

State of California  
AIR RESOURCES BOARD

Research Resolutions

Research Division

December 7-8, 2000



## INTRODUCTION

Contained herein for Board review are seven resolutions and accompanying summaries from the Extramural Research Program recommended to the Board by the Research Screening Committee.

Item 1 is a research proposal from the Research Triangle Institute entitled, "Environmental Health Conditions in Portable Classrooms." The principal investigator will be Mr. Gerald Akland.

Resolution No. 00-46

Item 2 is a research proposal from Harvard University entitled, "Detailed Characterization of Indoor and Personal Particulate Matter Concentrations." The principal investigators will be Drs. Helen Suh and Petros Koutrakis

Resolution No. 00-47

Item 3 is a research proposal from Automotive Testing Laboratories, Inc. entitled, "Collection of Evaporative Emissions Data from Off-Road Equipment." The principal investigator will be Mr. Dennis McClement.

Resolution No. 00-48

Item 4 is a research proposal from West Virginia University entitled, "Development of a Test Method to Measure Stationary and Portable Engine Emissions." The principal investigator will be Dr. Mridul Guatam.

Resolution No. 00-49

Item 5 is a research proposal from Pacific Environmental Services entitled, "Improvement for Emissions Inventories for Industrial Coatings and Thinning and Cleanup Solvents." The principal investigator will be Dr. Michael Rogozen.

Resolution No. 00-50

Item 6 is a research proposal from the University of California, Davis entitled, "Oxygenated Organics in Gas and Fine Particle Diesel Emissions for Source Apportionment." The principal investigator will be Professors M. Judith Charles, Britt Holmen, and Lowell Ashbaugh.

Resolution No. 00-51

Item 7 is a research proposal from the University of California, Riverside entitled, "Demonstration of Ozone Impacts on Crop Species in the San Joaquin Valley: Open Top Chambers at Kearney Agricultural Center." The principal investigator will be Dr. David Grantz.

Resolution No. 00-52

**PROPOSED****State of California  
AIR RESOURCES BOARD****RESEARCH PROPOSAL**

Environmental Health Conditions in Portable Classrooms

Resolution 00-46  
December 7, 2000

**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 2467-217, entitled "Environmental Health Conditions in Portable Classrooms", has been submitted by Research Triangle Institute, in response to RFP No. 00-5;

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

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

Proposal Number 2467-217 entitled "Environmental Health Conditions in Portable Classrooms", submitted by Research Triangle Institute, for a total amount not to exceed \$673,879.

**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 2467-217 entitled "Environmental Health Conditions in Portable Classrooms", submitted by Research Triangle Institute, for a total amount not to exceed \$673,879.

**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 in an amount not to exceed \$673,879.

## **Environmental Health Conditions in Portable Classrooms**

### **Background**

Children in California spend a significant portion of their time in classrooms during the school day. Teachers typically spend even more time in classrooms and other school buildings. About 250,000 classrooms are currently in use in California and, of these, 75,000 to 95,000 are portable classroom units. An increasing number of portable classrooms will be used in the future, because they are an economical answer to the increasing demand for classrooms due to population growth and the State's educational improvement programs.

The limited information available indicates that some environmental conditions in portable classrooms potentially put children at risk of serious health impacts. Reported classroom problems include contamination from formaldehyde and other volatile organic compounds, microbial growth, odors, and excessive temperature and noise. Some of the contaminants and conditions can trigger asthma attacks and allergy symptoms in sensitive individuals; irritate mucous membranes in the eyes, nose, and throat; cause respiratory infections or headaches; and contribute to the development of cancer. However, no comprehensive study of indoor environmental conditions has been conducted in California schools.

To address increasing concerns about portable classrooms, the Governor and the State Legislature approved funding requests from the Air Resources Board (ARB) and the Department of Health Services (DHS) to jointly conduct a comprehensive study and review of the environmental health conditions in portable classrooms. The field work for the study will be performed under this contract. The legislation requires the field work to begin no later than July 2001. The final report to the Legislature (including recommendations that will be developed by ARB and DHS) is due by June 30, 2002.

### **Objective**

The objective of this project is to obtain the survey and field measurement data needed to assess the statewide environmental health conditions in California's portable classrooms. The investigators would conduct a mail survey of school facility managers and teachers in 2,000 schools across California and send passive formaldehyde monitors to 1,000 of the schools. Then, the investigators would conduct a pilot study to test the field measurement methods in two school sites. Finally, they would conduct a detailed field study of indoor and outdoor pollutant levels, building conditions, and maintenance practices in 240 classrooms at 60 schools. The field study would include three seasons, two geographical areas of the state, and some schools with known indoor environment problems. The investigators would provide the data needed in a timely manner consistent with the legislative mandate.

### **Expected Results**

The investigators will obtain representative data from the mail survey on the number, type, age, condition, and location of portable classrooms in California and on

formaldehyde levels in portable classrooms. From the field study, they will obtain representative data on portable classroom ventilation systems; classroom cleaning and maintenance practices; levels of indoor volatile organic chemicals, particles, biological pollutants (animal allergens and molds), carbon monoxide, and other pollutants; and other building-related factors. The investigator will systematically gather high-quality environmental data that are representative of California and will form a sound basis for recommendations to the Legislature.

