

State of California
AIR RESOURCES BOARD

RESEARCH PROPOSAL

Resolution 04-32

October 29, 2004

Agenda Item No.: 04-9-9

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 2553-244, entitled "Climate Change - Characterization of Black Carbon and Organic Carbon Air Pollution Emissions and Evaluation of Measurement Methods", has been submitted by Desert Research Institute;

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 2553-244 entitled "Climate Change - Characterization of Black Carbon and Organic Carbon Air Pollution Emissions and Evaluation of Measurement Methods", submitted by Desert Research Institute, for a total amount not to exceed \$449,997.

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 2553-244 entitled "Climate Change - Characterization of Black Carbon and Organic Carbon Air Pollution Emissions and Evaluation of Measurement Methods", submitted by Desert Research Institute, for a total amount not to exceed \$449,997.

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 \$449,997.

I hereby certify that the above is a true and correct copy of Resolution 04-32, as adopted by the Air Resources Board.

Lori Andreoni, Clerk of the Board

ATTACHMENT A

“Climate Change - Characterization of Black Carbon and Organic Carbon Air Pollution Emissions and Evaluation of Measurement Methods”

Background

The ARB is required under AB 1493 to adopt regulations that reduce greenhouse gas emissions from motor vehicles. However, particulate emissions are also believed to play a significant role in global warming. Highly absorbing aerosols, such as soot, are so efficient as light absorbers that they could result in a net warming of the atmosphere. Aside from the direct warming effect of atmospheric aerosols (which may exceed the accumulated impact of non-CO₂ greenhouse gases), they can reduce rainfall by "burning off" cloud cover, causing further climatic effects. Black carbon is generally defined as the carbon component of particulate matter that absorbs light. However, this specific component of particulate matter is difficult to measure. Different measurements of light-absorbing carbon are not well related, and consensus on interpretation has not yet been reached for the current suite of available measurement techniques. This project will examine the fundamental reasons underlying differences of optical and thermo-optical methods, and will develop reliable emissions factors for use in development of a California emission inventory of climate active carbonaceous particulate matter.

Objective

This project will compare and contrast results from laboratory tests and an ambient air field study of particulate carbon sampling using optical and filter-based sampling techniques. This project will also clarify the role of different combustion processes in determining emission rates of black carbon (BC) and organic carbon (OC) to the atmosphere including the uncertainty inherent in these factors.

Methods

This research study will be conducted in two phases. Phase I consists of gaining a better understanding of OC and BC measurement methods. This is accomplished by generating test aerosols from carbon powders and combustion sources in a test chamber where they can be sampled simultaneously by a photoacoustic particle absorption instrument, as well as onto filters suitable for other thermal and optical analyses. Several thermal evolution methods typical of those used in California source and ambient samples and in international inventories will be applied. A fundamental measure of BC absorption, the photoacoustic instrument, is used as a benchmark and primary calibration standard. Phase II evaluates existing inventories, determining their similarities and differences, and enhancing understanding about why those differences exist. It compiles and compares available particulate matter and BC emission factors relevant to California combustion sources and determines how these relate to national and global inventories. The combustion sources to be tested and the testing venues will be defined in Phase I. This project involves testing stationary and mobile non-road

diesel emissions at California military bases and testing agricultural and forest burning at the UC Davis burning simulator.

Expected Results

The results of all parts of the project will be documented as a technical report submitted to ARB and as technical papers submitted to peer-reviewed journals. The investigator will provide to the ARB electronic copy of all the data collected during this research contract. The investigator will also present the results of the project to ARB staff at two 1-hour long technical seminars, one in Sacramento and the second in El Monte.

Significance to the Board

Particulate matter (PM) emissions, which often accompany emissions of greenhouse gases such as carbon dioxide, affect the Earth's climate, human health, visibility, surface soiling, and crop productivity. This project will examine the fundamental reasons underlying differences of optical and thermo-optical methods, and will result in an improved understanding of the effect of different combustion sources and their particle emissions, in particular black carbon and organic carbon, on air pollution and climate change. This project will develop reliable emissions factors for use in development of a California emission inventory of climate active carbonaceous particulate matter.

