State of California
AIR RESOURCES BOARD

RESEARCH PROPOSAL

Resolution 07-11

April 26, 2007

Agenda Item No. 07-4-2

WHEREAS, the Air Resources Board has been directed to carry out an effective research program in conjunction with its efforts to combat air pollution, pursuant to Health and Safety Code sections 39700 through 39705;

WHEREAS, a research proposal, number 2626-255 entitled "Evaluation of the Potential Impact of Emissions of HFC-134a from Non-Professional Servicing of Motor Vehicle Air Conditioning Systems," has been submitted by Ecole des Mines de Paris, ARMINES;

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 2626-255 entitled "Evaluation of the Potential Impact of Emissions of HFC-134a from Non-Professional Servicing of Motor Vehicle Air Conditioning Systems," submitted by Ecole des Mines de Paris, ARMINES, for a total amount not to exceed $126,073.

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 2626-255 entitled "Evaluation of the Potential Impact of Emissions of HFC-134a from Non-Professional Servicing of Motor Vehicle Air Conditioning Systems," submitted by Ecole des Mines de Paris, ARMINES, for a total amount not to exceed $126,073.

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 $126,073.

I hereby certify that the above is a true and correct copy of Resolution 07-11, as adopted by the Air Resources Board.

Lori Andreoni

Lori Andreoni, Clerk of the Board

ATTACHMENT A

"Evaluation of the Potential Impact of Emissions of HFC-134a from Non-Professional Servicing of Motor Vehicle Air Conditioning Systems"

Background

Millions of motor vehicle air conditioning systems (MACS) exist in California. The dominant MACS refrigerant in use, HFC-134a, is a potent greenhouse gas (GHG). The climate impacts from MACS are due primarily to direct refrigerant leakage and indirect CO_2 emissions resulting from equipment energy demands. This project will focus on the direct HFC-134a emissions associated with the servicing of MACS by the vehicle owner and on the leakage mechanism in those in-use systems.

In order to save money, many individuals recharge the MAC systems on their personal vehicles using small cans of HFC-134a purchased in auto parts stores. This practice has the potential to release significant amounts of refrigerant into the atmosphere. Emissions can result from non-professional "Do-It-Yourselfers" using incorrect recharging techniques and procedures and discarding partially empty cans following the recharging event. Even if the individual attempts to transfer all of the can's HFC-134a contents into the MACS, it is known that potentially half of the can's content, referred to as the "heel," will remain in the can and will be released during the disposal of the can. However, the amount of HFC-134a emitted to the air from non-professional operations has not been quantified conclusively.

In addition, the non-professional practice results in a pervasive leak-recharge-leak cycle of unnecessary harm to the environment. Unfortunately, the non-professional is unlikely to have the necessary training or equipment to properly identify and repair the leak(s) in the MACS and to recharge the manufacturer-suggested amount of refrigerant. Because leaks go unrepaired, whatever goes into the system eventually is emitted into the atmosphere unchecked. Under California law, the professional MACS technician is required to check for leaks when servicing automobile air conditioning systems. The national inventory of high global warming potential gases maintained by the U.S. EPA suggests that non-professional recharging of a MACS increases emissions of HFC-134a compared to recharging performed by professionally trained and industry certified technicians employed by licensed auto repair facilities. However, additional data are needed to identify the actual practices by the professional that yield improvements over the non-professional.

Objective

The main objective of the program is to collect experimental data that will result in an improved estimate of the emissions of HFC-134a refrigerant due to non-professional servicing of MACSs by the "Do-It-Yourselfer." Included in this work is the collection of data on the number of small cans of refrigerant sold in the state to non-professionals, the typical amount of HFC-134a remaining in the can heel after use, and the amount of HFC-134a that is not transferred to a vehicle AC system due to improper charging techniques. In addition, the contractor will quantify the emissions from professional servicing of MACSs so the data can be compared with the impacts of non-professional servicing. A baseline will be established by conducting experiments that measure the emissions from the MACSs used predominantly in the California motor vehicle fleet.

Methods
The research method will be based on the laboratory measurement of MAC system emissions, field tests with careful analysis of the operating modes of non-professionals and professionals while servicing MAC systems, simulation at the contractor's laboratory of the different operating modes for step-by-step analysis of refrigerant losses and emissions, and top down analysis based on HFC-134a sales in the California retail market. The methodology will describe the procedures used by non-professionals as well as professional technicians.

