State of California
AIR RESOURCES BOARD

Greenhouse Gas Measurements at Walnut Grove Tower

RESEARCH PROPOSAL

Resolution 15-15

May 21, 2015

Agenda Item No.: 15-4-1

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 2786-282, titled "Greenhouse Gas Measurements at Walnut Grove Tower," has been submitted by the University of California, Davis, for a total amount not to exceed $200,000;

WHEREAS, the Research Division staff has reviewed Proposal Number 2786-282 and finds that in accordance with Health and Safety Code section 39701, the results of this project will help ARB evaluate and improve the statewide greenhouse gas emission inventory for California, which is the basis for developing effective emission mitigation plans; and

WHEREAS, in accordance with Health and Safety Code section 39705, the Research Screening Committee has reviewed and recommends funding the Research Proposal.

NOW, THEREFORE BE IT RESOLVED that the Air Resources Board, pursuant to the authority granted by Health and Safety Code section 39700 through 39705, hereby accepts the recommendations of the Research Screening Committee and staff and approves the Research Proposal.

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 Proposal as further described in Attachment A, in an amount not to exceed $200,000.

I hereby certify that the above is a true and correct copy of Resolution 15-15 as adopted by the Air Resources Board.

Tracy Jensen

Tracy Jensen, Clerk of the Board

ATTACHMENT A

"Greenhouse Gas Measurements at Walnut Grove Tower"

Background
Assembly Bill 32 (AB 32) requires that greenhouse gas (GHG) emissions in California be reduced to 1990 levels by 2020. Careful accounting of GHG emissions and future reductions is therefore essential. Current inventory estimates of California's non-CO_2 GHG emissions are based on a combination of techniques, but independent estimates of GHG emissions help ensure that ARB's emission inventory is accurate and comprehensive. Atmospheric inverse methods, which estimate the surface emissions of GHGs using in-situ and remotely sensed GHG concentrations and modeled wind fields, have been widely applied at both global and regional scales to provide independent tests of GHG emission inventories.

Objective
To maintain an ongoing record of high quality multi-species GHG measurements the objectives of this proposal are: 1) to operate and maintain the Walnut Grove tower site to collect both continuous records of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and carbon monoxide (CO) mixing ratios from 91 and 483 meters, and flask samples from 91 meters for analysis of all major GHGs, and associated tracers; and 2) to perform data quality control, calibration, and analysis including data calibration and quality control to provide ARB with a three-year measurement record of continuous GHG species and National Oceanic and Atmospheric Administration– Earth Systems Research Laboratory (NOAA-ESRL) flask analyses of major GHG species and volatile organic compound (VOC) tracers, and long-term analysis of the GHG trends in the California Central Valley and San Francisco Bay Area region.

Methods
In the case of Walnut Grove, the project Principal Investigator (PI) collaborates with NOAA-ESRL and ARB to measure both in situ mixing ratios and collect air samples for laboratory analysis. In-situ measurements are made for CO_2, CH_4, N_2O, and CO, using a sampling and analysis system combining pumps, air driers, and gas analyzers. Briefly, air samples are drawn continuously from the different heights on the tower, dried using a combination of condensing system and membrane driers (to a -33 °C dew point), and then are supplied to gas analyzers for CO_2 and CH_4 (Picarro 2301); and N_2O and CO (Los Gatos EP). Additionally, older instruments provide redundant measurements for CO (Thermo Scientific TE48TC) and CO_2 (Licor LI-7000). To quantify and correct instrument drifts, offset and gain are checked and corrected using gas standards. In addition, brief (1 min) flask samples are collected daily (near 2200 hr Greenwich Mean Time from a separate sample line and analyzed at NOAA-ESRL to provide quality assurance on the in-situ GHG measurements.

The PI will continue multi-species continuous (CO_2, CO, CH_4, and N_2O) and roughly bi-daily flask (CO_2, CO, CH_4, N_2O, high global warming potential GHGs, and radiocarbon ($^{14}CO_2$), and volatile organic compound (VOC) measurements at Walnut

Grove. The highly calibrated in-situ measurement capability and bi-daily flask sampling and analysis will continue through the PI's existing NOAA-ESRL collaboration. To provide ongoing data processing and quality control for the Walnut Grove site, the PI will continue daily-to-weekly inspection and correction of problems, quarterly quality control checks. In addition, final one-year data sets will be screened for quality assurance using NOAA flask sample analysis. Data screening will include time inspection of the mixing ratio time series to identify outlying events due to unexpected emission sources (e.g., CO from fires).

Expected Results
This project will provide data that can be used to verify ARB's GHG emission inventory. Data deliverables will include final processed and quality controlled Walnut Grove site data in a three-year record including one year prior to the project (June 2014-June 2015), and two years during the project (July 2015-June 2017) of CO_2, CH_4, N_2O, and CO hourly average mixing ratios at 91 and 483 meters above ground. The project will also provide ARB raw data from Walnut Grove site for the July 2017-December 2017 time period but data collected during this period will not be subject to the same quality control and thus will be excluded from the final report. The PI will provide long-term analysis of the GHG trends in the California Central Valley and San Francisco Bay Area region over a 10-year period and the results of flask sample analyses of GHGs, $^{14}CO_2$, and VOC tracers as available by NOAA-ESRL for June 2015 through June, 2017

Significance to the Board
Accurate GHG emission inventory is crucial to the design and implementation of mitigation measures to fulfill the goal of AB 32. This project will help ARB evaluate and improve the statewide GHG emission inventory for California, which is the basis for developing effective emission mitigation plans.

Contractor:
University of California, Davis

Contract Period:
36 months

Principal Investigator (PI):
Marc Fischer, Ph.D.

Contract Amount:
$200,000

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

Past Experience with this Principal Investigator:
Dr. Fischer has led research for the ARB and the California Energy Commission on the use of atmospheric inverse methods to quantify GHG exchange from California. Through the ARB-supported California Greenhouse Gas Emission Measurement

(CALGEM) project, Dr. Fischer has developed a combined GHG measurement and modeling system specifically for estimating non-CO_2 GHG emissions from California.

Prior Research Division Funding to the University of California, Davis:

Year	2013	2012	2011
Funding	$ 2,249,136	$ 1,131,716	$ 4,949,363

BUDGET SUMMARY

Contractor: University of California, Davis

Greenhouse Gas Measurements at Walnut Grove Tower

DIRECT COSTS AND BENEFITS				
1.	Labor and Employee Fringe Benefits	$ 124,396		
2.	Subcontractors	$ 0		
3.	Equipment	$ 0		
4.	Travel and Subsistence	$ 7,920		
5.	Electronic Data Processing	$ 0		
6.	Reproduction/Publication	$ 0		
7.	Mail and Phone	$ 302		
8.	Supplies	$ 20,400[1]		
9.	Analyses	$ 0		
10.	Miscellaneous	$ 28,800[2]		
	Total Direct Costs		$	181,818
INDIRECT COSTS				
1.	Overhead	$ 18,182		
2.	General and Administrative Expenses	$ 0		
3.	Other Indirect Costs	$ 0		
4.	Fee or Profit	$ 0		
	Total Indirect Costs		$	18,182
TOTAL PROJECT COSTS			**$**	**200,000**

[1] Supplies include cost for six calibration gas bottles at $800 each per year, replacement cost of $2000 for sampling pump and Picarro instrument repair cost per year.

[2] Cost of lease of the Walnut Grove tower is $1,200/month. Year 1 will be paid the through the contractor's existing lease agreement. Years 2 & 3 will be paid through this contract.