State of California

AIR RESOURCES BOARD

Research Resolutions

Research Division

March 21, 2002

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 University of California, Riverside, entitled "A Post-Regulatory Evaluation of the Cost and Economic Impact Estimates of Air Pollution Control Regulations." The principal investigator will be Dr. James M. Lents.
Resolution No. 02-09

Item 2 is a research proposal from the University of California, Berkeley, entitled "Indoor Air Chemistry: Cleaning Agents, Ozone, and Toxic Air Contaminants." The principal investigator will be Dr. William W. Nazaroff.
Resolution No. 02-10

Item 3 is a research proposal from NASA/Jet Propulsion Laboratory/California Institute of Technology, entitled "Gas-Phase Formation Rates of Nitric Acid and its Isomers under Urban Conditions." The principal investigator will be Dr. Stanley Sander.
Resolution No. 02-11

Item 4 is a research proposal from Arizona State University, entitled "Quantitative Analysis of Aerosol Time-of-Flight Mass Spectrometry Data using YAADA." The principal investigator will be Dr. Jonathan O. Allen.
Resolution No. 02-12

Item 5 is a research proposal from San Diego State University, entitled "Research into the Development of Biological Methods of Dust Suppression in the Antelope Valley." The principal investigator will be Dr. Thomas A. Zink.
Resolution No. 02-13

Item 6 is a research proposal from the California Department of Health Services, entitled "Determination of the Asbestos Content of Current Automotive Dry Friction Materials, and the Potential Contribution of Asbestos to the Particulate Matter Derived from Brake Wear." The principal investigator will be Dr. Stephen Wall.
Resolution No. 02-14

Item 7 is a research proposal from the University of California, Riverside, entitled, "Incidence of Malfunctioning and Tampering in Heavy-Duty Vehicles." The principal investigator will be Dr. J. Wayne Miller.
Resolution No. 02-15

PROPOSED

State of California
AIR RESOURCES BOARD

RESEARCH PROPOSAL

Resolution 02-9

March 21, 2002

Agenda Item No.: 02-2-2

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 2512-224, entitled "A Post-Regulatory Evaluation of the Cost and Economic Impact Estimates of Air Pollution Control Regulations," has been submitted by the University of California, Riverside;

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 2512-224 entitled "A Post-Regulatory Evaluation of the Cost and Economic Impact Estimates of Air Pollution Control Regulations," submitted by the University of California, Riverside, for a total amount not to exceed $149,997.

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 2512-224 entitled "A Post-Regulatory Evaluation of the Cost and Economic Impact Estimates of Air Pollution Control Regulations," submitted by the University of California, Riverside, for a total amount not to exceed $149,997.

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 $149,997.

ATTACHMENT A

"A Post-Regulatory Evaluation of the Cost and Economic Impact Estimates of Air Pollution Control Regulations"

Background

California has made great strides in improving the air quality over the past few decades. However, despite the dramatic air quality improvement, California has not been able to achieve the federal clean air standards. A majority of Californians still breathe unhealthy air on at least some days during the year. Additional regulations are needed to meet the federal requirements for attaining national air quality standards within this decade. New regulations may be more expensive if businesses must meet more stringent air quality standards. Yet there is numerous evidence showing that costs may not be as high as originally estimated. This may be due to the fact that the regulatory agencies, when estimating costs, usually assume that more stringent standards will be attained with current technologies. But, history shows that technology continues to improve and technological innovation tends to lower future compliance costs.

Although anecdotal evidence indicates that regulation stimulates innovation, there are no comprehensive studies to assess the impact of innovation on the actual costs of regulations. This study plans to collect and analyze data on actual regulatory costs and economic impacts of a selected number of ARB and South Coast Air Quality Management District (SCAQMD) regulations and rules, and then compare them to the original estimates. The study will also conduct a comparison of emission reduction data before and after a regulation if such data are available. The results may shed light on how innovation can lower compliance costs.

Objective

The objective of this study is to conduct a post-regulation engineering and economic evaluation of the accuracy of the costs, economic impacts, and emission reductions of air pollution control regulations in California. This study also intends to identify the primary causes of the differences between the original estimates and the actual results.

Methods

The contractor proposes to select a minimum of ten key ARB and SCAQMD rules and regulations that have affected a variety of industries and geographic areas and that have required different technologies to assess the accuracy of their cost, economic impact, and emission reduction estimates. The contractor will develop a profile of candidate regulations. The profiles include estimates of costs, economic impacts, and emission reductions, along with underlying assumptions made by various stakeholders and regulatory agencies to develop those estimates. Information will be obtained from the initial regulatory process, including staff reports, published reports and materials, stakeholder comments, and actual rule adoption records. Stakeholders will also be contacted to collect any historical information available.

The contractor will utilize a variety of sources to collect or develop actual data on costs, economic impacts and emission reductions for the candidate regulations. Such sources include the Internet, documents and reports, trade publications and surveys, interviews of affected industries, consumers, and equipment vendors, and emission reduction transaction costs from RECLAIM or offsets where appropriate. The main focus of this study will be to collect the actual data on control/process equipment costs, operating/maintenance costs, and indirect costs associated with the selected regulations. However, information will also be collected on the actual technologies used to comply with the candidate regulations. Special attention will be given to accounting for any productivity effects these technologies may have created.