### **Significance to the Board**

Children are one of the population groups most susceptible to adverse health effects of toxic air pollutants. This study focuses on a location where children spend a considerable amount of their time. Data gathered in the study will be used to assess the potential for adverse health impacts from environmental conditions and toxic pollutants that may be present in portable classrooms. Secondly, specific effective actions will be identified to remedy or prevent any unhealthful conditions found. The ARB will also use the data from this study to improve our estimates of children's exposure to air pollution.

**Contractor:**  
Research Triangle Institute

**Principal Investigator (PI):**  
Gerald A. Akland

**Contract Period:**  
18 months

**Contract Amount:**  
\$673,879

**Co-funding:**  
None. However, co-funding for analysis of house dust samples will be sought.

**Basis for Indirect Cost Rate:**  
The rates used are the contractor's federally approved rates.

**Past Experience with this Principal Investigator:** ARB has not contracted directly with this Principal Investigator before; however, Research Triangle Institute has successfully completed several large, complex field studies for ARB. The Principal Investigator has significant experience overseeing large-scale survey and exposure studies, both with RTI and in previous work during his years at U.S. EPA. Most importantly, RTI has conducted many of the foremost indoor field studies of schools and residences in the nation. RTI relies mainly on in-house staff to perform critical tasks, which facilitates effective oversight by the Principal Investigator and timely project completion.

### **Prior Research Division Funding to Research Triangle Institute:**

Year	1999	1998	1997
Funding	\$0	\$0	\$0

## BUDGET SUMMARY

Research Triangle Institute

Environmental Health Conditions in Portable Classrooms

### DIRECT COSTS AND BENEFITS

1.	Labor and Employee Fringe Benefits	\$199,289
2.	Subcontractors	\$ 65,000
3.	Equipment	\$ 12,900
4.	Travel and Subsistence	\$ 45,830 (1)
5.	Electronic Data Processing	\$ 400
6.	Reproduction/Publication	\$ 825
7.	Mail and Phone	\$ 750
8.	Supplies	\$ 14,437
9.	Analyses	\$ 0
10.	Miscellaneous	<u>\$ 54,670 (2)</u>
Total Direct Costs		<b>\$394,103</b>

### INDIRECT COSTS

1.	Overhead	\$117,436
2.	General and Administrative Expenses	\$ 99,106
3.	Other Indirect Costs	\$ 1,972
4.	Fee or Profit	<u>\$ 61,262</u>
Total Indirect Costs		<u><b>\$279,776</b></u>

### TOTAL PROJECT COSTS

**\$673,879**

(notes)

<sup>1</sup> Travel costs included 8 trips to Sacramento, with one trip requiring a full month stay.

<sup>2</sup> Miscellaneous costs include those items needed for general operation of a laboratory. This includes cost of glassware, cleaning agents, shipping, service center labor, telephone, and survey support materials.

**PROPOSED****State of California  
AIR RESOURCES BOARD****RESEARCH PROPOSAL**

Detailed Characterization of Indoor and Personal Particulate Matter Concentrations

Resolution 00-47  
December 7, 2000

**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 2472-217, entitled "Detailed Characterization of Indoor and Personal Particulate Matter Concentrations", has been submitted by the Harvard University School of Public Health;

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

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

Proposal Number 2472-217 entitled "Detailed Characterization of Indoor and Personal Particulate Matter Concentrations", submitted by the Harvard University School of Public Health, for a total amount not to exceed \$609,145.

**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 2472-217 entitled "Detailed Characterization of Indoor and Personal Particulate Matter Concentrations", submitted by the Harvard University School of Public Health, for a total amount not to exceed \$609,145.

**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 in an amount not to exceed \$609,145.

## Detailed Characterization of Indoor and Personal Particulate Matter Concentrations

### Background

Outdoor concentrations of particles have been consistently associated with daily mortality and morbidity. However, the relationships between these outdoor particle concentrations measured at stationary ambient monitoring sites and the actual exposure levels measured on individuals (personal exposure) are not well understood. We also lack information on the physical and chemical characteristics of particles in indoor and personal microenvironments, information that is used to identify the sources of the particles. The National Academy of Sciences has listed research on personal, outdoor and indoor exposures as a top priority for PM<sub>2.5</sub> research.

In 1990, ARB co-funded with the U.S. Environmental Protection Agency (U.S.EPA) a large study of personal, indoor and outdoor particle levels in Riverside, California. The results of this landmark study revealed that the daytime personal exposures to PM<sub>10</sub> generally exceeded concurrent outdoor PM<sub>10</sub> levels and state and federal health-based standards for PM<sub>10</sub>. The major indoor PM sources identified were tobacco smoking, cooking, and house-cleaning. Outdoor sources could not be disaggregated, and a significant portion of the particle sources could not be identified. Personal exposures to PM<sub>2.5</sub> were not measured due to limitations in monitoring methods. However, more recent studies have found strong correlations between seven-day averages of outdoor and personal exposures to PM<sub>2.5</sub>, especially for some individuals.

