State of California

AIR RESOURCES BOARD

Research Resolutions

Research Division

December 11, 2003

INTRODUCTION

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

Item 1 is a research proposal, Resolution 03-31, from the University of California, Riverside, entitled, "Identification and Atmospheric Reactions of Polar Products of Selected Aromatic Hydrocarbons". The principal investigators will be Professors Roger Atkinson and Janet Arey.
Resolution No.

Item 2 is a research proposal, Resolution 03-32, from the University of California, Riverside, entitled, "Updated Chemical Mechanism for Airshed Model Applications". The principal investigator will be Professor William P. L. Carter.
Resolution No.

Item 3 is a research proposal, Resolution 03-33, from the University of California, San Diego, entitled, "The Use of Multi-Isotope Ratio Measurements and a New and Unique Technique to Resolve NO Transformation, Transport and Nitrate Deposition in the Lake Tahoe Basin". The principal investigator will be Professor Mark Thiemens.
Resolution No.

Item 4 is a research proposal, Resolution 03-34, from the Office of Environmental Health Hazard Assessment, entitled, "Traffic Pollution and Children's Health: Refining Estimates of Exposure For The East Bay Children's Respiratory Health Study". The principal investigator will be Dr. Bart Ostro.
Resolution No.

Item 5 is a research proposal, Resolution 03-35, from the University of California, Riverside, entitled, "Polycyclic Aromatic Hydrocarbons (PAHs): Sources of Ambient Quinones". The principal investigators will be Professors Roger Atkinson and Janet Arey.
Resolution No.

Item 6 is a research proposal, Resolution 03-36, from California Institute of Technology/NASA/Jet Propulsion Laboratory, entitled, "Gas-Phase Formation Rates of Nitric Acid and its Isomers under Urban Conditions". The principal investigator will be Professor Mitchio Okumura.
Resolution No.

PROPOSED

State of California
AIR RESOURCES BOARD

Resolution 03-31

December 11, 2003

Agenda Item No.: 03-10-5

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 2538-232, entitled "Identification and Atmospheric Reactions of Polar Products of Selected Aromatic Hydrocarbons", 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 2538-232 entitled "Identification and Atmospheric Reactions of Polar Products of Selected Aromatic Hydrocarbons", submitted by the University of California, Riverside, for a total amount not to exceed $49,999.

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 2538-232 entitled "Identification and Atmospheric Reactions of Polar Products of Selected Aromatic Hydrocarbons", submitted by the University of California, Riverside, for a total amount not to exceed $49,999.

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, and as described in Attachment A, in an amount not to exceed $49,999.

ATTACHMENT A

"Identification and Atmospheric Reactions of Polar Products of Selected Aromatic Hydrocarbons"

Background

Aromatic hydrocarbons are a significant portion of anthropogenic emissions of VOCs, and form major components of vehicle exhaust, emissions from combustion processes, and evaporative emissions from industrial processes and solvent usage. These compounds play a central role in the formation of secondary pollutants, such as ozone and secondary organic aerosol (SOA), which is due not only to their high emission rates but also to their generally high reactivity in the atmosphere. Estimates indicate that the oxidation of aromatic hydrocarbons is a major contributor to ozone formation on local and regional scales, and, because of the relatively high yield of low volatility products, to the formation of SOA. In contrast to their importance in the production of secondary pollutants, information concerning reaction rates and detailed mechanisms leading to these products is limited. This incomplete knowledge is due to several factors: ring-opening reaction pathways are complex and depend sensitively on the experimental conditions (e.g. NOx concentrations); multifunctional oxygenated compounds are difficult to measure, especially as a function of time as needed in kinetic studies; the multifunctional products are generally highly reactive.

Objective

The objectives of this project are to identify and measure the rates of formation of dicarbonyl and hydroxycarbonyl compounds that are produced by hydroxyl radical-initiated reactions of aromatic hydrocarbons. In addition, the rates of reaction of the carbonyl-containing products with hydroxy radicals will be measured, along with photolysis rates and products of these processes.