Expected Results
This study will provide the Board with a report on the accuracy of the projected vis-à-vis actual costs, economic impacts, and emission reduction impacts for a number key of regulations. It will also provide an explanation of any significantly inaccurate estimates, and suggest specific recommendations on how to improve cost and emission reduction projections for future rulemaking efforts.

Significance to the Board
The insights gained from this study will assist the board and the districts to improve estimates of cost, economic impacts, and emission reductions of their proposed regulations and rules.

Contractor:
University of California, Riverside

Contract Period:
18 months

Principal Investigator (PI):
Dr. James M. Lents

Contract Amount:
$149,997

Cofunding:
None

Basis for Indirect Cost Rate:
The 10 percent rated used is a negotiated rated between the ARB and University of California campuses.

Past Experience with this Principal Investigator:
Dr. James Lents, the principal investigator for this project, was the Executive Officer of the South Coast Air Quality Management District for 11 years. He has impeccable credentials in the fields of environmental science, technology, and policy.

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

Year	2001	2000	1999
Funding	$79,884	$654,788	$659,987

BUDGET SUMMARY

University of California, Riverside

A Post-Regulatory Evaluation of the Cost and Economic Impact Estimates of Air Pollution Control Regulations

DIRECT COSTS AND BENEFITS			
1.	Labor and Employee Fringe Benefits	$99,475	
2.	Subcontractors	$18,000	
3.	Equipment	$ 0	
4.	Travel and Subsistence	$ 2,133	
5.	Electronic Data Processing	$ 0	
6.	Photocopying and Printing	$ 0	
7.	Mail, Telephone and Fax	$ 3,030	
8.	Materials and Supplies	$ 0	
9.	Analyses	$ 0	
10.	Miscellaneous	$15,600	
	Total Direct Costs		$138,238
INDIRECT COSTS			
1.	Overhead	$11,759	
2.	General and Administrative Expenses	$ 0	
3.	Other Indirect Costs	$ 0	
4.	Fee or Profit	$ 0	
	Total Indirect Costs		$11,759
TOTAL PROJECT COSTS			**$149,997**

PROPOSED

State of California
AIR RESOURCES BOARD

Resolution 02-10

March 21, 2002

Agenda Item No.: 02-2-2

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 2510-224, entitled "Indoor Air Chemistry: Cleaning Agents, Ozone, and Toxic Air Contaminants," 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 2510-224 entitled "Indoor Air Chemistry: Cleaning Agents, Ozone, and Toxic Air Contaminants," submitted by the University of California, Berkeley, for a total amount not to exceed $446,865.

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 2510-224 entitled "Indoor Air Chemistry: Cleaning Agents, Ozone, and Toxic Air Contaminants," submitted by the University of California, Berkeley, for a total amount not to exceed $446,865.

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 $446,865.

ATTACHMENT A

"Indoor Air Chemistry: Cleaning Agents, Ozone, and Toxic Air Contaminants"

Background

Household products such as cleaning agents, polishes, and air fresheners contain many volatile constituents that can contribute to indoor pollutant levels, including both directly emitted Toxic Air Contaminants (TACs) and pollutants formed by chemical reaction. Many volatile constituents of household cleaning agents have been identified as TACs, such as toluene, ethyl benzene, styrene, glycol ethers, formaldehyde, acetaldehyde, and methyl ethyl ketone. Therefore, the use of cleaning products in residences, schools, and commercial and institutional buildings can result in inhalation exposure to TACs. Additionally, ozone, a very reactive gas, has been found to react with some common cleaning agent constituents to form respiratory irritants and/or carcinogens such as formaldehyde, acrolein, and numerous carboxylic acids, among others.

Formulations of cleaning products have undergone considerable change in response to ARB's regulations limiting percent by weight of VOCs in consumer products, with regulations requiring further reductions for some products (to 4% VOC by weight) to be implemented in 2004. As a result, there is concern that many household cleaners are evolving to have a larger contribution to the total composition from unsaturated, lower volatility hydrocarbons (e.g., d-limonene, selected terpenes and glycol ethers), a class of compounds generally more available to participate in reactions with ozone. Additionally, accurate and realistic information on indoor exposure to TACs, both directly emitted and formed by chemical reaction, is crucial because of the importance of such exposures in determining health risks from these chemicals.

Objective

The objective of the proposed research is to identify and quantify primary emissions of TACs from cleaning products, as well as secondary emissions resulting from reactions between cleaning agent emissions and ozone under realistic indoor conditions. Tests will be conducted using realistic indoor use scenarios, so that the potential exposure of product users and room occupants can be assessed. In addition to obtaining product emissions and exposure information, the investigators will identify the conditions under which these processes contribute to elevated indoor levels of TACs.

