

SSD
Contractor: UC Davis
Contract # 08-410

FUNDING FISCAL YEAR	FY 08/09	
TERM	04/01/09-12/31/10	
PCA	72480	
LINE ITEM/OBJECT	398.00	TOTAL
DESCRIPTION	Consulting Services	
Contract \$	300,354.00	300,354.00

Total, Contract	300,354.00	300,354.00
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Payments to Contractor:

Inv. # Inv. Date Ser Per C/S

(Handwritten mark)

Total, Payments		
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Balance Available to Pay Contractor	300,354.00	300,354.00
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Balance Must Be Spent By: 06/30/11 06/30/12 06/30/13

Notes:

Contract Manager: John Courtis

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STATE OF CALIFORNIA
STANDARD AGREEMENT
 STD 213 (Rev 06/03)

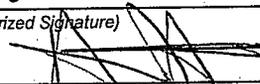
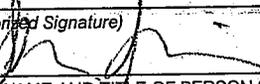
AGREEMENT NUMBER 08-410
REGISTRATION NUMBER

- This Agreement is entered into between the State Agency and the Contractor named below:
 STATE AGENCY'S NAME
Air Resources Board (State)
 CONTRACTOR'S NAME
The Regents of the University of California, Davis (UC Davis, UC, or Contractor)
- The term of this Agreement is: **April 1, 2009 or upon DGS approval through December 31, 2010**
- The maximum amount of this Agreement is: **\$ 300,354.00**
Three Hundred Thousand Three Hundred Fifty Four Dollars and No Cents
- The parties agree to comply with the terms and conditions of the following exhibits which are by this reference made a part of the Agreement.

Exhibit A – Scope of Work	4 pages
Exhibit B – Budget Detail and Payment Provisions	2 pages
Exhibit B, Attachment 1 – Detailed Budget	2 pages
Exhibit C* – General Terms and Conditions	GIA 101*
Exhibit D – Special Terms and Conditions	1 page
Exhibit E – Additional Provisions	3 pages
Exhibit F – Research Final Report Format Guidelines	5 pages

Items shown with an Asterisk (*), are hereby incorporated by reference and made part of this agreement as if attached hereto.
 These documents can be viewed at www.ols.dgs.ca.gov/Standard+Language

IN WITNESS WHEREOF, this Agreement has been executed by the parties hereto.

CONTRACTOR	
CONTRACTOR'S NAME (if other than an individual, state whether a corporation, partnership, etc.) The Regents of the University of California, Davis	
BY (Authorized Signature) 	DATE SIGNED (Do not type) JUN 17 2009
PRINTED NAME AND TITLE OF PERSON SIGNING Ahmad Hakim-Elahi, Ph.D., J.D., Director of Sponsored Programs	
ADDRESS 1850 Research Park Drive, Suite 300, Davis, CA 95618	
STATE OF CALIFORNIA	
AGENCY NAME Air Resources Board	
BY (Authorized Signature) 	DATE SIGNED (Do not type) 6/24/09
PRINTED NAME AND TITLE OF PERSON SIGNING Socorro Watkins, Chief, Business Management Branch	
ADDRESS P.O. Box 2815, Sacramento, CA 95812	Sharon Simmons Contract Services Section Manager Air Resources Board

California Department of General Services Use Only
<div style="border: 2px solid black; padding: 10px; width: fit-content; margin: 0 auto;"> <p style="text-align: center; margin: 0;">APPROVED</p> <p style="text-align: center; margin: 0;">JUL 31 2009</p> </div> <p style="text-align: center; margin-top: 5px;">DEPT OF GENERAL SERVICES</p>
<input type="checkbox"/> Exempt per:


EXHIBIT A SCOPE OF WORK

BACKGROUND

On January 18, 2007, California's Low Carbon Fuel Standard (LCFS) was announced through Executive Order S-1-07. The LCFS creates a state-wide goal of reducing the carbon intensity of California's transportation fuel by 10 percent by 2020, compared to the baseline year of 2006, and will apply to all fuel providers, including refiners, blenders, producers, and importers. The 10 percent carbon intensity reduction target is reachable but challenging, and will require a detailed examination of many analytical, technical, and policy issues to ensure successful implementation of the LCFS (Farrell and Sperling 2007b, 2007a). Among these, top priority issues are the quantification and certification of global greenhouse gas emission reductions, as well as the development of better methods to study lifecycle emission factors, land use changes, climate impacts of emissions, treatment of market-mediated effects, and standards to ensure sustainability. Toward that end, researchers at the University of California, Davis and Berkeley have assisted the Air Resources Board (ARB) by studying technical and policy issues related to the implementation of the LCFS, including lifecycle emission analysis (LCA), policy analysis, compliance and implementations, and environmental impacts and sustainability.