Methods

A variety of techniques will be used to both identify and measure the concentrations of chemical species within large volume Teflon chambers: derivatization will be done with Solid-Phase Micro Extraction (SPME) fibers, which allows on-fiber derivatization of carbonyl-containing products; identification of compounds will be made by combined gas chromatography-mass spectrometry (GC-MS) and gas chromatography-flame ionization detection (GC-FID) analysis.

Expected Results

Using these methods, time-concentration measurements of carbonyl products will be taken (approximately every five minutes during a reaction); this data will allow accurate determination of the rate constants for both hydroxyl radical-initiated reactions and photolysis of the products.

Significance to the Board

The primary benefit provided by this project would be accurate kinetic and mechanistic data for atmospheric reactions of aromatic hydrocarbons, highly reactive compounds

that form ozone and PM2.S_1 which will assist in the formulation of more accurate atmospheric chemistry models of air pollution, including the formation of secondary organic aerosols. Such models will also help in the development of effective air pollution control strategies and in assessments of the human health risks associated with aromatic hydrocarbons.

Contractor:
University of California, Riverside

Contract Period:
12 months

Principal Investigators (PIs):
Roger Atkinson and Janet Arey

Contract Amount:
$49,999

Cofunding:
None

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

Past Experience with this Principal Investigator:
These Principal Investigators have performed very successfully in all previous contracts with the ARB, which span over 15 years. Their work has addressed the atmospheric chemistry of a variety of volatile organic compounds and has led to improved rates and mechanisms in models.

980

Prior Research Division Funding to UCR:

Year	2002	2001	2000
Funding	$0	$467,736	$894,890

BUDGET SUMMARY

University of California at Riverside

"Identification and Atmospheric Reactions of Polar Products of Selected Aromatic Hydrocarbons"

DIRECT COSTS AND BENEFITS				
1.	Labor and Employee Fringe Benefits	$	35,304	
2.	Subcontractors	$	0	
3.	Equipment	$	0	
4.	Travel and Subsistence	$	1,000	
5.	Electronic Data Processing	$	0	
6.	Reproduction/Publication	$	0	
7.	Mail and Phone	$	200	
8.	Supplies	$	8,500	
9.	Analyses	$	0	
10.	Miscellaneous	$	450	
	Total Direct Costs			$ 45,454
INDIRECT COSTS				
1.	Overhead	$	4,545	
2.	General and Administrative Expenses	$	0	
3.	Other Indirect Costs	$	0	
4.	Fee or Profit	$	0	
	Total Indirect Costs			$ 4,545
TOTAL PROJECT COSTS				**$ 49,999**

PROPOSED

State of California
AIR RESOURCES BOARD

Resolution 03-32

December 11, 2003

Agenda Item No.: 03-10-5

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 2542-232, entitled "Updated Chemical Mechanism for Airshed Model Applications", 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 2542-232 entitled "Updated Chemical Mechanism for Airshed Model Applications", submitted by the University of California, Riverside, for a total amount not to exceed $166,132.

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 2542-232 entitled "Updated Chemical Mechanism for Airshed Model Applications", submitted by the University of California, Riverside, for a total amount not to exceed $166,132.

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 $166,132.

ATTACHMENT A

"Updated Chemical Mechanism for Airshed Model Applications"

Background

Air quality simulation models are used to assess the effectiveness of the control strategies and to develop plans and regulations for achieving air quality standards by regulatory agencies. An example is the use of urban airshed models in the State Implementation Plan (SIP) development. Among many factors that affect the model performance, the gas-phase chemical mechanism that represents the gas-phase chemical reactions involved in the model is a critical component for predictions of pollutants such as ozone, particulate matter, and other secondary pollutants (e.g., air toxics).

Under the sponsorship of the ARB, a detailed version of atmospheric chemical mechanism (referred to as SAPRC-99) was developed in 1999 by Dr. Carter at UCR. This mechanism was peer-reviewed and found to be a state-of-the-science mechanism. It has been widely used in many regulatory and research applications. For example, this mechanism was recently used in updating the reactivity scales for volatile organic compounds (VOCs) for the California's aerosol coatings regulation. Since the chemical information used in the SAPRC99 mechanism is evolving and improving, it is crucial that the mechanism is reviewed and updated periodically to be consistent with the up-to-date atmospheric science.