EPA has recently funded major field studies of personal exposures to PM<sub>10</sub> and PM<sub>2.5</sub> in Los Angeles, Boston, and Atlanta. Recent improvements in monitoring methods for personal exposures to PM<sub>2.5</sub> and for one-hour indoor PM<sub>2.5</sub> levels have made such studies possible. In the Los Angeles study, the investigators (Harvard University) are measuring personal, indoor, and outdoor levels of PM<sub>2.5</sub> and PM<sub>10</sub> in 15 patients with chronic obstructive pulmonary disease (COPD). ARB co-funded the U.S.EPA's Los Angeles study to provide the measurements of PM composition and home air exchange rates necessary for source apportionment. This study is near completion.

### Objective

In this study, the investigators propose to examine in detail the indoor-outdoor-personal PM relationships in the homes of 16 healthy subjects in the inland Los Angeles area. As in the current ARB-U.S.EPA study of COPD patients in Los Angeles, the investigators would measure personal, indoor, and outdoor levels of PM<sub>2.5</sub>, PM<sub>10</sub>, and PM<sub>2.5</sub> composition (nitrate, elemental carbon [EC], organic carbon [OC], elements), and collect data on housing characteristics and daily activities. To this protocol, they would add measurements of one-hour PM<sub>2.5</sub> averages and continuous measurements of air exchange rates, EC, and nitrate. Also, house dust would also be analyzed for elements, particle size, and particle type. Monitoring would be conducted in each home for nine days, in either summer or winter, for a combined total of 144 sampling days and 3,456 repeated hourly measurements.

The investigators will use the data on PM<sub>2.5</sub> speciation, air exchange rates, subject and household activities, and housing characteristics to determine the influence of individual-specific factors on personal-indoor-outdoor PM relationships for each component. The investigators will also compare study results to those of the U.S.EPA companion studies in Los Angeles, Boston, and Atlanta. The total project budget is \$909,145 of which U.S. EPA is contributing \$300,000 directly to Harvard University.

### **Expected Results**

This project would deliver high-quality data and analyses that would ARB quantify the contribution of outdoor PM sources to indoor and personal PM<sub>2.5</sub> exposures in California. Because the proposed PM<sub>2.5</sub> speciation would go well beyond that of previous exposure studies, it would provide more complete and accurate estimates of the contributions of indoor and outdoor PM sources to personal PM<sub>2.5</sub> exposures. The investigators would identify and quantify the sources of most of the PM, including specific sources such as motor vehicles and secondary aerosols.

### **Significance to the Board**

This study focuses on one of the most critical needs in particle research -- the contribution of outdoor sources to indoor and personal PM<sub>2.5</sub> exposures. This study will provide the first extensive, continuous monitoring of PM<sub>2.5</sub> chemical composition in California homes, and will provide the most accurate and detailed apportionment of contributions of different sources to indoor and personal exposures to date. It is very timely in light of recent study results on the health effects of short- and long-term exposures to particles and the recent adoption of the federal PM<sub>2.5</sub> standard.

The ARB would use the study results to improve estimates of indoor and personal exposures to PM and particulate toxic air contaminants from different sources, and to better understand the results of epidemiology studies. The ARB also would use the study results to more effectively focus regulatory efforts and public guidance for reducing PM and toxic air contaminant exposures.

**Contractor:**  
Harvard University School of Public Health

**Principal Investigators (PIs):**  
Drs. Helen Suh and Petros Koutrakis

**Contract Period:**  
27 months

**Contract Amount:**  
\$609,145

**Cofunding:**  
An additional \$300,000 is being provided by U.S. EPA bringing the total project budget to \$909,145.

**Basis for Indirect Cost Rate:**

The Indirect Cost Rate is 35 percent, which is well below the 59.5 percent rate submitted for federal agency (DHHS and U.S.EPA) approval. No fee is requested under indirect costs.

**Past Experience with Principal Investigators:**

ARB is currently co-funding the investigators in the U.S.EPA study of PM exposures in COPD patients in Los Angeles. The investigators have performed well through the study design, method validation, and field work phases of the study. ARB staff are very familiar with the investigators' previous and current work in this field. The investigators are world leaders in the study of personal exposure and the development of personal exposure monitors. They have extensive experience in measuring and analyzing PM and its chemical components in indoor, outdoor, and personal microenvironments.