SCOPE OF WORK

As the ARB staff started its LCFS rulemaking in 2008, it becomes apparent that many new issues have emerged and posed new challenges that need to be addressed before the board review in early 2009. It is also critical that many of these challenges need to be evaluated and monitored when the implementation starts in 2010. UC LCFS team is committed to continue providing technical and advisory support to ARB in new research areas and expand the scope of the existing work. Thus we request additional resources to cover many of these new topics. The Regents of the University of California, Davis agrees to provide the following consulting services to support California's LCFS. This includes consultation support on the following topics: lifecycle analysis tool development and modification, development of California's LCFS compliance and monitoring, and environmental and economic impact analysis. All tasks listed here will be lead by Dr. Sonia Yeh from University of California, Davis in full collaboration and communication with ARB staff and UC Berkeley LCFS team, lead by Dr. O'Hare. Dr. Yeh may subcontract with other experts as needed.

The contract period will cover upon contract approval to December 31, 2010.

Task 1. Provide consultation support to ARB on lifecycle analysis tool development modification, and implementation.

During the development of the LCFS, lifecycle analysis will play a major role in determining the carbon intensity of various transportation fuels. This task will focus on addressing the policy and technical issues associated with lifecycle model development and providing consultation support to ARB staff in our efforts to modify existing LCA methods during the LCFS development phase.

Under this task, two areas will be investigated:

- Estimate CO₂-equivalent impact on climate of a full range of lifecycle emissions of transportation fuels. Current LCAs of CO₂-equivalent GHG emissions from transportation fuels include only CO₂, CH₄, and N₂O. However, every gas and

aerosol emitted from every transportation fuel lifecycle has some effect on climate. In some cases, the climate effect of the gases and aerosols omitted from current LCA is large relative to the effect of CO₂. In this project, we propose to estimate the CO₂-equivalent impact on climate of a full range of emissions, including CO, NMOCs, NO₂, NH₃, SO₂, CFCs, BC-PM (black carbon), OM-PM (organic-matter), and dust-PM, as well as CO₂, CH₄, and N₂O.

- Using GIS to do overlays of the entire oil sands area (mining plus in situ) with peatlands and Alberta's eco-regions to identify C emissions and eco impacts at detailed level. This research aims to compare the land-related emissions intensities of conventional transportation fuels including conventional oil, oil sands mining and in situ technologies. Two metrics will be compared: power density and GHG emissions intensity (vegetation clearing and soil disturbance). The aim is to compare land use-related emissions intensity based on the output of transportation fuel produced using relevant conversion efficiencies. The results will be compared with the results of "conventional" crude analysis.

Deliverables: Formal papers describing work and results, presentations regarding subject matter for workshops and internal meetings, as well as email and telephone support.

Budget: \$100,000.00

Timeline: These deliverables are expected to be completed by December 2010, though it is expected all tasks will be implemented by stages and some will be finished earlier depending on the urgency of the tasks requested by the ARB staff. We will continue to have regular weekly briefings with ARB sharing technical details and the status of the research papers.

Task 2. Providing consultation support to ARB on the development of LCFS compliance and monitoring system.

The goal of this project is to provide issue analyses and consultation support to ARB staff on methods of determining compliance during the implementation of LCFS. Key issues that will be addressed, among several others, include trade issues associated with the biofuels and bio-based feedstocks. We will also evaluate scenarios to move toward a national LCFS, feasibility and cost assessment, and how California's system may be harmonized with the national efforts.

Under this task, four areas will be investigated:

- Study the global trade impacts of U.S. LCFS policy and potential World Trade Organization (WTO) issues with implementation
- Synthesize and extend state of the art models of market-mediated impacts of biofuel policies to examine issues of trades, tariffs, and food vs. fuel.
- Evaluate national approaches as well as international in the developments of LCFS and determine the interface and effects to the California LCFS.