Methods

The investigators propose to conduct a series of chamber tests at the Lawrence Berkeley National Laboratory (LBNL) to examine cleaning product emissions and associated indoor chemistry in realistic use scenarios. A set of screening tests will be performed in a small-scale chamber to identify cleaning products with a high potential either for primary TAC emissions or for formation of TACs as secondary emissions. These products will be further tested in a full-scale chamber under simulated indoor use conditions to better quantify emissions and user/occupant exposure during cleaning product application. A subset of these experiments will be conducted with and without the introduction of ozone into the chamber to assess reaction products. Analytes for all

chamber experiments will include a large number of VOCs, aldehydes, acids, glycol ethers, and terpenes and related compounds.

Expected Results
Results from the study will include semi-quantitative data on the primary emissions of TACs from approximately 20 cleaning products, and more specific, quantitative data on the primary emissions and exposure concentrations for approximately nine of these products. Also, the proposed study will provide quantitative data on the secondary (reaction) emissions of TACs (including formation and removal processes) resulting from cleaning agent-ozone reactions under realistic use scenarios for at least three of the cleaning products selected in screening tests as described above. In addition to obtaining product emissions and exposure information, the investigators will identify the conditions under which these processes contribute to elevated indoor levels of TACs.

Significance to the Board
Results from this study will be used by ARB to assess the need for further refinement of ARB's consumer products regulations to protect public health, and to provide guidance to the public on ways to reduce any potentially harmful exposure that may occur when using cleaning products.

Contractor:
University of California, Berkeley

Contract Period:
36 months

Principal Investigator (PI):
William W. Nazaroff, Ph.D.

Contract Amount:
$446,865

Cofunding:
None

Basis for Indirect Cost Rate:
The indirect cost rate of 10 percent is a negotiated rate agreed to by the State and University of California campuses.

Past Experience with this Principal Investigator:
Dr. William Nazaroff is a Professor in the Department of Civil and Environmental Engineering at the University of California, Berkeley, and is a leader in the field of indoor air quality, aerosol physics, air pollution control, and contaminant transport processes. Dr. Nazaroff also serves as a member of ARB's Research Screening Committee. Dr. Nazaroff has completed one ARB-funded project in the past, entitled "Assessing Exposure to Air Toxicants From Environmental Tobacco Smoke" (ARB contract

#94-344). In that work, Dr. Nazaroff demonstrated his excellent analytical abilities and the ability to oversee the administration and management of research projects.

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

Year	2001	2000	1999
Funding	$0	$0	$392,027

BUDGET SUMMARY

University of California, Berkeley

Indoor Air Chemistry: Cleaning Agents, Ozone, and Toxic Air Contaminants

DIRECT COSTS AND BENEFITS			
1.	Labor and Employee Fringe Benefits	$207,531	
2.	Subcontractors	$190,695	
3.	Equipment	$ -0-	
4.	Travel and Subsistence	$ 1,820	
5.	Electronic Data Processing	$ -0-	
6.	Reproduction/Publication	$ 1,400	
7.	Mail, Phone, and FAX	$ 1,100	
8.	Materials and Supplies	$ 15,620	
9.	Analyses	$ -0-	
10.	Miscellaneous	$ 1,158	
	Total Direct Costs		$419,324
INDIRECT COSTS			
1.	Overhead	$ 27,541	
2.	General and Administrative Expenses	$ -0-	
3.	Other Indirect Costs	$ -0-	
4.	Fee or Profit	$ -0-	
	Total Indirect Costs		$27,541
TOTAL PROJECT COSTS			**$446,865**

Two subcontractors will be part of this project: Lawrence Berkeley Laboratory and a private consultant, Dr. Charles J. Weschler.

Labor	116,891	
Miscellaneous	14,364	
Total Direct Cost		$131,255
Indirect Cost	59,440	
Subcontractors Total		$190,695

PROPOSED

State of California
AIR RESOURCES BOARD

Resolution 02-11

March 21, 2002

Agenda Item No.: 02-2-2

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 2515-224, entitled "Gas-Phase Formation Rates of Nitric Acid and its Isomers under Urban Conditions," has been submitted by NASA/Jet Propulsion Laboratory/California Institute of Technology;

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 2515-224 entitled "Gas-Phase Formation Rates of Nitric Acid and its Isomers under Urban Conditions," submitted by NASA/Jet Propulsion Laboratory/California Institute of Technology, for a total amount not to exceed $180,000.

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 2515-224 entitled Gas-Phase Formation Rates of Nitric Acid and its Isomers under Urban Conditions," submitted by NASA/Jet Propulsion Laboratory/California Institute of Technology, for a total amount not to exceed $180,000.

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 $180,000.

ATTACHMENT A

"Gas-Phase Formation Rates of Nitric Acid and its Isomers under Urban Conditions"

Background

Urban airshed models are indispensable tools in the assessment of control strategies for NO_X and VOCs. The controlling processes for ozone formation in such models are fast free-radical reactions. These reactions involve the generation of free radicals (primarily through photolysis reactions), conversion and regeneration of radicals, and removal of radicals through termination reactions. An important process in this latter category is the formation of nitric acid from the hydroxyl radical OH and nitrogen dioxide NO_2: $OH + NO_2 + M = HNO_3 + M$, where M is an inert bath gas, such as N_2. This reaction removes two short-lived reactive intermediates, OH and NO_2, and produces a relatively long-lived product, HNO_3. The significance of the termination step to urban airshed models is reflected in the high sensitivities of the spatial and temporal distributions of ozone from models to the value of the rate constant. For example, propagation of the uncertainty in the $OH+NO_2$ rate constant (~25 percent) in an urban airshed model produces an uncertainty of 35 ppbv in the calculated ozone concentration at a site downwind (i.e., ~25-50 percent uncertainty in the total ozone concentration). Also, this overall reaction is comprised of two reaction channels in which nitric acid HNO_3 and peroxynitrous acid HOONO are produced; complications arising from these channels introduce an additional uncertainty of 10-20 percent in the rate constant.