**Prior Research Division Funding to Harvard University:**

Year	1999	1998	1997
Funding	\$0	\$434,929	\$0

## BUDGET SUMMARY

Harvard School of Public Health

Detailed Characterization of Indoor and Personal  
Particulate Matter Concentrations

### DIRECT COSTS AND BENEFITS

1.	Labor and Employee Fringe Benefits	\$264,017
2.	Subcontractors	\$ 65,000
3.	Equipment	\$ 50,400
4.	Travel and Subsistence	\$ 27,020
5.	Electronic Data Processing	\$ 0
6.	Reproduction/Publication	\$ 500
7.	Mail and Phone	\$ 8,500
8.	Supplies	\$ 25,242
9.	Analyses	\$ 9,000
10.	Miscellaneous	<u>\$ 17,200</u>
	Total Direct Costs	\$466,879

### INDIRECT COSTS

1.	Overhead	\$142,266
2.	General and Administrative Expenses	\$ 0
3.	Other Indirect Costs	\$ 0
4.	Fee or Profit	<u>\$ 0</u>
	Total Indirect Costs	<u>\$142,266</u>

<b><u>TOTAL PROJECT COSTS</u></b>	<b><u>\$609,145</u></b>
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Agenda Item No.: 00-12-4

**PROPOSED****State of California  
AIR RESOURCES BOARD****RESEARCH PROPOSAL**

Collection of Evaporative Emissions Data from Off-Road Equipment

Resolution 00-48  
December 7, 2000

**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; and

**WHEREAS**, a research proposal, number 2463-217, entitled "Collection of Evaporative Emissions Data from Off-Road Equipment," has been submitted by Automotive Testing Laboratories in response to RFP No. 00-4; and

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

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

Proposal Number 2463-217 entitled "Collection of Evaporative Emissions Data from Off-Road Equipment", submitted by Automotive Testing Laboratories, for a total amount not to exceed \$285,913.

**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 2463-217 entitled "Collection of Evaporative Emissions Data from Off-Road Equipment" submitted by Automotive Testing Laboratories for a total amount not to exceed \$285,913.

**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 in an amount not to exceed \$285,913.

## Collection of Evaporative Emissions Data from Off-Road Equipment

### Background

With the adoption of recent exhaust emissions regulations involving off-road equipment categories and further emissions reduction requirements likely to occur in the future, the off-road equipment contribution to the California emissions inventories has been significantly reduced. As a result, the relative contribution from evaporative emissions from off-road equipment has increased as a percent of the total emissions inventory. At present, the emissions inventory for gasoline off-road evaporative emissions is not comprehensive. This is because gasoline off-road equipment has not been extensively tested for evaporative emissions.

Based on equipment population, the largest contributors of evaporative emissions are lawn and garden equipment, marine vehicles, recreational vehicles, and light-duty commercial equipment. Furthermore, since there are no defined procedures to test off-road equipment for evaporative emissions, adherence to on-road testing procedures is necessary and deviations from those procedures should occur only to accommodate unique characteristics of off-road equipment.

### Objective

The objective of this study is to collect evaporative emissions data from gasoline powered off-road equipment for inclusion in the Air Resources Board's emissions inventory model, OFFROAD.

### Expected Results

The project will provide emissions measurements for four evaporative processes. Diurnal and resting losses/permeation and hot soak emissions will be collected for all equipment categories. Running losses will be collected for all equipment, except marine vehicles.

### Significance to the Board

The project will offer evaporative emissions test data for the largest contributors and under real-world conditions, to estimate California's off-road equipment evaporative emissions inventory.

**Contractor:**  
Automotive Testing Laboratories, Inc.

**Principal Investigator (PI):**  
Mr. Dennis McClement

**Contract Period:**  
30 months

**Contract Amount:**  
\$285,913

**Cofunding:**  
None

**Basis for Indirect Cost Rate:**

The rates used are the contractor's federally approved rates.

**Past Experience with this Principal Investigator:**

ARB staff have had very positive previous experience with the principal investigator, Mr. Dennis McClement. He has significant expertise in this field and has been involved in all aspects of emissions testing.

**Prior Research Division Funding to Automotive Testing Laboratories, Inc.:**

Year	1999	1998	1997
Funding	\$0	\$0	\$0

## BUDGET SUMMARY

Automotive Testing Laboratories, Inc.

Collection of Evaporative Emissions Data from Off-Road Equipment

### DIRECT COSTS AND BENEFITS

1.	Labor and Employee Fringe Benefits	\$13,891
2.	Subcontractors	\$ 8,575
3.	Equipment	\$ 0
4.	Travel and Subsistence	\$ 2,172
5.	Electronic Data Processing	\$ 0
6.	Reproduction/Publication	\$ 225
7.	Mail and Phone	\$ 0
8.	Supplies	\$ 53
9.	Analyses	\$ 7,522
10.	Miscellaneous	<u>\$201,650 (1)</u>
Total Direct Costs		\$234,088

### INDIRECT COSTS

1.	Overhead	\$33,697
2.	General and Administrative Expenses	\$11,170
3.	Other Indirect Costs	\$ 0
4.	Fee or Profit	<u>\$ 6,957</u>
Total Indirect Costs		<u>\$51,825</u>

### TOTAL PROJECT COSTS

\$285,913

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<sup>1</sup> Costs shown are for actual emission testing. The facilities used to perform tests are highly automated. This automation makes it virtually impossible to recover costs through billing of direct labor. Costs are quoted from Automotive Testing Laboratories, Inc. Price List dated 4/16/96 and reduced for volume discount.