The most cost-effective and reliable way to test the accuracy of a chemical mechanism is to compare its predictions against results of environmental chamber experiments that simulate the range of conditions in the atmosphere. Due to the experimental limitations, most of the chamber experiments that have been carried out lack measurement data for important intermediate and product species. This limits the level of detail to which the mechanisms can be evaluated, and the types of air quality impact predictions that can be assessed. The U.S. EPA funded Dr. Carter to develop a "next generation" environmental chamber facility to provide an improved capability for more comprehensive mechanism evaluation under more realistic conditions (e.g., low NOx conditions). This project will take advantage of this advanced facility.

Objective

The overall objective of this project is to develop and comprehensively evaluate updated detailed and condensed SAPRC atmospheric mechanisms for use in photochemical airshed models for predicting formation of secondary gas-phase pollutants (e.g., ozone and air toxics).

Methods

Both experimental and model studies are proposed to accomplish the objectives of this project. The proposed project will incorporate the most recent laboratory and environmental chamber data, improve representations for aromatics, develop a capability of representing chlorine chemistry, conduct environmental chamber

experiments, develop a condensed mechanism for model applications requiring computational efficiency, and implement the updated mechanisms into a regional air quality model.

Expected Results
The product from this effort will be updated detailed and condensed versions of SAPRC chemical mechanism for airshed model applications.

Significance to the Board
The results of this project will provide the ARB, other regulatory agencies, and researchers with improved and more up-to-date models for the prediction of secondary pollutants, and lead to more scientifically sound control plans and strategies.

Contractor:
University of California, Riverside

Contract Period:
18 months

Principal Investigator (PI):
William P. L. Carter, Ph.D.

Contract Amount:
$166,132

Cofunding:
The U.S. EPA has funded Dr. Carter to develop the next-generation environmental chamber facility needed for evaluating gas-phase and gas-to-particle atmospheric reaction mechanisms. Specifically, this facility is designed for mechanism evaluation under more realistic conditions (e.g., low NO_x conditions). Considering the significant amount of the U.S. EPA funding allocated for the chamber work, this project is considered significantly cost-effective.

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:
The principal investigator, Dr. William Carter, is one of the pioneers in developing the gas-phase atmospheric chemical mechanism. He has published approximately 75 journal articles and almost 70 technical reports in the areas of atmospheric chemistry, chemical mechanism development, and VOC reactivity assessment. He has completed several projects on the gas-phase chemical mechanism developments and has always delivered a quality product at a very reasonable cost. Currently, the Principal Investigator is conducting two ARB projects on reactivity assessment and low NO_x evaluation, respectively.

Prior Research Division Funding to UCR:

Year	2002	2001	2000
Funding	$0	$467,736	$894,890

BUDGET SUMMARY

The University of California, Riverside

"Updated Chemical Mechanism for Airshed Model Applications"

DIRECT COSTS AND BENEFITS				
1.	Labor and Employee Fringe Benefits	$	112,546	
2.	Subcontractors	$	0	
3.	Equipment	$	0	
4.	Travel and Subsistence	$	0	
5.	Electronic Data Processing	$	825	
6.	Reproduction/Publication	$	0	
7.	Mail and Phone	$	0	
8.	Supplies	$	13,544	
9.	Analyses	$	0	
10.	Miscellaneous*	$	26,525	
	Total Direct Costs			$ 153,440
INDIRECT COSTS				
1.	Overhead	$	12,692	
2.	General and Administrative Expenses	$	0	
3.	Other Indirect Costs	$	0	
4.	Fee or Profit	$	0	
	Total Indirect Costs			$ 12,692
TOTAL PROJECT COSTS				**$ 166,132**

*** CE-CERT is a permanent off-campus facility, federal regulations require us to account for facilities rental as a direct cost. Facilities rental is charged based on 20.9% of Modified Total Direct Costs (MTDC). MTDC consists of total direct costs minus equipment, facilities rental, graduate student partial fee remission/health insurance (included benefits), and subcontracts over $25,000.**

PROPOSED

State of California
AIR RESOURCES BOARD

Resolution 03-33

December 11, 2003

Agenda Item No.: 03-10-5

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 2543-232, entitled "The Use of Multi-Isotope Ratio Measurements and a New and Unique Technique to Resolve NO Transformation, Transport and Nitrate Deposition in the Lake Tahoe Basin", has been submitted by the University of California, San Diego.