Objective

This primary objectives of this research are: 1) determine kinetic data for the radical termination reaction $OH + NO_2 + M \rightarrow$ products, and 2) measure the branching ratio for the formation of the isomers, HNO_3 and HOONO, which are produced by this reaction.

Methods

A new laser photolysis/laser-induced fluorescence apparatus will be used to obtain kinetic data for the reaction $OH + NO_2$. The reaction will be studied over the temperature range 250-310 K and the pressure range 500-800 Torr. The Chemical Kinetics and Photochemistry Group will carry out this work at NASA Jet Propulsion Laboratories. The targeted uncertainty in the rate constant is 15 percent or less. The branching ratios for the formation of the products HNO_3 and HOONO will also be measured. The groups of Prof. M. Okumura and Prof. P. Wennberg at the California Institute of Technology will carry out these studies using the techniques of infrared cavity ringdown spectroscopy and near-infrared photofragment (action) spectroscopy.

Expected Results

This project will determine kinetic and mechanistic information about a key radical termination process under urban conditions. This information is essential to improve the predictive capabilities of urban airshed models with respect to oxidant formation.

Significance to the Board
This project will improve our understanding of an important termination pathway for both OH and NO_X. The kinetic information obtained about this process will further the predictive capabilities of urban airshed models, which in turn will help determine the relative effectiveness of NO_X and VOC controls on oxidant formation in urban areas. In addition, since this termination step is the primary pathway for the production of gas-phase nitric acid, this project may also have implications for the control of particulate matter.

Contractor:
NASA/Jet Propulsion Laboratory/California Institute of Technology

Contract Period:
24 Months

Principal Investigator (PI):
Dr. Stanley Sander

Contract Amount:
$180,000

Basis for Indirect Cost Rate:
The Jet Propulsion Laboratory is using a federally approved rate.

Past Experience with this Principal Investigator:
Dr. S. Sander is team leader of the Chemical Kinetics and Photochemistry Group at NASA JPL. This group is a recognized leader in research concerning elementary reaction kinetics and photochemical processes relevant to the earth. Dr. S. Sander is also the chairman of the NASA Panel for the Evaluation of Chemical Kinetic and Photochemical Data for Atmospheric Modeling, which provides a critical tabulation of the most recent kinetic and photochemical data for use by modelers in computer simulations of atmospheric chemistry.

Prior Research Division Funding to NASA/Jet Propulsion Laboratory/California Institute of Technology:

Year	2001	2000	1999
Funding	$0	$0	$0

BUDGET SUMMARY

NASA/Jet Propulsion Laboratory/California Institute of Technology

"Gas-Phase Formation Rates of Nitric Acid and its Isomers under Urban Conditions"

DIRECT COSTS AND BENEFITS			
1.	Labor and Employee Fringe Benefits	$44,700	
2.	Subcontractors	$60,000[1]	
3.	Equipment	$ 7,000	
4.	Travel and Subsistence	$ 700	
5.	Electronic Data Processing	$ - 0 -	
6.	Reproduction/Publication	$ - 0 -	
7.	Mail and Phone	$ - 0 -	
8.	Supplies	$ 4,000	
9.	Analyses	$ - 0 -	
10.	Miscellaneous	$14,000	
	Total Direct Costs		$130,400
INDIRECT COSTS			
1.	Overhead	$29,100	
2.	General and Administrative Expenses	$10,300	
3.	Other Indirect Costs	$10,200	
4.	Fee or Profit	$ -0-	
	Total Indirect Costs		$49,600
TOTAL PROJECT COSTS			**$180,000**

(notes)

[1] CalTech subcontractor

Labor	$34,600
Tuition	4,640
Indirect Cost	$20,760
	$60,000

PROPOSED

State of California
AIR RESOURCES BOARD

Resolution 02-12

March 21, 2002

Agenda Item No.: 02-2-2

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 2514-224, entitled "Quantitative Analysis of Aerosol Time-of-Flight Mass Spectrometry Data using YAADA," has been submitted by Arizona State University;

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 2514-224 entitled "Quantitative Analysis of Aerosol Time-of-Flight Mass Spectrometry Data using YAADA," submitted by Arizona State University, for a total amount not to exceed $50,281.

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 2514-224 entitled "Quantitative Analysis of Aerosol Time-of-Flight Mass Spectrometry Data using YAADA," submitted by Arizona State University, for a total amount not to exceed $50,281.

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 $50,281.