Agenda Item No.: 00-12-4

**PROPOSED****State of California  
AIR RESOURCES BOARD****RESEARCH PROPOSAL**

Development of a Test Method to Measure Stationary and Portable Engine Emissions

Resolution 00-49  
December 7, 2000

**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; and

**WHEREAS**, a research proposal, number 2468-217, entitled "Development of a Test Method to Measure Stationary and Portable Engine Emissions," has been submitted by West Virginia University Research Corporation in response to RFP No. 00-6; and

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

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

Proposal Number 2468-217 entitled "Development of a Test Method to Measure Stationary and Portable Engine Emissions", submitted by West Virginia University Research Corporation, for a total amount not to exceed \$284,019.

**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 2468-217 entitled "Development of a Test Method to Measure Stationary and Portable Engine Emissions" submitted by West Virginia University Research Corporation for a total amount not to exceed \$284,019.

**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 in an amount not to exceed \$284,019.

## **Development of a Test Method to Measure Stationary and Portable Engine Emissions**

### **Background**

To date, over 10,000 portable engines have been registered with the Statewide Portable Equipment Registration Program. In addition, ARB estimates there are over 16,000 stationary engines operating in various capacities in the state. Most of these engines are diesel fueled. Other types of fuels used include gasoline, natural gas, propane, and waste gases such as landfill gas and digester gas. Stationary and portable engines are equivalent in size; the federal definition designates the category of engine by the length of time a unit resides at a given work site.

Historically, stationary source test methods have been used by local air districts to measure emissions from both stationary and portable engines. However, portable engines manufactured after January 1, 1996 are required to meet manufacturer-based standards, where compliance is measured using methods similar to those required for engines used in on-highway vehicles. Thus, the development of an in-the-field surrogate inspection and maintenance test method for stationary and portable engines (both compression-ignition and spark-ignition) to measure in-use emissions that can be compared to the equipment manufacturer's emissions data and/or correlated to the applicable ISO 8178 certification test procedure is necessary.

### **Objective**

The objective of this project is to develop a cost-effective, in-the-field, and surrogate inspection-and-maintenance test method for in-use emissions from stationary and portable engines.

### **Expected Results**

The project will provide a test method for stationary and portable engines to measure in-use emissions and determine compliance with emission standards for newly manufactured off-road engines as promulgated by either ARB or U.S. EPA.

### **Significance to the Board**

From the stationary and portable engines tested with the newly developed method, ARB will be able to provide representative in-use emissions estimates for the statewide emissions inventory, identify emission reductions achieved through technology, and better assess attainment of State and federal ambient air quality standards.

**Contractor:**  
West Virginia University Research Corporation

**Principal Investigator (PI):**  
Dr. Mridul Gautam

**Contract Period:**  
30 months

**Contract Amount:**  
\$284,019

**Cofunding:**  
None

**Basis for Indirect Cost Rate:** The indirect cost rate of 25 percent was established via audit determination by the U.S. DHHS in accordance with the Colleges and Universities Rate Agreement with the U.S. Federal Government.

**Past Experience with this Principal Investigator:**

ARB has had positive previous experience with the principal investigator, Dr. Mridul Gautam. He and West Virginia University are recognized nationally and internationally and offer extensive experience and expertise to the project.

**Prior Research Division Funding to West Virginia University:**

Year	1999	1998	1997
Funding	\$0	\$323,622	\$0

## BUDGET SUMMARY

West Virginia University Research Corporation

Development of a Test Method to Measure Stationary and Portable Engine Emissions

### DIRECT COSTS AND BENEFITS

1.	Labor and Employee Fringe Benefits	\$173,386
2.	Subcontractors	\$ 0
3.	Equipment	\$ 17,600 (1)
4.	Travel and Subsistence	\$ 15,499 (2)
5.	Electronic Data Processing	\$ 0
6.	Reproduction/Publication	\$ 0
7.	Mail and Phone	\$ 0
8.	Supplies	\$ 10,250
9.	Analyses	\$ 0
10.	Miscellaneous	<u>\$ 14,000</u>
Total Direct Costs		\$230,735

### INDIRECT COSTS

1.	Overhead	\$53,284
2.	General and Administrative Expenses	\$ 0
3.	Other Indirect Costs	\$ 0
4.	Fee or Profit	<u>\$ 0</u>
Total Indirect Costs		<u>\$53,284</u>

**TOTAL PROJECT COSTS** **\$284,019**

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<sup>1</sup> Equipment to be purchased: Datalogger, Zirconia Sensor for NO<sub>x</sub>, Annubars, Engine Speed Sensor, Pressure Transducers, Temperature Transducers, Solid State NDIR, Heated Lines and Filters.

<sup>2</sup> Travel costs are for 6 trips to Sacramento for biannual progress review meetings.