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 2543-232 entitled "The Use of Multi-Isotope Ratio Measurements and a New and Unique Technique to Resolve NO Transformation, Transport and Nitrate Deposition in the Lake Tahoe Basin", submitted by the University of California, San Diego, for a total amount not to exceed $75,000.

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 2543-232 entitled "The Use of Multi-Isotope Ratio Measurements and a New and Unique Technique to Resolve NO Transformation, Transport and Nitrate Deposition in the Lake Tahoe Basin", submitted by the University of California, San Diego, for a total amount not to exceed $75,000.

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 $75,000.

ATTACHMENT A

"The Use of Multi-Isotope Ratio Measurements and a New and Unique Technique to Resolve NO Transformation, Transport and Nitrate Deposition in the Lake Tahoe Basin"

Background

The world-renowned clarity of Lake Tahoe has significantly declined since the mid-1960s due to increased inputs into the Lake of particulate matter, phosphorus and nitrate. To address this concern, the Lahontan Regional Water Quality Board and the Nevada Division of Environmental Protection are currently developing a Total Maximum Daily Load (TMDL) for Lake Tahoe. A TMDL is a water quality restoration plan designed to determine the ability of a body of water to accept contaminants without resulting in a reduction of water clarity. The TMDL process includes a plan to implement the controls necessary to meet the TMDL. Identification of the sources of pollutants such as nitrate to Lake Tahoe is an essential precursor to any control strategies.

Objective

The objective of this project is to perform nitrate isotope measurements on both aerosol and Lake water nitrates to identify and quantify the sources and variability of nitrate in the region and to the Lake.

Methods

The work will use a new technique based on ratios of isotopes of nitrogen and oxygen. This new technique has already been demonstrated to be unique in its ability to provide this information and will be a powerful complement to other work being done to support the development of the TMDL.

Expected Results

This project will provide estimates of the contributions from atmospheric deposition, and ground water to nitrate inputs to Lake Tahoe.

Significance to the Board

The ARB is currently conducting the Lake Tahoe Atmospheric Deposition Study (LTADS) with the goal of developing improved estimates of the annual and seasonal loading of phosphorus, nitrogen and particulate matter from atmospheric deposition to Lake Tahoe and improved attribution of the in-basin and out-basin sources of these materials. The results from this proposal will be used to augment nitrate data gathered during LTADS and help identify and quantify sources and variability of nitrate inputs to the Lake.

Contractor:

University of California, San Diego

Contract Period:
24 months

Principal Investigator (PI):
Professor Mark Thiemens

Contract Amount:
$75,000

Cofunding:
This project will be funded with funds provided by the U.S. EPA to the Board for work related to Lake Tahoe.

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:
This is the ARB's first contract with Professor Thiemens. Professor Thiemens is the Dean of the Division of Natural Science at UC San Diego and a distinguished Scientist. He has received numerous awards and is a member of the American Academy of Arts and Sciences Member. He has co-authored over 150 publications.

990

Prior Research Division Funding to UCSD:

Year	2002	2001	2000
Funding	$0	$0	$333,790

BUDGET SUMMARY

University of California at San Diego

"The Use of Multi-Isotope Ratio Measurements and a New and Unique Technique to Resolve NO Transformation, Transport and Nitrate Deposition in the Lake Tahoe Basin"

DIRECT COSTS AND BENEFITS			
1.	Labor and Employee Fringe Benefits	$ 51,815	
2.	Subcontractors	$ 0	
3.	Equipment	$ 6,000	
4.	Travel and Subsistence	$ 5,000	
5.	Electronic Data Processing	$ 0	
6.	Reproduction/Publication	$ 0	
7.	Mail and Phone	$ 868	
8.	Supplies	$ 5,000	
9.	Analyses	$ 0	
10.	Miscellaneous	$ 1,000	
	Total Direct Costs		$ 69,683
INDIRECT COSTS			
1.	Overhead	$ 5,317	
2.	General and Administrative Expenses	$ 0	
3.	Other Indirect Costs	$ 0	
4.	Fee or Profit	$ 0	
	Total Indirect Costs		$ 5,317
TOTAL PROJECT COSTS			**$ 75,000**