ATTACHMENT A

"Quantitative Analysis of Aerosol Time-of-Flight Mass Spectrometry Data using YAADA"

Background

Epidemiological studies have shown that the concentration of very small airborne particles (aerodynamic diameter less than 2.5 μm) is correlated with excess human mortality in cities across the United States. Further studies have shown that some airborne particles contain toxic substances such as carcinogens suggesting that health effects may be associated with a small subset of toxic particles within atmospheric aerosols. One approach taken to understand the cause of these observed health effects is to measure atmospheric aerosol composition in detail and relate this to observations of acute or chronic health effects.

Researchers are now able to measure the size and composition of single aerosol particles using instruments like the Aerosol Time-of-Flight Mass Spectrometry (ATOFMS) instruments developed by Prof. Kimberly Prather and others. Complete mass spectra are collected on individual particles at a rate of approximately one per second. Thus, very large data sets (approximately 200 MB/day) can be collected during a multi-day, multi-instrument experiment. These data sets are too large for *ad hoc* data analysis techniques. YAADA is a software package of data management and analysis that can be used to process these large data sets. YAADA includes functions to import, plot, and quantitatively analyze ATOFMS data. The import module rapidly converts data from the common ATOFMS data acquisition software and performs quality control checks on the data.

Objective

The objectives of this research project are to compare quantitatively ATOFMS data and collocated impactor measurements of aerosol mass to investigate particle detection efficiencies for the modified ATOFMS design, to determine chemical sensitivity of ATOFMS instruments for organic and elemental carbon in the Bakersfield Instrument Intercomparison and other studies, and to develop, test, and distribute the quantification package for YAADA so that other users can perform quantitative comparisons of ATOFMS and reference sampler data.

Methods

The proposed work is based on the hypothesis that ATOFMS data can be scaled to account for nonlinear particle and ion detection efficiencies to yield quantitative aerosol composition. The initial approach will be to develop scaling functions for particle transmission efficiency which have parameters fitted by nonlinear regression of scaled ATOFMS data with reference measurements. ATOFMS data to be used for in this research project are available from several recent field studies. The investigator will also develop scaling functions for carbonaceous species detection efficiency by comparison with quantitative size-segregated aerosol carbonaceous aerosol measurements. In order to perform the complex analyses proposed in this research

project, the investigator will use YAADA software toolkit. Several general functional modules will be written to improve the current proprietary codes. In addition to improved documentation and ease-of-use, the new functions will allow complex mass spectral responses to be compared with reference data.

Expected Results
The deliverables from the proposed research will include a final report summarizing the research methods, results, and conclusions, and the YAADA quantification module. The investigator will release to the public the programs used in this work. The programs will include those used to quantitatively compare ATOFMS data to reference sampler data and those used to scale up ATOFMS data collected to determine continuous aerosol mass, elemental carbon, and organic carbon concentrations.

Significance to the Board
The resulting software will allow for a much wider analysis of the ATOFMS data (very large data sets of approximately 200 MB/day) collected under other ARB contracts. Quantitative aerosol measurements are needed to better understand the sources, transformations, and fate of ambient particles in order to understand the effects of particulate matter on global climate, human health, and regional visibility.

Contractor:
Arizona State University (ASU)

Contract Period:
18 months

Principal Investigator (PI):
Dr. Jonathan O. Allen

Contract Amount:
$50,281

Cofunding:
None

Basis for Indirect Cost Rate:
Indirect cost is calculated per ASU office of research and creative activities guidelines.

Past Experience with this Principal Investigator:
Dr. Allen's research work to analyze large aerosol data sets follows from his long-standing and mutually productive collaboration with other investigators. This collaboration began in 1996 when the PI was a postdoctoral with Prof. Glen Cass at the California Institute of Technology. Numerous peer-reviewed research papers and the YAADA software toolkit are the result of this collaboration.

Prior Research Division Funding to Arizona State University:

Year	2001	2000	1999
Funding	$0	$0	$0

BUDGET SUMMARY

Arizona State University
Quantitative Analysis of Aerosol Time-of-Flight Mass Spectrometry
Data using YAADA

DIRECT COSTS AND BENEFITS			
1.	Labor and Employee Fringe Benefits	$28,054	
2.	Subcontractors	$ -0-	
3.	Equipment	$ 4,000 [1]	
4.	Travel and Subsistence	$ 1,800	
5.	Electronic Data Processing	$ -0-	
6.	Reproduction/Publication	$ 1,000	
7.	Mail and Phone	$ -0-	
8.	Supplies	$ -0-	
9.	Analyses	$ -0-	
10.	Miscellaneous	$ -0-	
	Total Direct Costs		$34,854
INDIRECT COSTS			
1.	Overhead	$ 15,427	
2.	General and Administrative Expenses	$ -0-	
3.	Other Indirect Costs	$ -0-	
4.	Fee or Profit	$ -0-	
	Total Indirect Costs		$15,427
TOTAL PROJECT COSTS			**$50,281**

(notes)

[1] Funding is requested for a data analysis workstation running Linux to be purchased for $4,000. Based on a recent quote, a Dell Precision Workstation 340 computer purchased for this amount would be equipped with a 2 GHz Pentium 4 processor, 1 GB RAM, two 40 GB disks, and a DD3 tape drive.