Contractor: Desert Research Institute (DRI)

Contract Period: 36 months

Principal Investigator (PI): Dr. Judith C. Chow

Contract Amount: \$449,997

Cofunding: There is no co-funding but the DRI research proposal is highly leveraged against other projects, and other relevant research efforts (both planned and that have already been conducted) could add significant value to ARB's research project. DRI is providing \$944,000 of equipment and maintenance at no cost to ARB. The Research Screening Committee concluded that this proposal is superior to UC efforts at the same total cost.

Basis for Indirect Cost Rate: The State and Desert Research Institute have agreed to a fifty percent indirect cost rate which is substantially lower than DRI's federally approved rate of 69 percent. This is a very comprehensive field monitoring and data analysis research project aimed at refining and testing the ability of several optical and filter -based interments. All of the facilities needed for this project are in the possession of DRI. Several instruments that have been developed and applied by DRI scientists cannot be found elsewhere.

Past Experience with this Principal Investigator:

This Principal Investigator has performed very successfully on past contracts. Of special significance is the global perspective that the DRI team brings to the ARB study as they are monitoring, participating, and reviewing international efforts in this area. In addition, their knowledge of the state-of-the-science instrumentation is excellent and they are clearly recognized leaders in the area, and their research studies are well-published.

Prior Research Division Funding to DRI:

Year	2003	2002	2001
Funding	\$0	\$0	\$0

BUDGET SUMMARY

Desert Research Institute
Climate Change - Characterization of Black Carbon and Organic Carbon Air Pollution
Emissions and Evaluation of Measurement Methods

DIRECT COSTS AND BENEFITS

1.	Labor and Employee Fringe Benefits	\$	175,829
2.	Subcontractors	\$	35,000
3.	Equipment	\$	0
4.	Travel and Subsistence	\$	11,732
5.	Electronic Data Processing	\$	3,453
6.	Reproduction/Publication	\$	3,517
7.	Mail and Phone	\$	0
8.	Supplies	\$	0
9.	Analyses	\$	73,800 ^a
10.	Miscellaneous	\$	<u>0</u>
	Total Direct Costs		\$303,331

INDIRECT COSTS

1.	Overhead	\$	146,666
2.	General and Administrative Expenses	\$	0
3.	Other Indirect Costs	\$	0
4.	Fee or Profit	\$	<u>0</u>
	Total Indirect Costs		<u>\$146,666</u>

TOTAL PROJECT COSTS

\$449,997

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- a) The field component of this research study includes continuous hourly samples per day, collected over a period of several weeks during each deployment. Approximately 300 carbon analyses are proposed as part of laboratory and field evaluations. To take advantage of concurrent source characterization studies currently funded at DRI, 40 of the source samples will be acquired during the first year and archived for later analysis. Additional source testing will also be performed. Most of the needed laboratory facilities and field sampling systems are already in place at DRI. DRI is providing \$944,000 of equipment and maintenance at no cost to ARB.

Attachment 1

SUBCONTRACTORS' BUDGET SUMMARY

Subcontractor: Atmoslytic, Inc. Dr. Kochy Fung

Description of subcontractor's responsibility: To serve as the external quality assurance and quality control auditor to ensure the accuracy, precision, and validity of the measurements acquired in the proposed study. Atmoslytic Inc. will also provide carbon standard development, technical guidance in carbon method evaluation, and data analysis as part of the proposed study.

DIRECT COSTS AND BENEFITS

1.	Labor and Employee Fringe Benefits	\$	35,000 *
2.	Subcontractors	\$	0
3.	Equipment	\$	0
4.	Travel and Subsistence	\$	0
5.	Electronic Data Processing	\$	0
6.	Reproduction/Publication	\$	0
7.	Mail and Phone	\$	0
8.	Supplies	\$	0
9.	Analyses	\$	0
10.	Miscellaneous	\$	<u>0</u>
	Total Direct Costs		\$ 35,000

INDIRECT COSTS

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

TOTAL PROJECT COSTS **\$35,000**

* The cost will be for labor charge as a rate of \$125 per hour to work 280 hours for this project