PROPOSED

State of California
AIR RESOURCES BOARD

Resolution 03-34

December 11, 2003

Agenda Item No.: 03-10-5

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 2540-232, entitled "Traffic Pollution and Children's Health: Refining Estimates of Exposure For The East Bay Children's Respiratory Health Study", has been submitted by the Office of Environmental Health Hazard Assessment.

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 2540-232 entitled "Traffic Pollution and Children's Health: Refining Estimates of Exposure For The East Bay Children's Respiratory Health Study", submitted by the Office of Environmental Health Hazard Assessment, for a total amount not to exceed $243,854.

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 2540-232 entitled "Traffic Pollution and Children's Health: Refining Estimates of Exposure For The East Bay Children's Respiratory Health Study", submitted by the Office of Environmental Health Hazard Assessment, for a total amount not to exceed $243,854.

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 $243,854.

ATTACHMENT A

"Traffic Pollution and Children's Health: Refining Estimates of Exposure For The East Bay Children's Respiratory Health Study"

Background

Traffic-related emissions are the principal source of air pollution in most urban areas. Several epidemiological studies suggest that residence near areas of high traffic density may be associated with a variety of respiratory health outcomes. Most of these epidemiological studies were conducted in Europe and Japan, and of the studies conducted in the United States and Canada only a few have measured levels of traffic pollutants at a school or residential location as part of the exposure assessment. Bart Ostro et al. of Office of Environmental Health Hazard Assessment (OEHHA) initiated the East Bay Children's Respiratory Health Study (EBCHRS) in 2000-2001. This study collected primary data on health and traffic-related pollutant concentrations from children attending elementary schools in Alameda County, California. Health outcomes evaluated included episodes of asthma and bronchitis. The proposed study builds on the Alameda County study.

Objective

This study will refine estimates of residential and school exposure to traffic-related pollutants through the integration of traffic, air pollution and time-activity data using geographic information methods. This study will provide methodological guidance for future traffic studies, help elucidate associations between traffic and health, and address issues of environmental justice.

Methods

The contractor will develop and test empirical models that relate school- and neighborhood-scale ambient pollution monitoring to GIS based traffic metrics and use GIS-based traffic estimates to validate self-report traffic measures. They will also develop time-weighted estimates, using traffic-based exposure measures at the subjects' schools and residences and evaluate the impact of these traffic based exposure metrics on the direction, magnitude, and precision of the effect estimate. In addition, the contractor will evaluate other potential school-facility specific factors that might contribute to respiratory symptoms using a school indoor air quality survey and utilize GIS based traffic estimates to test empirically for differential residential exposures by socioeconomic status, race, and ethnicity in the study population.

Expected Results

This study will provide methodological guidance for future traffic studies, help elucidate associations between traffic and health, and investigate issues of environmental justice. The investigators will be able to refine their exposure estimates, reduce exposure misclassification, and provide reliable estimates of the association between exposure to air pollution and adverse health outcomes.

Significance to the Board
The refinement and comparison of the various traffic metrics could lead to the best low-cost expedient methods of determining exposure for use in other epidemiological studies and risk assessments. Information generated from this study will be useful for both ambient air quality standards and pollution control strategies by identifying vulnerable populations and determining ambient concentrations that are levels of concern for these groups.

Contractor:
Office of Environmental Health Hazard Assessment

Contract Period:
24 months

Principal Investigator (PI):
Bart Ostro

Contract Amount:
$243,854

Cofunding:
None for this project.

Basis for Indirect Cost Rate:
Negotiated rate with the Office of Environmental Health Hazard Assessment of ten percent.

