

State of California  
AIR RESOURCES BOARD

Resolution 02-21

May 16, 2002

Agenda Item No.: 02-4-2

**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 2519-225, entitled "A Pilot 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 2519-225 entitled "A Pilot 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 \$306,261.

**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 2519-225 entitled "A Pilot 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 \$306,261.

**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 \$306,261.

I hereby certify that the above is a true and correct copy of Resolution 02-21, as adopted by the Air Resources Board.

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Stacey Dorais, Clerk of the Board

## ATTACHMENT A

### “A Pilot Study to Quantify Health Benefits of Incremental Improvements in Air Quality”

#### **Background**

For more than 20 years, the ARB has been promulgating ambient air quality standards at levels which are protective of human health. The standards are based in part on epidemiological evidence strongly suggesting 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 has not previously been analyzed to determine whether or not measurable improvements in the population's health can be quantified. Air pollution in the South Coast Air Basin (SoCAB) has decreased significantly since 1980. This project would 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. The project would also estimate the economic value of those improvements in health which are shown to be related to the improvements in air quality. The analysis would account for changes in a large number of socioeconomic, behavioral, and medical factors associated with cardiovascular and respiratory 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 health indicators that will be evaluated are the rates of mortality from all causes and the rates of mortality and morbidity from fifteen specific cardiac, cardiovascular, and respiratory conditions. The economic benefits of the reduced mortality and morbidity rates found to be associated with the improvements in air quality will be evaluated.

#### **Methods**

For the project's analyses, the SoCAB would be divided into 5 km or 10 km grid squares. Adjacent grid squares with small populations might be combined. Because obtaining long-term data for a large cohort of individuals would not be feasible, the basic spatial units for the analysis would be the populations of these grid squares. The investigators would obtain the numerous types of data described below for each grid square for four three-month periods per year; the periods (winter fine particle season, spring, summer ozone season, and fall ozone and/or fine particle season) being chosen to maximize differences in pollution patterns.

The following types of data required for the analysis would be obtained: (1) air quality and meteorological data; (2) population and socioeconomic data from the 1980, 1990,

and 2000 censuses; data for intermediate years would be estimated from the Current Population Survey if possible, or interpolated; (3) data on behavioral risk factors associated with adverse health effects, such as smoking, obesity, and hypertension, would be obtained from California Department of Health Services surveys; (4) rates of occurrence of health outcomes would be estimated from hospital discharge databases and mortality databases, both of which have been compiled in a consistent way during the twenty year period to be included in the study.

All-cause mortality and a number of very specific cardiovascular and respiratory health endpoints would be studied by the project. The respiratory endpoints would include cancer, acute and chronic bronchitis, asthma, and pneumonia. Ischemic heart disease and congestive heart failure would be two of the cardiovascular endpoints studied. Trends in the rates of these diseases known to be associated with air pollution would be compared to the trends in diseases not considered to be associated with air pollution, for example peptic ulcer. The rates of occurrence of the diseases would be standardized by age and sex.

The standardized rates of health effects would be analyzed for the existence of trends and the consistency of trends across the basic spatial units. Marginal structural models, a recently developed type of statistical model that minimizes the biases in estimators caused by confounding factors, would be employed to adjust the health effect rates for confounders and relate the trends in rates to trends in air pollution. The results of the analyses by the innovative methods would be compared to results from analyses by more standard methods. The economic benefits of improvements in health would be estimated by standard models and methods used in many previous benefit estimation studies.

### **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**

This project will result in important information for the Board by quantifying the benefits to health resulting from reductions in air pollution. The Board has devoted significant resources to reducing air pollution in the SoCAB, however, to date, there are no studies that quantify the health benefits of the Board's actions. This project would provide an analysis of the association between long-term changes in air quality and health benefits due to these changes. In addition, an analysis will be conducted to elucidate the economic benefits of reducing air pollution in the SoCAB.

**Contractor:**

University of California, Berkeley.

