State of California
AIR RESOURCES BOARD

RESEARCH PROPOSAL

Resolution 08-25

April 24, 2008

Agenda Item No.: 08-4-2

WHEREAS, the Air Resources Board (ARB or the 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 2660-260, entitled "Lifecycle Analysis of High-Global Warming Potential Greenhouse Gas Destruction" has been submitted by ICF International, in response to RFP No. 07-330;

WHEREAS, the Research Division (RD) staff has reviewed and recommended this proposal for approval; and

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

> Proposal Number 2660-260 entitled "Lifecycle Analysis of High-Global Warming Potential Greenhouse Gas Destruction," submitted by ICF International, for a total amount not to exceed $297,765.

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 2660-260 entitled "Lifecycle Analysis of High-Global Warming Potential Greenhouse Gas Destruction," submitted by ICF International, for a total amount not to exceed $297,765.

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 $297,765.

I hereby certify that the above is a true and correct copy of Resolution 08-25, as adopted by the Air Resources Board.

Lori Andreoni

Lori Andreoni, Clerk of the Board

ATTACHMENT A

"Lifecycle Analysis of High-Global Warming Potential Greenhouse Gas Destruction"

Background

With the passage of the California Global Warming Solutions Act of 2006 (AB 32), the California Air Resources Board (ARB) is charged with developing and implementing mitigation strategies to enable the State of California to reach its goal of carbon dioxide equivalent (CO_2-e) greenhouse gas (GHG) emission reductions to 1990 levels by 2020. As a starting point, the Climate Action Team (CAT) report, which was developed by several agencies through a stakeholder process, identified a suite of strategies for reducing the six Kyoto pollutants (i.e., CO_2, methane, nitrous oxide, perfluorocarbons, hydrofluorocarbons, and sulfur hexafluoride). Other efforts, including the development of Early Actions under AB 32, have revealed additional opportunities to reduce emissions of GHG, and it has become apparent to ARB staff that significant high-global warming potential (GWP) GHG emissions reductions are possible, particularly if ozone depleting substances (ODS) are considered.

Objective

The project will support the development of regulatory and non-regulatory programs to move forward with the Climate Change Early Action Measures titled "Foam Recovery/ Destruction Program," and "Refrigerant Tracking, Reporting, and Recovery Program."

The objective of the project will be to perform a lifecycle analysis (LCA) to evaluate different recovery and destruction options for high-GWP GHG in California. CO_2-e emissions rates and monetary costs associated with disposal, transport, recovery, and destruction of high-GWP GHG from discarded appliances, decommissioned equipment, construction and demolition waste, as well as stockpiled or recovered/reclaimed chemicals will be quantified. Options explored are not limited to destruction of recovered materials, but may also include re-use and recycling of recovered high-GWP GHG.

Findings of the LCA will be used to develop and recommend the most cost-effective and practical approaches to reducing emissions of high-GWP GHG.

Methods

The LCA includes a review of published literature, reports, and industry databases relevant to the topics of high-GWP GHG recovery, disposal, and destruction, including any projected future high-GWP GHG recovery and destruction technologies. Data will be collected directly from manufacturers, waste management entities, and other stakeholders for a bottom-up and top-down representation of costs and benefits of various recovery and collection programs and the recycling, re-use, and destruction of the high-GWP GHGs.

The project will produce a detailed, comprehensive LCA of business-as-usual as well as the various high-GWP GHG destruction options, and will use forecasting to predict costs

and benefits associated with recovery and destruction of such chemicals for each year out to 2020.

Due to their high GWP, the types of chemicals that are of immediate concern and should be included in the LCA are the banked ODS (chlorofluorocarbons, hydrochlorofluorocarbons, Halons) in old refrigeration and air conditioning equipment, foams, fire extinguishing equipment, and chemical stockpiles. Other high-GWP GHG that are candidates for a recovery and destruction protocol are hydrofluorocarbons, perfluorocarbons, nitrogen trifluoride, sulfur hexafluoride, and possibly hydrofluoroethers or perfluoropolyethers.

Expected Results
A detailed lifecycle analysis on recovery, re-use and recycling, and destruction of high-GWP GHG specific to California will result from this project. The LCA results will be shown in terms of CO_2-e, monetary costs, and generation of toxic emissions or hazardous wastes for each high-GWP GHG destruction option. Also included will be a figure summarizing the business-as-usual CO_2-e emissions and forecasted reductions due to various destruction strategies for each year out to 2020.

The results of this project will help ARB refine CO_2-e GHG emissions control strategies currently being developed, in terms of costs/benefits. The study will also help to identify as well as prioritize new mitigation opportunities, so that those presenting the greatest benefits receive the most attention. The most cost-effective strategies that achieve reduction goals will be incorporated into regulatory and non-regulatory programs to reduce high-GWP GHG emissions.

Significance to the Board
AB 32 codifies in law targets set by CAT to reduce CO_2-e GHG emissions to 1990 levels by 2020. Controlling high-GWP GHG emissions can lead to significant, cost-effective reductions.