Expected Results
The proposed project will yield data resulting in a more accurate estimate of the emissions due to non-professional servicing. In addition, data will also be collected on the emissions associated with the professional servicing of MACs. Comparing the data from these two different types of service will allow us to determine the potential emission reduction benefit from professional servicing.

Significance to the Board
AB 32, the California Global Warming Solutions Act of 2006, codifies in law targets set by the California Climate Action Team (CAT) to reduce CO2-equivalent greenhouse gas (GHG) emissions to 1990 levels by 2020. Controlling high global warming potential (GWP) GHG emissions, such as refrigerants employed in MACS, can lead to significant, cost-effective GHG reductions.

ARB is charged with generating strategies that will lead to regulations or voluntary measures to reduce refrigerant emissions. The development of a regulation restricting the retail sale of small cans of refrigerant to the non-professional is a critical part of creating strategies to reduce GHG emissions; regulations cannot be enacted to reduce refrigerant emissions in a cost-effective manner without the data resulting from this project. The research proposed in this project will produce data, which will form the basis for the proposed regulation and allow California to meet its 2020 GHG emissions target.

Contractor:
ARMINES

Contract Period:
18 months

Principal Investigator (PI):
Denis Clodic

Contract Amount:
$126,073

Basis for Indirect Cost Rate:
The only indirect costs that will be incurred during the course of this project are personnel overhead and indirect travel costs.

The personnel overhead rate of 37 percent includes operational expenses of the research laboratories. It also includes all expenses related to the maintenance of the

premises, rental costs, general administrative personnel, technical personnel who operate equipment, computer costs, telephones, fax, copies, internet services, library, equipment and consumables for experiments.

The overhead rate agreed upon in France by the administrative organizations with whom ARMINES contracts varies from 80 to 94 percent of the direct costs of salaries. Because ARB is not willing to accept such a rate, ARMINES agrees to apply an exceptional rate of 37 percent. The difference in cost will be made up by ARMINES' own funds.

ARMINES indirect travel costs were calculated to be 10 percent of the baseline travel costs.

Past Experience with this Principal Investigator:
The PI has not worked under contract for ARB in the past. However, ARB staff does have extensive experience and interaction with Dr. Clodic. His leading work on refrigerant emission measurements is internationally recognized and was fundamental in the development of the technical support document for AB 1493, the greenhouse gas emission regulation for motor vehicles, adopted by the Board in 2004. Based on this previous experience with the PI, ARB staff have great expectations for the work to be performed and the benefit for ARB's climate change protection efforts. It should also be pointed out that the PI has just been awarded a contract entitled, "Inventory of Direct and Indirect GHG Emissions from Stationary Air Conditioning and Refrigeration Sources, with Special Emphasis on Retail Food Refrigeration and Unitary Air Conditioning."

Prior Research Division Funding to ARMINES:

Year	2006	2005	2004
Funding	$225,060	$0	$0

BUDGET SUMMARY

Contractor: Denis Clodic/ARMINES

Evaluation of the Potential Impact of Emissions of HFC-134a from Non-Professional Servicing of Motor Vehicle Air Conditioning Systems

DIRECT COSTS AND BENEFITS				
1.	Labor and Employee Fringe Benefits	$	56,664	
2.	Subcontractors	$	0	
3.	Equipment	$	0	
4.	Travel and Subsistence	$	21,430[1]	
5.	Electronic Data Processing	$	0	
6.	Reproduction/Publication	$	0	
7.	Mail and Phone	$	0	
8.	Supplies	$	8,700	
9.	Analyses	$	7,770	
10.	Miscellaneous	$	8,400	
	Total Direct Costs			$102,964
INDIRECT COSTS				
1.	Overhead	$	20,966	
2.	General and Administrative Expenses	$	0	
3.	Other Indirect Costs	$	2,143	
4.	Fee or Profit	$	0	
	Total Indirect Costs			$ 23,109
TOTAL PROJECT COSTS				**$126,073**

[1] Travel charges include airfare, ground transportation, and per diem at the government rate for three people for a total aggregate period of 39 days to perform the necessary field work in California.