- Evaluate biomass, including, but not limited to forest residue, availability, distribution mechanisms, and competition for other purposes other than use in producing transportation fuel. This includes estimating criteria and toxic pollutants associated with biomass use.

Deliverables: Formal papers describing work and results, presentations regarding subject matter for workshops and internal meetings, as well as email and telephone support.

Budget: \$100,000.00

Timeline: These deliverables are expected to be completed by December 2010, though it is expected all tasks will be implemented by stages and some will be finished earlier depending on the urgency of the tasks requested by the ARB staff. We will continue to have regular weekly briefings with ARB sharing technical details and the status of the research papers.

Task 3. Sustainability Effects of the LCFS

Our goal is to develop a roadmap for establishing sustainability standards within the LCFS framework. We expect to provide guidance on establishing performance-based standards and propose practical and effective monitoring and compliance strategies. In addition, we will be providing support in ARB's efforts to evaluate cap and trade issues in relation to LCFS. The work needs to be consistent with other environmental standards and similar programs within California (such as AB118 overseen by the California Energy Commission), with federal Renewable Fuel Standard (RFS) and with international efforts (such as European Commission's sustainability scheme). This project will provide consultation service to ARB staff on issues of conducting environmental and economic impact assessments. These may include health and equity issues, other environmental considerations, evaluating the costs and benefits of the LCFS, and uncertainty analysis. One of the major areas that we will expand under this task is the study of sustainability.

Under this task, three areas will be investigated:

- Sustainability research for the Low Carbon Fuel Standard with an international review and update.
- Approach to sustainability reporting for the Low Carbon Fuel Standard.
- Develop a roadmap for sustainability standards and implementation of sustainability criteria and methods.

Deliverables: Formal papers describing work and results, presentations regarding subject matter for workshops and internal meetings, as well as email and telephone support.

Budget: \$100,354.00

Timeline: These deliverables are expected to be completed by December 2010, though it is expected all tasks will be implemented by stages and some will be finished earlier depending on the urgency of the tasks requested by the ARB staff. We will continue to have regular weekly briefings with ARB sharing technical details and the status of the research papers.

The project representatives during the term of this agreement will be:

State Agency: Air Resources Board	Contractor: The Regents of the University of California, Davis
Name: John Courtis	Name: Sonia Yeh
Section/Unit: Stationary Source Division	Section/Unit: Institute of Transportation Studies
Address: 1001 I Street, 6 th Floor Sacramento, CA 95812	Address: 2028 Academic Surge Davis, CA 95616
Phone: (916) 324-9299	Phone: (530) 754-9000
Fax: (916) 323-1045	Fax: (530) 752-6572
Email: jcourtis@arb.ca.gov	Email: slyeh@ucdavis.edu

The ARB Contract Administrator is:

The University's Contract Administrator is:

State Agency: Air Resources Board	Contractor: The Regents of the University of California, Davis
Name: Sue Bayoneta	Attention: Paula Noble
Section/Unit: Administrative Services Division	Section/Unit: Contracts and Grants Analyst
Address: 1001 "I" Street, 20 th Floor Sacramento, CA 95814	Address: 2028 Academic Surge Davis, CA 95616
Phone: (916) 327-8215	Phone: (530) 747-3921
Fax: (916) 327-2940	(530) 747-3929
Email: sbayonet@arb.ca.gov	Email: pnoble@ucdavis.edu

EXHIBIT B

BUDGET DETAIL AND PAYMENT PROVISIONS

1. Invoicing

- A. For services satisfactorily rendered in accordance with this Agreement and upon receipt and approval of the invoices which properly detail all charges the ARB agrees to compensate the Regents of the University of California, Davis for actual expenditures incurred in accordance with the rates specified below and in Exhibit, B, Attachment 1, which is incorporated into this agreement.

FY 08/09: \$162,407.00
FY 09/10: \$137,947.00
Total Amount \$ 300,354.00

- B. Invoices shall include the Agreement Number and shall be submitted in triplicate not more frequently than monthly in arrears to:

Air Resources Board
Accounting Section
P.O. Box 1436
Sacramento, CA 95812

- C. BUDGET FLEXIBILITY: Subject to the prior review and approval of the contract manager, line items shifts of up to \$25,000 or ten percent of the annual contract total, whichever is less, may be made up to a cumulative maximum of \$25,000 or 10%, whichever is less, for all line item shifts over the life of the contract. There must be a substantial business justification for any shifts made. Fund shifts which increase Indirect, Overhead or General Expense line items are prohibited. Line item shifts may be proposed/requested by either the State or the University in writing and must not increase or decrease the total contract amount allocated. Any line item shifts must be approved in writing by the Division Chief of Stationary Source Division, or his or her designee, and must be sent to Contracts Section within 10 days of approval for inclusion in contract folder. If the contract is formally amended, any line item shifts agreed to by the parties must be included in the amendment.