The completion of a lifecycle assessment for high-GWP GHG recovery and destruction is a critical part in developing regulatory and non-regulatory programs that reduce GHG emissions in the most cost-effective and feasible manner. To date, no comprehensive LCA has been conducted for high-GWP GHG anywhere in the world, which makes the completion of this project critical to informing ARB's decision making for high-GWP GHG management.

The research proposed in this project will produce a heretofore non-existent LCA for high-GWP GHG in California, which will form the basis of ARB's future emissions reductions policies and allow California to meet its 2020 GHG emissions target.

Contractor:
ICF International

Contract Period:
23 months

Principal Investigator (PI):
Mark Wagner

Contract Amount:
$297,765.

Basis for Indirect Cost Rate:
Indirect costs account for $118,646 of the total $297,765 budget proposal, or 39.9 percent of the total budget. ICF International and its subcontractors are private consulting firms, and as such, incorporate overhead into all of their contracts.

Past Experience with this Principal Investigator:
ICF International is an internationally recognized expert in the area of high-GWP GHG management and issues, including lifecycle assessments, emission estimates, and best practices of managing ozone-depleting substances. ICF International is supporting ARB's efforts to reduce GHG under the authority of AB 32, and currently has another contract with ARB, contract number 06-343 "Modeling of Greenhouse Gas Reduction Measures to Support the Implementation of the California Global Warming Solution Act (AB 32)" for $399,718.

ICF International also successfully completed a contract with ARB under contract number 98-327 "Update and Refinement of an Indoor Exposure Assessment Methodology", which was funded for a total of $245,074.61 and ran from June 28, 1999, through September 30, 2001. Note that in 1999, when the contract was awarded, the name of the firm was ICF Kaiser, which changed later that year to ICF Consulting, and subsequently changed again in 2006 to its current name.

Prior Research Division Funding to ICF International:

Year	2007	2006	2005
Funding	$ 39,718	$ 360,000	$ 0

BUDGET SUMMARY

Contractor: ICF International

Lifecycle Analysis of High-Global Warming Potential Greenhouse Gas Destruction

DIRECT COSTS AND BENEFITS			
1.	Labor and Employee Fringe Benefits	$ 100,380	
2.	Subcontractors	$ 77,638	
3.	Equipment	$ 0	
4.	Travel and Subsistence	$ 420	
5.	Electronic Data Processing	$ 0	
6.	Reproduction/Publication	$ 330	
7.	Mail and Phone	$ 351	
8.	Supplies	$ 0	
9.	Analyses	$ 0	
10.	Miscellaneous	$ 0	
	Total Direct Costs		$179,119
INDIRECT COSTS			
1.	Overhead	$ 63,076	
2.	General and Administrative Expenses	$ 28,500	
3.	Other Indirect Costs	$ 0	
4.	Fee or Profit	$ 27,070	
	Total Indirect Costs		$118,646
TOTAL PROJECT COSTS			**$297,765**

ATTACHMENT B

SUBCONTRACTORS' BUDGET SUMMARY

Subcontractor: Lifecycle Associates

Description of subcontractor's responsibility: Lifecycle Associates will be responsible for the technical analyses of lifecycle boundaries and assumptions for high-GWP GHG recovery, re-use and recycling, or destruction. They will support ICF International by assisting in the collection of applicable data for cost and benefit for recovery of targeted ozone-depleting substances, hydrofluorocarbons, perfluorocarbons and other high-GWP GHG, analyzing data, and providing emissions and energy use on a complete lifecycle basis, taking into account the environmental constraints that apply to California. The lifecycle analysis will be specific to California inventory, emissions, waste management regulations, and cost of managing high-GWP GHG.

DIRECT COSTS AND BENEFITS			
1.	Labor and Employee Fringe Benefits	$ 37,401	
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	$ 0	
	Total Direct Costs		$37,401
INDIRECT COSTS			
1.	Overhead	$ 18,701	
2.	General and Administrative Expenses	$ 2,805	
3.	Other Indirect Costs	$ 0	
4.	Fee or Profit	$ 4,094	
	Total Indirect Costs		$25,600
TOTAL PROJECT COSTS			**$63,001**

SUBCONTRACTORS' BUDGET SUMMARY

Subcontractor: SDV-SCC, Inc.

Description of subcontractor's responsibility: SDV-SCC, Inc. will assist ICF International in the lifecycle analyses of the recovery, re-use, recycling, and destruction of the various high-GWP GHG used in California. SDV-SCC, Inc. will use the Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation and the Lifecycle Emissions Model lifecycle analysis models, using California-specific data to estimate emissions, energy consumptions, and costs of the various management scenarios.

DIRECT COSTS AND BENEFITS				
1.	Labor and Employee Fringe Benefits	$	14,637	
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	$	0	
	Total Direct Costs			$14,637
INDIRECT COSTS				
1.	Overhead	$	0	
2.	General and Administrative Expenses	$	0	
3.	Other Indirect Costs	$	0	
4.	Fee or Profit	$	0	
	Total Indirect Costs			$0
TOTAL PROJECT COSTS				**$14,637**