**PROPOSED**

**State of California  
AIR RESOURCES BOARD**

**RESEARCH PROPOSAL**

**Improvement of Emissions Inventories for Industrial Coatings  
and Thinning and Cleanup Solvents**

Resolution 00-50  
December 7, 2000

**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 2460-217, entitled "Improvement of Emissions Inventories for Industrial Coatings and Thinning and Cleanup Solvents", has been submitted by Pacific Environmental Services, Incorporated, in response to RFP No. 00-3;

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

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

Proposal Number 2460-217, entitled "Improvement of Emissions Inventories for Industrial Coatings and Thinning and Cleanup Solvents", submitted by Pacific Environmental Services, Incorporated, for a total amount not to exceed \$274,456.

**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 2460-217, entitled "Improvement of Emissions Inventories for Industrial Coatings and Thinning and Cleanup Solvents", submitted by Pacific Environmental Services, Incorporated, for a total amount not to exceed \$274,456.

**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 in an amount not to exceed \$274,456.

## **Improvement of Emissions Inventories for Industrial Coatings and Thinning and Cleanup Solvents**

### **Background**

The evaporation of organic solvents used in industrial coatings, for thinning and cleaning-up industrial coatings, and for thinning and cleaning-up architectural coatings constitute an important part of the inventory of organic gases in California. According to the current emissions inventory, industrial coatings and the associated thinning and cleanup solvents caused 103 tons of organic gas emissions per day in the state in 1985, and solvents used to thin and clean-up architectural coatings caused another 23 tons per day.

However, these elements of the inventory are based on incomplete and obsolete data.

### **Objective**

The objectives of this study are to:

- Obtain by surveys, data on the formulation and amounts of coatings and solvents used in California during 1999, by county.
- Calculate emissions inventory elements for the coatings and solvents, by county.
- Develop speciation profiles, temporal profiles, a method for creating gridded inventories (for air-quality modeling), and a method for periodically updating the inventory elements.

### **Expected Results**

A complete project will produce valid inventory elements for the subject coatings and solvents, inputs needed for air-quality modeling work, and a method for updating the inventory elements as economic and demographic circumstances change.

### **Significance to the Board**

The Board must maintain and improve its emission inventory for reactive organic gases as a planning tool for attaining the federal and State ambient air quality standards for ozone. The improvement of the coating and solvent elements of the inventory is an important part of meeting that requirement.

**Contractor:**  
Pacific Environmental Services, Inc.

**Principal Investigator (PI):**  
Michael B. Rogozen, D.Env.

**Contract Period:**  
33 months

**Contract Amount**  
\$274,456

**Cofunding:**  
None

**Basis for Indirect Cost Rate:** The rates used are the contractor's federally approved rates.

**Past Experience with this Principal Investigator:**

The PI has conducted several survey projects for ARB:

- survey of 718 polyester resin users in fiberglass impregnation and fabrication
- survey of several hundred operators of cooling towers on chemical additives
- survey of 6,500 users of organic solvents on purchases and handling
- survey of manufacturers of urea-formaldehyde and phenol formaldehyde
- survey of chloroform users

**Prior Research Division Funding to Pacific Environmental Services:**

Year	1999	1998	1997
Funding	\$0	\$0	\$0

## BUDGET SUMMARY

Pacific Environmental Services

Improvement of Emissions Inventories for Industrial Coatings and  
Thinning and Cleanup Solvents

### DIRECT COSTS AND BENEFITS

1.	Labor and Employee Fringe Benefits	\$ 49,070
2.	Subcontractors	\$ 89,721
3.	Equipment	\$ 0
4.	Travel and Subsistence	\$ 1,348
5.	Electronic Data Processing	\$ 5,733
6.	Reproduction/Publication	\$ 7,411
7.	Mail and Phone	\$ 12,704
8.	Supplies	\$ 0
9.	Analyses	\$ 0
10.	Miscellaneous	<u>\$ 7,495</u>
	Total Direct Costs	\$173,482

### INDIRECT COSTS

1.	Overhead	\$ 60,356
2.	General and Administrative Expenses	\$ 15,667
3.	Other Indirect Costs	\$ 0
4.	Fee or Profit	<u>\$ 24,951</u>
	Total Indirect Costs	<u>\$100,974</u>

### TOTAL PROJECT COSTS

\$274,456

**PROPOSED****State of California  
AIR RESOURCES BOARD****RESEARCH PROPOSAL****Oxygenated Organics in Gas and Fine Particle Diesel Emissions for Source Apportionment**

Resolution 00-51  
December 7, 2000

**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 2469-217, entitled "Oxygenated Organics in Gas and Fine Particle Diesel Emissions for Source Apportionment", has been submitted by the University of California, Davis,

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

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

Proposal Number 2469-217 entitled "Oxygenated Organics in Gas and Fine Particle Diesel Emissions for Source Apportionment", submitted by the University of California, Davis, for a total amount not to exceed \$249,999.

**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 2469-217 entitled "Oxygenated Organics in Gas and Fine Particle Diesel Emissions for Source Apportionment", submitted by the University of California, Davis, for a total amount not to exceed \$249,999.