Past Experience with this Principal Investigator:
Bart Ostro is the Chief of the Air Pollution and Epidemiology Unit of the Office of Environmental Health Hazard Assessment. His experience in air pollution and epidemiology has led him, together with ARB, to evaluate the Ambient Air Pollutants Standards. He has published over 32 studies that are related to ambient air, indoor air pollution, and health effects.

Prior Research Division Funding to OEHHA:

Year	2002	2001	2000
Funding	$0	$0	$0

BUDGET SUMMARY

Office of Environmental Health Hazard Assessment

"Traffic Pollution and Children's Health: Refining Estimates of Exposure For The East Bay Children's Respiratory Health Study"

DIRECT COSTS AND BENEFITS				
1.	Labor and Employee Fringe Benefits	$	0	
2.	Subcontractors	$	196,910*	
3.	Equipment	$	2,500	
4.	Travel and Subsistence	$	6,800	
5.	Electronic Data Processing	$	7,500	
6.	Reproduction/Publication	$	1,000	
7.	Mail and Phone	$	0	
8.	Supplies	$	2,000	
9.	Analyses	$	0	
10.	Miscellaneous	$	4,975	
	Total Direct Costs			$ 221,685
INDIRECT COSTS				
1.	Overhead	$	22,169	
2.	General and Administrative Expenses	$	0	
3.	Other Indirect Costs	$	0	
4.	Fee or Profit	$	0	
	Total Indirect Costs			$ 22,169
TOTAL PROJECT COSTS				**$ 243,854**

*** Subcontractor's: California Department of Health Service for a total cost of $44,660, CSUS foundation for a total cost of $196,910, GIS consultant for a total cost of $32,000, and Brett Singer, Ph.D for a total cost of $3,500.**

PROPOSED

State of California
AIR RESOURCES BOARD

Resolution 03-35

December 11, 2003

Agenda Item No.: 03-10-5

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 2539-232, entitled "Polycyclic Aromatic Hydrocarbons (PAHs): Sources of Ambient Quinones", 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 2539-232 entitled "Polycyclic Aromatic Hydrocarbons (PAHs): Sources of Ambient Quinones", submitted by the University of California, Riverside, for a total amount not to exceed $120,000.

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 2539-232 entitled "Polycyclic Aromatic Hydrocarbons (PAHs): Sources of Ambient Quinones", submitted by the University of California, Riverside, for a total amount not to exceed $120,000.

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 $120,000.

ATTACHMENT A

"Polycyclic Aromatic Hydrocarbons (PAHs): Sources of Ambient Quinones"

Background

Exposure to fine particulate matter in ambient air has been associated with high rates of morbidity and mortality. Although the causes are not established, much of these health effects may be due to quinones residing on the particles. After inhalation, quinones can generate large amounts of toxic 'reactive oxygen species' that can overwhelm cellular defenses. PAH-quinones, which are formed from atmospheric reactions of polycyclic aromatic compounds (PAHs) present in vehicle exhaust, may have significant consequences for the health of Californians.

Objective

The objective of this study is to evaluate the potential for atmospheric reactions to contribute to PAH-quinone exposure by:
1) assessing the formation of PAH-quinones from the atmospheric reactions of naphthalene, alkyl-naphthalenes, and phenanthrene; and
2) identifying the dimethyl-nitro-naphthalenes formed from atmospheric reactions of dimethyl-naphthalenes and studying their photolysis products, which are expected to include quinones.

Methods

PAHs will be chosen based upon their abundance in ambient air, and photolyzed in an environmental chamber. The investigators will screen the products derived from these reactions for the presence of quinones. The investigators will also screen for quinone products from the reaction of phenanthrene with the nitrate radical and with ozone, as well as from the photolysis products of nitronaphthalenes. Based on the screening experiments, the investigators will conduct further experiments on those PAHs that show the highest abundance of tentative quinone products.

Expected Results

Products of reactions of likely PAH-quinone precursors will be analyzed, with an emphasis on the quinones. Sufficient quantities of PAH-quinones will be produced to allow isomer-specific identification of the quinone products. If possible, the rate and extent of quinone formation will be determined.