PROPOSED

State of California
AIR RESOURCES BOARD

Resolution 02-13

March 21, 2002

Agenda Item No.: 02-2-2

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 2516-224, entitled "Research into the Development of Biological Methods of Dust Suppression in the Antelope Valley," has been submitted by San Diego State University;

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 2516-224 entitled "Research into the Development of Biological Methods of Dust Suppression in the Antelope Valley," submitted by San Diego State University, for a total amount not to exceed $89,830.

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 2516-224 entitled "Research into the Development of Biological Methods of Dust Suppression in the Antelope Valley," submitted by San Diego State University, for a total amount not to exceed $89,830.

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 $89,830.

ATTACHMENT A

"Research into the Development of Biological Methods of Dust Suppression in the Antelope Valley"

Background
Due to their lack of vegetation, the deserts of the southwest experience frequent dust problems that often induce air quality problems in local and surrounding areas. One area with just such a problem is Antelope Valley, the westernmost arm of the Mojave Desert. Dust particles continue to become airborne there because of abandoned and fallow agricultural fields and other disturbances of the desert soil.

One method to curtail the problem of airborne dust is to reintroduce native plant life to the area. Vegetation helps to reduce airborne dust in two ways. First, the very shape of the native plants slows the wind, thus allowing airborne dust to settle at the base of the plant. Secondly, the roots of the plants essentially grab the dirt around it, helping to hold potentially airborne dust in place.

Direct seeding of native species, the current method of restoration of plant life, has proven to be inadequate in arid and semi-arid ecosystems. This failure of direct seeding in arid and semi-arid environments can be attributed to the fact that the necessary requirements of precipitation, humidity, temperature, and soil conditions occur only rarely and at very irregular intervals. Since current methods have proven ineffective, there is a need to develop more effective methods of reintroducing native plants.

Objective
The primary objective of this project is to develop cost efficient methods for controlling airborne dust, particularly PM10 and smaller sized particles, from disturbed desert soils.

Methods
The contractor will conduct research at two agricultural sites (one where soil has been fallow for several (3-5) years since being disturbed and another that has been abandoned for many (15-20) years since disturbed. The contractor will evaluate, over a 3-year period, three types of irrigation and three types of soil amendments to determine the most effective method of reintroducing native plants for reducing the amount of windblown dust.

Expected Results
The contractor will determine the most cost efficient method of reintroducing native plant growth to disturbed desert soils.

Significance to the Board
The development of cost efficient methods to control airborne dust, particularly PM10 and smaller particles, will not only limit the loss of valuable soil, but will also remove a serious health hazard for the residents of Antelope Valley.

Contractor:
San Diego State University

Contract Period:
48 months

Principal Investigator (PI):
Dr. Thomas A. Zink

Contract Amount:
$89,830

Cofunding:
None for this project.

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:

ARB has not previously contracted with Dr. Zink, however he has been a member of the Dustbusters Cooperative for several years (using funding from a different source). Working with him in this setting we have observed Dr. Zink to be energetic, resourceful, and dedicated to the success of the Dustbusters program. We expect his diligent and efficient performance to continue under this contract.

Prior Research Division Funding to San Diego State University

Year	2001	2000	1999
Funding	$0	$0	$284,080

BUDGET SUMMARY

San Diego State University

Research into the Development of Biological Methods of Dust Suppression in the Antelope Valley

DIRECT COSTS AND BENEFITS

1.	Labor and Employee Fringe Benefits	$	56,812
2.	Subcontractors	$	-0-
3.	Equipment	$	-0-
4.	Travel and Subsistence	$	6,429
5.	Electronic Data Processing	$	-0-
6.	Reproduction/Publication	$	550
7.	Mail and Phone	$	270
8.	Supplies	$	15,503 [1]
9.	Analyses	$	2,100
10.	Miscellaneous	$	-0-
	Total Direct Costs	$	81,664

INDIRECT COSTS

1.	Overhead	$	8,166
2.	General and Administrative Expenses	$	-0-
3.	Other Indirect Costs	$	-0-
4.	Fee or Profit	$	-0-
	Total Indirect Costs	$	8,166

TOTAL PROJECT COSTS $89,830

(notes)

[1] The materials and supplies for this project consist of native seeds and plants ($7150), plant protectors ($3390), irrigation materials ($2597), tractor rental ($1500), and soil amendments ($866).

PROPOSED

State of California
AIR RESOURCES BOARD

Resolution 02-14

March 21, 2002

Agenda Item No.: 02-2-2

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 2507-223, entitled "Determination of the Asbestos Content of Current Automotive Dry Friction Materials, and the Potential Contribution of Asbestos to the Particulate Matter Derived from Brake Wear," has been submitted by the California Department of Health Services;

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 2507-223 entitled "Determination of the Asbestos Content of Current Automotive Dry Friction Materials, and the Potential Contribution of Asbestos to the Particulate Matter Derived from Brake Wear," submitted by the California Department of Health Services, for a total amount not to exceed $131,055.

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 2507-223 entitled "Determination of the Asbestos Content of Current Automotive Dry Friction Materials, and the Potential Contribution of Asbestos to the Particulate Matter Derived from Brake Wear," submitted by the California Department of Health Services, for a total amount not to exceed $131,055.

