$	<u>0</u>
	Total Direct Costs		\$22,249

**INDIRECT COSTS**

1.	Overhead	\$	22,236
2.	General and Administrative Expenses	\$	0
3.	Other Indirect Costs	\$	0
4.	Fee or Profit	\$	<u>4,437</u>
	Total Indirect Costs		<u>\$26,673</u>

	<b><u>TOTAL PROJECT COSTS</u></b>		<b><u>\$48,922</u></b>
--	-----------------------------------	--	------------------------

## **SUBCONTRACTORS' BUDGET SUMMARY**

Subcontractor: California State University, Fullerton

Description of subcontractor's responsibility: Drs. Jane Hall and Victor Brajer will support UC Berkeley as described below. In the pilot phase, they worked with UC Berkeley and STI to develop a final work plan and ensure database compatibility. They developed the database on health outcomes, including cause-specific mortality and hospitalizations, as well as birth outcomes. Furthermore, they assembled data that represents the behavioral and social trends likely to confound the analyses. In the new proposal, they will assist UCB on an as-needed basis and write relevant sections of the final report, documenting the work they performed.

### **DIRECT COSTS AND BENEFITS**

1.	Labor and Employee Fringe Benefits	\$	4,090
2.	Subcontractors	\$	0
3.	Equipment	\$	0
4.	Travel and Subsistence	\$	0
5.	Electronic Data Processing	\$	0
6.	Reproduction/Publication	\$	0
7.	Mail and Phone	\$	0
8.	Supplies	\$	0
9.	Analyses	\$	0
10.	Miscellaneous	\$	<u>0</u>
	Total Direct Costs		\$4,090

### **INDIRECT COSTS**

1.	Overhead	\$	410
2.	General and Administrative Expenses	\$	0
3.	Other Indirect Costs	\$	0
4.	Fee or Profit	\$	<u>0</u>
	Total Indirect Costs		<u>\$410</u>

**TOTAL PROJECT COSTS** **\$4,500**