**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 in an amount not to exceed \$249,999.

## Oxygenated Organics in Gas and Fine Particle Diesel Emissions for Source Apportionment

### Background

Both gas-phase and particle emissions from diesel engines are significant contributors to California's air pollution. Dynamometer studies have provided some information about the chemical composition of diesel emissions. However, the dilution techniques used in dynamometer studies affect the particle size and mass and the load or test cycle can affect the chemical composition of the emissions. For these reasons, characterization of 'real world' diesel emissions is urgently needed. In addition, preliminary data indicate that some oxygenated organic compounds may be unique components of diesel exhaust. Therefore, research is also needed to assess whether specific chemicals or signature patterns of chemicals can serve as tracers of diesel emissions for source apportionment.

### Objective

The objective of this study is to develop and test a method that will measure the oxygenated organic compounds present in diesel exhaust in gas phase and fine particulate matter (PM). The method will then be used to investigate the emissions in the Caldecott tunnel, during sources tests, and in the ambient air with the goal of identifying compounds which can be used as marker compounds for diesel exhaust in source apportionment.

### Expected Results

This project will develop and test a method to measure carbonyls, multifunctional carbonyls, and carboxylic acids in both the gas phase and PM<sub>2.5</sub>. This method will then be used to analyze emissions in the heavy- and light-duty bores of the Caldecott tunnel, and test gasoline and diesel engines at the ARB Heavy Duty Emissions Testing Laboratory. Ambient samples will also be examined for possible marker compounds. The results will provide insights into the gas and fine particulate matter distribution of oxygenated organic compounds in 'real world' emissions. They will also verify whether oxygenated organic compounds may serve as tracers for source apportionment of diesel exhaust.

### Significance to the Board

ARB will be directing a major effort, over the next decade, to reduce the health risk associated with toxic air contaminants (TAC) from diesel engines. While PM from diesel engines has been identified as a TAC, diesel PM is a complex mixture of many organic compounds and as much as 95 percent of the organic compounds in the particle phase have not been identified. Identification of additional compounds, particularly carbonyls and multi-functional carbonyls, may provide much needed tracer compounds which can be used to estimate exposure and apportion diesel as a source of PM. Conflicting results in previous gasoline versus diesel source apportionment studies demonstrate the need for additional research in this area.

**Contractor:**  
University of California, Davis

**Principal Investigators (PIs):**  
Professor M. Judith Charles,  
Professor Britt A. Holmen,  
Professor Lowell Ashbaugh

**Contract Period:**  
36 months

**Contract Amount:**  
\$249,999

**Cofunding:**  
None

**Basis for Indirect Cost Rate:**

The indirect cost rate of 10 percent is a negotiated rate agreed to by the University of California campuses and the State.

**Past Experience with Principal Investigators:**

These investigators have worked on several ARB-sponsored projects in the past and have always delivered quality results with a very reasonable budget. Specifically, Dr. Charles' previous work for ARB has resulted in several articles in peer reviewed journals.

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

Year	1999	1998	1997
Funding	\$479,943	\$278,580	\$433,457

## BUDGET SUMMARY

University of California, Davis

Oxygenated Organics in Gas and Fine Particle Diesel Emissions for Source  
Apportionment

### DIRECT COSTS AND BENEFITS

1.	Labor and Employee Fringe Benefits	\$113,289
2.	Subcontractors	\$ 0
3.	Equipment	\$ 0
4.	Travel and Subsistence	\$ 7,770
5.	Electronic Data Processing	\$ 0
6.	Reproduction/Publication	\$ 335
7.	Mail and Phone	\$ 200
8.	Supplies	\$ 68,850 (1)
9.	Analyses	\$ 0
10.	Miscellaneous	<u>\$ 39,021 (2)</u>
Total Direct Costs		\$229,465

### INDIRECT COSTS

1.	Overhead	\$ 20,534
2.	General and Administrative Expenses	\$ 0
3.	Other Indirect Costs	\$ 0
4.	Fee or Profit	<u>\$ 0</u>
Total Indirect Costs		<u>\$20,534</u>

### TOTAL PROJECT COSTS

\$249,999

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<sup>1</sup> Supplies include: gas chromatographic columns, reagents, GC/MS supplies, solvents, gases, denuders, filters, and chemical waste disposal. The cost for supplies for Year 1 is \$24,150, Year 2 is \$23,850, and Year 3 is \$20,850. The total cost of supplies is \$68,850.

<sup>2</sup> Instrument Service contract. (4,800/year x 3)                   9,600  
Maintenance of Diesel Engine                                   500  
Graduate Student Fees   18,952  
  39,021

**PROPOSED**

**State of California  
AIR RESOURCES BOARD**

**RESEARCH PROPOSAL**

Demonstration of Ozone Impacts on Crop Species in the San Joaquin Valley:  
Open Top Chambers at Kearney Agricultural Center

Resolution 00-52  
December 7, 2000

**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 2471-217, entitled "Demonstration of Ozone Impacts on Crop Species in the San Joaquin Valley: Open Top Chambers at Kearney Agricultural Center" has been submitted by University of California, Riverside;

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

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

Proposal Number 2471-217 entitled "Demonstration of Ozone Impacts on Crop Species in the San Joaquin Valley: Open Top Chambers at Kearney Agricultural Center", submitted by University of California, Riverside, for a total amount not to exceed \$145,301.

