PROPOSED

State of California
AIR RESOURCES BOARD

RESEARCH PROPOSAL

Resolution 11-13

February 24, 2011

Agenda Item No.: 11-1-1

WHEREAS, the Air Resources Board (ARB or 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 2707-269, entitled "Calibrating, Validating, and Implementing Process Models for California Agriculture Greenhouse Gas Emissions," has been submitted by the University of New Hampshire;

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 2707-269 "Calibrating, Validating, and Implementing Process Models for California Agriculture Greenhouse Gas Emissions," has been submitted by the University of New Hampshire for a total amount not to exceed $249,688.

NOW, THEREFORE, BE IT RESOLVED that ARB, 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 2707-269 entitled "Calibrating, Validating, and Implementing Process Models for California Agriculture Greenhouse Gas Emissions," submitted by the University of New Hampshire for a total amount not to exceed $249,688.

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 $249,688.

ATTACHMENT A

"Calibrating, Validating, and Implementing Process Models for California Agriculture Greenhouse Gas Emissions"

Background

Agricultural soils are important sources of nitrous oxide (N_2O) and methane (CH_4), both of which are potent greenhouse gases (GHG) that cause global warming. Because formation of N_2O and CH_4 in soil are microbe driven processes, affected by numerous environmental factors, the emission fluxes of these gases are extremely variable both spatially and temporally. Therefore, the traditional approach of using emission factors for soil emission estimate is limited and suffers from great uncertainty. The Intergovernmental Panel for Climate Change (IPCC) has recommended alternative approaches such as process modeling as ways to improve the emission estimation. This project is intended to simulate N_2O and CH_4 emissions from agricultural soils using geochemical modeling based on California specific soil, crop, meteorological, and management conditions. The outcome of this project is expected to improve the understanding of GHG emissions in agricultural soils and transfer to ARB the modeling technology and databases for future use in emission assessment.

Objective

The goal of the project is to develop, demonstrate, and deploy a spatial modeling tool for simulating GHG emissions from agricultural soils in California. Specific objectives include: 1) develop spatial databases for statewide soil, crop, meteorological conditions, and crop management practices; 2) refine the crop growth parameters for a wide spectrum of California cropping systems; 3) assess model uncertainties; 4) perform comparisons of the two geochemical models DNDC and DAYCENT; 5) compile GHG emission inventory for California agriculture; and 6) transfer to ARB the spatial modeling tool.

Methods

This project is a modeling study of GHG emissions from agricultural soils using California specific data. It will consist of the following seven tasks:

1. Build statewide GIS databases on California soils, climate, crops, and dairy farms.
2. Collect region- or county-specific crop growth curve and management practice data such as tillage, irrigation, fertilizer application, crop residue management, etc. to ensure a high spatial resolution of the geochemical modeling. Potential data sources include open publications, government reports, University of California Cooperative Extension reports, as well as direct communications with various commodity groups.
3. Compile existing field measurement data of GHG emissions, which will include all monitoring results of the currently funded studies by ARB, California Department of Food and Agriculture, California Energy Commission (CEC), and California Department of Resources Recycling and Recovery.

4. Calibrate the DNDC crop growth model for the entire geographic region of California using the plant growth curve data and crop yield data collected above, as well as data from pertaining literatures, if necessary.
5. Evaluate quantitatively differences between the two geochemical models of DNDC and DAYCENT to identify any disparities in model performance.
6. Run validated DNDC models to compile statewide N_2O and CH_4 inventories and spatial maps of emission sources reflecting local soil, crop, metrological, and management conditions; and quantify sensitivities and uncertainties in inventory estimates.
7. Transfer to ARB the spatial modeling tool and databases for future assessment of GHG emissions from California agricultural systems.

Expected Results
The project will provide statewide GHG emission estimates from California agricultural cropping systems, and a spatial modeling tool, along with all databases built, that can be used for future assessment of GHG emissions.

Significance to the Board
The outcome of the project and the modeling tool developed will help ARB improve estimates of baseline GHG emissions from California agricultural systems. The higher spatial resolution of the modeling results, compared to the simple emission factor approach currently used by ARB, would serve to pinpoint hot spots of GHG emissions and indicate potential management practices that reduce GHG emissions.