**Contract Period:**

24 Months

**Principal Investigator (PI):**

Dr. Ira Tager

**Contract Amount:**

\$306,261

**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	2001	2000	1999
Funding	\$634,986	\$0	\$3,992,027

# BUDGET SUMMARY

University of California, Berkeley

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

## **DIRECT COSTS AND BENEFITS**

1.	Labor and Employee Fringe Benefits	\$	103,146
2.	Subcontractors	\$	165,394 <sup>1</sup>
3.	Equipment	\$	2,500
4.	Travel and Subsistence	\$	1,815
5.	Electronic Data Processing	\$	0
6.	Reproduction/Publication	\$	500
7.	Mail and Phone	\$	3,000
8.	Supplies	\$	2,700
9.	Analyses	\$	0
10.	Miscellaneous	\$	<u>500</u>
	Total Direct Costs		<u>\$279,555</u>

## **INDIRECT COSTS**

1.	Overhead	\$	26,706
2.	General and Administrative Expenses	\$	0
3.	Other Indirect Costs	\$	0
4.	Fee or Profit	\$	<u>0</u>
	Total Indirect Costs		<u>\$26,706</u>

## **TOTAL PROJECT COSTS** \$306,261

<sup>1</sup>There are three subcontractors included in this project:

*Sonoma Technology Institute (STI)* will assist in refining the work plan for the project. STI offers personnel with expertise in working under the jurisdiction of the California Air Resources Board as well as expert knowledge in acquiring, implementing, merging, and analyzing air quality, meteorology, demographic, and health outcomes databases, \$110,442.

*California State University, Fullerton*, will assemble values to be used for each endpoint in the economic valuation, assemble descriptive data to evaluate behavioral factors (such as smoking and obesity), and draft portions of the final report. California State University, Fullerton will provide leadership on the economic analyses, \$44,952.

An external advisory committee will be formed of experts to aid in the oversight and direction of this project. This committee will include experts in the fields of public health epidemiology, biostatistical analysis and other appropriate fields of study, \$10,000.

## SUBCONTRACTORS' BUDGET SUMMARY

Sonoma Technology Institute

Description of subcontractor's responsibility: STI will be responsible for several important tasks. First, they will help UC Berkeley refine and finalize the work plan. One of the most important tasks that STI will perform is creating the exposure database. This will involve collection of air quality data for the South Coast Air Basin for the 20-year span of the project, managing missing data, and creating exposure metrics. STI will also be responsible for obtaining data from the Census to generate the demographic databases. Furthermore, STI will implement into the database the health outcome information from California State Fullerton. Finally, STI will participate in the statistical analyses to assure the air quality and demographic data are used and interpreted appropriately.

### **DIRECT COSTS AND BENEFITS**

1.	Labor and Employee Fringe Benefits	\$	48,533
2.	Subcontractors	\$	0
3.	Equipment	\$	0
4.	Travel and Subsistence	\$	543
5.	Electronic Data Processing	\$	800
6.	Reproduction/Publication	\$	0
7.	Mail and Phone	\$	180
8.	Supplies	\$	1,500
9.	Analyses	\$	0
10.	Miscellaneous	\$	<u>0</u>
	Total Direct Costs		<u>\$51,556</u>

### **INDIRECT COSTS**

1.	Overhead	\$	49,017
2.	General and Administrative Expenses	\$	0
3.	Other Indirect Costs	\$	0
4.	Fee or Profit	\$	<u>9,869</u>
	Total Indirect Costs		<u>\$58,886</u>

**TOTAL PROJECT COSTS** \$110,442

## Attachment 2

# SUBCONTRACTORS' BUDGET SUMMARY

California State University, Fullerton

Description of subcontractor's responsibility: Drs. Jane Hall and Victor Brajer will complete the following tasks in support of the overall study. They will work with UC Berkeley and STI to develop a final work plan and ensure database compatibility. They will develop the database on health outcomes, including cause-specific mortality and hospitalizations, as well as birth outcomes. Furthermore, they will assemble data that represents the behavioral and social trends likely to confound the analyses. They will complete the estimation of economic value of changes in health outcome and write relevant sections of the final report.

### **DIRECT COSTS AND BENEFITS**

1. Labor and Employee Fringe Benefits	\$	37,675
2. Subcontractors	\$	0
3. Equipment	\$	400
4. Travel and Subsistence	\$	1,000
5. Electronic Data Processing	\$	0
6. Reproduction/Publication	\$	400
7. Mail and Phone	\$	140
8. Supplies	\$	1,250
9. Analyses	\$	0
10. Miscellaneous	\$	<u>0</u>

Total Direct Costs \$40,865

### **INDIRECT COSTS**

1. Overhead	\$	4,087
2. General and Administrative Expenses	\$	0
3. Other Indirect Costs	\$	0
4. Fee or Profit	\$	<u>0</u>

Total Indirect Costs \$4,087

**TOTAL PROJECT COSTS** \$44,952