**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 2471-217 entitled "Demonstration of Ozone Impacts on Crop Species in the San Joaquin Valley: Open Top Chambers at Kearney Agricultural Center", submitted by University of California, Riverside, for a total amount not to exceed \$145,301.

**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 in an amount not to exceed \$145,301.

## **Demonstration of Ozone Impacts on Crop Species in the San Joaquin Valley: Open Top Chambers at Kearney Agricultural Center**

### **Background**

In California, the production of agricultural crops is a multi-billion dollar industry. Major production areas in the central valley are located in air basins that violate state and federal ambient air quality standards for ozone, and crop losses have been estimated to be in excess of \$100 million per annum. Currently, both the agricultural products industry and the public have little recognition of the economic consequences of air pollution-caused crop damage in the Valley. Increasing public awareness of the harmful effects of ambient air pollution is a critical first step toward gaining local support for actions to mitigate current and future air pollution-related crop losses.

### **Objective**

The objective of this proposed demonstration project is to establish an eight-unit open top chamber exhibit and research facility at the Kearney Agricultural Center in Parlier, and operate it for three years. Printed materials about the effects of air pollution on crops will be developed in conjunction with a website for the broad-scale dissemination of information and research findings.

### **Expected Results**

The value of a demonstration project of this kind is to provide the public with clear examples of what damage air pollution causes to crops grown in the San Joaquin Valley. School children are an important target group for this demonstration project. By spreading the word that reducing air pollution has important health and economic benefits, public awareness and support for measures to improve air quality in the Valley will be expanded.

### **Significance to the Board**

This project fulfills Health & Safety Code requirements to study the effects of air pollution on plants. The results can be used to support efforts to tabulate air pollution impacts on public welfare for justifying the technical basis of ambient air quality standards.

**Contractor:**  
University of California, Riverside

**Principal Investigator:**  
David A. Grantz, Ph.D.

**Contract Period:**  
36 months

**Contract Amount:**  
\$145,301

**Cofunding:**  
None

**Basis for Indirect Cost Rate:**

The indirect cost rate of 10 percent is a negotiated rate agreed to by the University of California campuses and the State.

**Past Experience with this Principal Investigator:**

Dr. Grantz was the P.I. on Contract No. A133-053 titled "Effect of Canopy Structure and Open-Top Chamber Techniques on Micrometeorological Parameters and the Gradients and Transport of Water Vapor, Carbon Dioxide, and Ozone in the Canopies of Plum Trees in the San Joaquin Valley (Final report completed in May, 1995). He has worked on the California Ozone Deposition Experiment, and published a paper on using vegetation as a means to mitigate dust in the Mojave Desert (e.g., Journal of Environmental Quality (1998), 27: 1209-1218).

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

Year	1999	1998	1997
Funding	\$449,987	\$ 668,945	\$ 258,702

## BUDGET SUMMARY

University of California, Riverside

Demonstration of Ozone Impacts on Crop Species in the San Joaquin Valley:  
Open Top Chambers at Kearney Agricultural Center

### DIRECT COSTS AND BENEFITS

1.	Labor and Employee Fringe Benefits	\$ 55,625
2.	Subcontractors	\$ 0
3.	Equipment	\$ 15,275 (1)
4.	Travel and Subsistence	\$ 12,000 (2)
5.	Electronic Data Processing	\$ 0
6.	Reproduction/Publication	\$ 4,500
7.	Mail and Phone	\$ 3,600
8.	Supplies	\$ 13,100 (3)
9.	Analyses	\$ 0
10.	Miscellaneous	<u>\$ 29,380 (4)</u>
	Total Direct Costs	<b>\$133,480</b>

### INDIRECT COSTS

1.	Overhead	\$ 11,821
2.	General and Administrative Expenses	\$ 0
3.	Other Indirect Costs	\$ 0
4.	Fee or Profit	<u>\$ 0</u>
	Total Indirect Costs	<u>\$ 11,821</u>

### TOTAL PROJECT COSTS

**\$145,301**

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1	Power Drop	\$2,500
	Shelter for Ozonator	\$2,000
	Sulfur Microwave Emission Growth Lamps - 4@2,500	\$10,775

2 Travel includes six professional meetings.  
3 meetings to Air and Waste Management Association.  
3 meetings to Crop Science Society of America

3 Supplies for three years include: oxygen (3,600), miscellaneous spare parts (4,500), and cultivation supplies (5,000).

4 Miscellaneous expenses for three years include: portable laboratory (14,400), electrician (5,980), website development (4,500), and a refurbished and repaired ozone generator (4,500).