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 $131,055.

ATTACHMENT A

"Determination of the Asbestos Content of Current Automotive Dry Friction Materials, and the Potential Contribution of Asbestos to the Particulate Matter Derived from Brake Wear"

Background
The U.S. EPA instituted a ban on the production of most Automotive Dry Friction Materials (ADFM) products (such as brake pads and linings) containing asbestos (a known carcinogen) in 1989. However, ADFM products were exempted in 1991. Recent reports indicate that asbestos is widely used in after-market brakes. However, the proportion of vehicle brakes containing asbestos, as well as the compositional formulation of asbestos in the brake lining material, is unknown. Therefore, motor vehicle emission rates and inventories of asbestos are also unknown.

Objective
The objective of this study is to obtain information that can be used to estimate the extent of asbestos emissions due to brake-wear from vehicles used in California. The key elements include the identification and verification of asbestos in brakes, and the determination of the character and composition of asbestos in dust produced by vehicle brake-wear.

Methods
The first task is to survey the brake industry to assess the prevalence of asbestos in brakes of vehicles in California. Subsequently, samples of brakes and brake dust will be collected from brake repair shops, and from vehicles operated on a dynamometer. These samples will be subjected to detailed laboratory analysis. Finally, the contractor will characterize the form, size, and levels of asbestos present in brake dust.

Expected Results
This project will characterize the asbestos composition of the brakes and brake-wear generated dust collected from vehicles, including the asbestos fiber type, fiber size distribution, and concentration as a percent of total mass. The results will help clarify the relationship between the form of asbestos present in brakes, and the asbestos released in the brake dust by high temperature abrasion. The ARB staff will obtain useful information on the nature and use of current automotive brake lining products containing asbestos, as verified through direct laboratory analysis.

Significance to the Board
Recent reports show that asbestos is widely used in after-market brakes. To determine the need to control emissions of this carcinogen, ARB staff need to estimate the extent of asbestos emissions due to brake-wear from vehicles used in California. The results of this project should help the ARB to assess the potential health threat from public exposure to asbestos emissions generated from brake-wear.

Contractor:
California Department of Health Services (DHS)

Contract Period:
18 months

Principal Investigator (PI):
Dr. Stephen Wall

Contract Amount:
$131,055

Cofunding:
None

Basis for Indirect Cost Rate:
The indirecct cost rate specified is what DHS requires for all contracts. The ARB staff accepted their 19 percent rate, regarding it as relatively low compared to those required by non-State laboratories.

Past Experience with this Principal Investigator:
Dr. Stephen Wall successfully completed a research study for the ARB that involved the development of a sophisticated sampling technique of toxic chemicals from stationary sources (Contract No. A932-098, Final Report Date October, 1996).

Prior Research Division Funding to California Department of Health Services:

Year	2001	2000	1999
Funding	$0	$0	$0

BUDGET SUMMARY

California Department of Health Services

Determination of the Asbestos Content of Current Automotive Dry Friction Materials, and the Potential Contribution of Asbestos to the Particulate Matter Derived from Brake Wear

DIRECT COSTS AND BENEFITS			
1.	Labor and Employee Fringe Benefits	$ 59,652	
2.	Subcontractors	$ 20,816	
3.	Equipment	$	
4.	Travel and Subsistence	$ 2,243	
5.	Electronic Data Processing	$	
6.	Reproduction/Publication	$ 1,215	
7.	Mail and Phone	$ 1,215	
8.	Supplies	$ 25,375[1]	
9.	Analyses	$	
10.	Miscellaneous	$ 374	
	Total Direct Costs		$ 110,890
INDIRECT COSTS			
1.	Overhead	$ 12,407	
2.	General and Administrative Expenses	$ 7,758	
3.	Other Indirect Costs	$	
4.	Fee or Profit	$	
	Total Indirect Costs		$ 20,165
TOTAL PROJECT COSTS			**$ 131,055**

[1] Supplies: $25,375
General expenses for consumables, $ 5,421
Calibration standards, sampling, and analysis consumables, $14,954
Components for fabrication and assembly of sampling system, $5,000

PROPOSED

State of California
AIR RESOURCES BOARD

Resolution 02-15

March 21, 2002

Agenda Item No.: 02-2-2

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 2505-223, entitled "Incidence of Malfunctioning and Tampering in Heavy-Duty Vehicles," has been submitted by the University of California, Riverside;

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 2505-223, entitled "Incidence of Malfunctioning and Tampering in Heavy-Duty Vehicles," submitted by the University of California, Riverside, for a total amount not to exceed $199,103.

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 2505-223, entitled "Incidence of Malfunctioning and Tampering in Heavy-Duty Vehicles," submitted by the University of California, Riverside, for a total amount not to exceed $199,103.

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 $199,103.

ATTACHMENT A

Incidence of Malfunctioning and Tampering in Heavy-Duty Vehicles

Background

The EMFAC2000 emission model estimates excess PM and NO_x emissions due to 23 faults in diesel engines. For each fault and class of diesel vehicle, the calculation is:

$$I \times F \times E$$

where: I is an incidence estimate (fraction of all such vehicles operating with the fault).
F is an estimate of the fractional emission increase for the average occurrence of the fault.
E is the base (w/o fault) emission rate for the class.