Significance to the Board

Several researchers have been referring to the hypothesis that much of the high morbidity and mortality associated with fine particulate matter may be due to quinones. Also, significant airborne levels of quinones may derive from PAHs emitted by motor vehicles, particularly diesel-powered vehicles. This study will provide important information to help staff understand the role of atmospheric reactions in the production of PAH-quinones. The resulting data will be needed for future assessment of the potentially significant health risk to California residents that is associated with emissions of traffic-derived PAHs.

Contractor:
University of California, Riverside

Contract Period:
24 months

Principal Investigators (PIs):
Janet Arey and Roger Atkinson

Contract Amount:
$120,000

Cofunding:
none

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

Past Experience with these Principal Investigators:
The PIs have consistently provided high-quality, cost-effective research results for the ARB. Their lab has state-of-the art environmental chambers for their proposed experiments, as well as access to extensive analytical instrumentation. They have successfully used their environmental chambers and appropriate analytic instrumentation in previous ARB contracts to characterize important PAH reaction products.

1000

Prior Research Division Funding to UCR:

Year	2002	2001	2000
Funding	$0	$467,736	$894,890

BUDGET SUMMARY

University of California, Riverside

"Polycyclic Aromatic Hydrocarbons (PAHs): Sources of Ambient Quinones"

DIRECT COSTS AND BENEFITS				
1.	Labor and Employee Fringe Benefits	$	83,278	
2.	Subcontractors	$	0	
3.	Equipment	$	0	
4.	Travel and Subsistence	$	0	
5.	Electronic Data Processing	$	0	
6.	Reproduction/Publication	$	0	
7.	Mail and Phone	$	0	
8.	Supplies	$	22,397	
9.	Analyses	$	0	
10.	Miscellaneous	$	3,416	
	Total Direct Costs			$ 109,091
INDIRECT COSTS				
1.	Overhead	$	10,909	
2.	General and Administrative Expenses	$	0	
3.	Other Indirect Costs	$	0	
4.	Fee or Profit	$	0	
	Total Indirect Costs			$ 10,909
TOTAL PROJECT COSTS				**$ 120,000**

PROPOSED

State of California
AIR RESOURCES BOARD

Resolution 03-36

December 11, 2003

Agenda Item No.: 03-10-5

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 California Institute of Technology/NASA/Jet Propulsion Laboratory;

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 California Institute of Technology/NASA/Jet Propulsion Laboratory, 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 California Institute of Technology/NASA/Jet Propulsion Laboratory, 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 NOx 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 this 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%) in an urban airshed model produces an uncertainty of 35 ppbv in the calculated ozone concentration at a site downwind (i.e. ~25-50% 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% 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% or less. The branching ratios for the formation of the products HNO_3 and HOONO will also be measured. The groups of Professor M. Okumura and Professor 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:
California Institute of Technology

Contract Period:
24 Months

Principal Investigator (PI):
Professor Mitchio Okumura

Contract Amount:
$180,000

Basis for Indirect Cost Rate:
Cost pools for functions and activities within this group are titled: (1) Engineering and Science, (2a) Procurement-subcontracts, (2b) Procurement-Purchase Orders, and (3) General. The accounting practice constructs each pool based on the nature of the specified functions or activities performed with costs consistently accumulated by expenditure type regardless of the associated organization.

Past Experience with this Principal Investigator:
Professor Mitchio Okumura is the head of a laser spectroscopy laboratory which contains several state-of-the-art instruments for high-sensitivity investigations of atmospheric radicals and transient species. He is a recognized leader in research concerning elementary reaction kinetics and photochemical processes relevant to the troposphere and stratosphere.

Prior Research Division Funding to CIT:

Year	2002	2001	2000
Funding	$0	$0	$0

BUDGET SUMMARY

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	$81,925	
2.	Subcontractors	$10,000	
3.	Equipment	$13,792	
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	$15,875	
	Total Direct Costs		$126,292
INDIRECT COSTS			
1.	Overhead	$53,708	
2.	General and Administrative Expenses	$ 0	
3.	Other Indirect Costs	$ 0	
4.	Fee or Profit	$ 0	
	Total Indirect Costs		$53,708
TOTAL PROJECT COSTS			**$180,000**