Contractor:
The University of New Hampshire

Contract Period:
24 months

Principal Investigator (PI):
Changsheng Li, Ph.D.

Contract Amount:
$249,688

Basis for Indirect Cost Rate:
The University of New Hampshire has agreed to a ten percent indirect cost rate.

Past Experience with this Principal Investigator:
The Principal Investigator, Dr. Changsheng Li, has not worked under contract to ARB in the past, but has extensive experience in geochemical modeling of agricultural systems. The PI is the developer of the DNDC model, which has been tested and used worldwide in studying carbon and nitrogen cycling in agro-ecosystems.

Prior Research Division Funding to the University of New Hampshire:

Year	2009	2008	2007
Funding	$0	$0	$0

BUDGET SUMMARY

Contractor: The University of New Hampshire

"Calibrating, Validating, and Implementing Process Models for California Agriculture Greenhouse Gas Emissions"

DIRECT COSTS AND BENEFITS			
1.	Labor and Employee Fringe Benefits	$ 119,007	
2.	Subcontractor/Consultant	$ 99,702[1]	
3.	Equipment	$ 0	
4.	Travel and Subsistence	$ 5,730	
5.	Electronic Data Processing	$ 2,550	
6.	Reproduction/Publication	$ 0	
7.	Mail and Phone	$ 0	
8.	Supplies	$ 0	
9.	Analyses	$ 0	
10.	Miscellaneous	$ 0	
	Total Direct Costs		$226,989
INDIRECT COSTS			
1.	Overhead	$ 0	
2.	General and Administrative Expenses	$ 22,699	
3.	Other Indirect Costs	$ 0	
4.	Fee or Profit	$ 0	
	Total Indirect Costs		$22,699
TOT0AL PROJECT COSTS			**$249,688**

Notes:

1. Subcontractors include the University of California, Davis and Dr. William Salas. Their responsibilities include database development, remote sensing, model calibration and validation, model simulation; and serving as project liaison among the investigators, various industrial stakeholders, and ARB.

ATTACHMENT 1

SUBCONTRACTOR'S BUDGET SUMMARY

Subcontractor: University of California, Davis

Description of subcontractor's responsibility: Develop databases for field monitoring of GHG emissions for DNDC and DAYCENT model calibration and validation; perform DAYCENT model simulation; and coordinate with Contractor for model comparison with DNDC.

DIRECT COSTS AND BENEFITS				
1.	Labor and Employee Fringe Benefits	$	41,584	
2.	Subcontractors	$	0	
3.	Equipment	$	0	
4.	Travel and Subsistence	$	0	
5.	Electronic Data Processing	$	0	
6.	Photocopying & Printing	$	600	
7.	Mail and Phone	$	0	
8.	Materials & Supplies	$	2,000	
9.	Analyses	$	0	
10.	Miscellaneous	$	1,000	
	Total Direct Costs			$45,184
INDIRECT COSTS				
1.	Overhead	$	4,518	
2.	General and Administrative Expenses	$	0	
3.	Other Indirect Costs	$	0	
4.	Fee or Profit	$	0	
	Total Indirect Costs			$4,518
TOTAL PROJECT COSTS				**$49,702**

ATTACHMENT 2

SUBCONTRACTORS' BUDGET SUMMARY

Subcontractor: Dr. William Salas

Description of subcontractor's responsibility: Perform the rice remote sensing monitoring work; assist in development of various spatial databases and modeling validation for DNDC; and serve as project liaison among the investigators, various industrial stakeholders, and ARB.

DIRECT COSTS AND BENEFITS				
1.	Labor and Employee Fringe Benefits	$	44,776	
2.	Subcontractors	$	0	
3.	Equipment	$	0	
4.	Travel and Subsistence	$	5,224	
5.	Electronic Data Processing	$	0	
6.	Photocopying & Printing	$	0	
7.	Mail and Phone	$	0	
8.	Materials & Supplies	$	0	
9.	Analyses	$	0	
10.	Miscellaneous	$	0	
	Total Direct Costs			$50,000
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				**$50,000**