Most of the estimates of incidence (I) are derived from a 1988 contract report. The scant empirical data on the incidence of faults available then were for trucks with engines whose controls were either mechanical-only or mechanical with rudimentary electronic controls. Much of the basis for the incidence estimates in the 1988 work was merely opinion expressed by fleet mechanics or engineering assumptions. Those opinions and assumptions applied to a situation before the ARB's current smoke inspection programs and before computerized electronic engine controls.

Objective

- To update estimates of the incidence (I) of 23 specified malfunctions and types of tampering ("faults") in on-road heavy-duty diesel vehicles. These faults have been identified as increasing NO_x or PM emissions from diesel engines made before the advent of electronic controls on the engines.

- To assess the need to characterize types of faults to which electronically controlled engines may be susceptible. Such faults could be added to emission inventory calculations and included in an inspection-and-maintenance program.

Methods

CE-CERT will develop the new estimates by reviewing all the existing work on estimating fault incidence, reviewing data from past field work, obtaining new data by surveying several sources of information, and conducting roadside inspections. Specific steps are:

1. <u>Review of Databases</u>

- Open literature
- Data from ARB's roadside inspections and fleet inspections
- U.S. EPA data
- OEM supplier and manufacturer recalls
- Manufacturers' warranty data

2. Surveys to Obtain New Data
- Surveys of manufacturers, engine rebuilders, and parts wholesalers for repair information
- Surveys of repair and maintenance records of HDD fleets
- Surveys of commercial repair shop registries

3. Field Work
- Random roadside inspections (in concert with Enforcement Division) to count the occurrence of the faults that are visually detectable
- Retrieval with proprietary scanning tools of fault records from the memory chips of inspected vehicles that have electronic controls

Abbreviated versions of the tasks in 2 and 3, above, will be conducted first in a pilot project to assess the availability and quality of data from the various sources. The balance of the project will be conducted only if the Research Screening Committee agrees that the results of the pilot work indicate that further work will be worthwhile. The budget for the pilot work and its report is $52,509.

Expected Results
The project should provide more accurate estimates of the incidence of the 23 faults now recognized in the emission inventory calculations for heavy-duty vehicles. Also, it will provide a basis for identifying new faults specific to engines with electronic controls.

Significance to the Board
Periodically, the ARB must update factors used in emission inventory calculations. Also, the ARB must analyze potential subjects for inclusion in a heavy-duty inspection-and-maintenance program.

Contractor
College of Engineering - Center for Environmental Research and Technology, University of California, Riverside (CE-CERT)

Contract Period: 18 months

Principal Investigator (PI): Dr. J. Wayne Miller

Contract Amount: $199,103

Cofunding: none

Basis for Indirect Cost Rate
The State and the UC System have agreed to a ten percent indirect cost rate.

Past Experience with this Principal Investigator
The principal investigator, J. Wayne Miller, has a Ph.D. in Chemical Engineering from Caltech. Because he joined CE-CERT only recently (December 2000), the Research Division has not previously engaged him for research. However, Dr. Miller is a key participant in the California Energy Commission's study "Methodology to Assess Air Quality Impacts of Distributed and Back-Up Generation", is a reviewer for SSD on fuels regulations, and heads the ARB-supported Mobile On-Road Heavy-Duty Emissions Laboratory. Prior to joining CE-CERT, Dr. Miller was Vice President of Technology and Development for Sun Oil. Previously, at Unocal, he led a large research program related to reformulated gasoline.

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

Year	2001	2000	1999
Funding	$ 79,884	$654,788	$659,987

BUDGET SUMMARY

College of Engineering - Center for Environmental Research
and Technology, University of California, Riverside

Incidence of Malfunctioning and Tampering in Heavy-Duty Vehicles

DIRECT COSTS AND BENEFITS			
1.	Labor and Employee Fringe Benefits	$133,461	
2.	Subcontractors	$ 0	
3.	Equipment	$ 12,966	
4.	Travel and Subsistence	$ 7,045	
5.	Electronic Data Processing	$ 0	
6.	Reproduction/Publication	$ 0	
7.	Mail and Phone	$ 1,000	
8.	Supplies	$ 0	
9.	Analyses	$ 0	
10.	Miscellaneous	$ 30,480 (1)	
	Total Direct Costs		$184,952
INDIRECT COSTS			
1.	Overhead	$ 14,151	
2.	General and Administrative Expenses	$ 0	
3.	Other Indirect Costs	$ 0	
4.	Fee or Profit	$ 0	
	Total Indirect Costs	$ 14,151	
TOTAL PROJECT COSTS			**$199,103** (2)

(1) a charge to cover CE-CERT's off-campus rent

(2) The budget will be implemented in two severable phases. The first phase, $52,509, is for pilot work consisting of partial completion of certain tasks. The second phase, $146,594, is for completing the balance of all the project's tasks. It will be implemented only if the Research Screening Committee finds that the pilot work provides a reasonable expectation of a successful project.