2. Budget Contingency Clause

- A. It is mutually agreed that if the Budget Act of the current year and/or any subsequent years covered under this Agreement does not appropriate sufficient funds for the program, this Agreement shall be of no further force and effect. In this event, the State shall have no liability to pay any funds whatsoever to Contractor or to furnish any other considerations under this Agreement and Contractor shall not be obligated to perform any provisions of this Agreement.
- B. If funding for any fiscal year is reduced or deleted by the Budget Act for purposes of this program, the State shall have the option to either cancel this Agreement with no liability occurring to the State, or offer an agreement amendment to Contractor to reflect the reduced amount.

3. Payment

- A. Costs for this Agreement shall be computed in accordance with State Administrative Manual Sections 8752 and 8752.1.
- B. Nothing herein contained shall preclude advance payments pursuant to Article 1, Chapter 3, Part 1, Division 3, Title 2 of the Government Code of the State of California.
- C. University will be paid for the payment period completed upon receipt, by ARB, of an invoice and progress report satisfying the requirements of this Agreement. The invoice and progress report must be deemed by ARB to reflect reasonable work performed in accordance with the Agreement.
- D. The amount to be paid to University under this Agreement includes all sales and use taxes incurred pursuant to this Agreement. University shall not receive additional compensation for reimbursement of such taxes and shall not decrease work to compensate therefore.

**EXHIBIT B
 ATTACHMENT 1**

DETAILED BUDGET

April 1, 2009 – December 31, 2009			
Personnel	Salary	% commitment	Total
Sonia Yeh, Assistant Researcher @ \$7481/month			
12 months @ 0.15	\$7,481	15.0%	\$13,465.80
+ Benefits @ 0.13		13.0%	\$1,750.55
Mark Delucchi, Researcher @ \$8502/month			
12 months @ 0.075	\$8,502	7.5%	\$7,651.80
+ Benefits @ 0.35		35.0%	\$2,678.13
2 Graduate Students, GSR IV @ \$3593/month	2.0		
Academic Year @ 0.5	\$3,593	50.0%	\$32,337.00
+ Summer @ 0.33	\$3,593	33.0%	\$7,114.14
+ Benefits @ 0.013		1.3%	\$420.38
Tuition @ \$10,617.90/year (minus 25% campus buy-down)			\$15,926.85
1 Postdoc researcher @ \$4500/month	1		
12 months @ 0.013	\$4,500	100.0%	\$54,000.00
+ Benefits @ 0.013		1.3%	\$702.00
Financial Assistant @ \$3508/month			
12 months @ 0.075	\$3,508	7.5%	\$3,157.20
+ Benefits @ 0.36		36.0%	\$1,136.59
Supplies & Expense			\$1,500.00
Travel			\$7,250.00
Direct Costs			\$149,090.44
Modified Total Direct Costs (excludes tuition)			\$133,163.59
Indirect Costs @ 10%			\$13,316.35
TOTAL BUDGET YEAR 1			\$162,406.79

January 1, 2010 - December 31, 2010			
Personnel	Salary	% commitment	Total
Sonia Yeh, Assistant Researcher @ \$7705.43/month			
13 months @ 0.15	\$7,705	15.0%	\$15,025.59
+ Benefits @ 0.13		13.0%	\$1,953.33
Mark Delucchi, Researcher @ \$8757.06/month	13		
13 months @ 0.075	\$8,757	7.5%	\$8,538.13
+ Benefits @ 0.35		35.0%	\$2,988.35
1 Graduate Students, GSR.IV @ \$3700.79/month	1.0		
Academic Year @ 0.5	\$3,701	50.0%	\$16,653.56
+ Summer @ 0.33	\$3,701	33.0%	\$3,663.78
+ Benefits @ 0.013		1.3%	\$216.50
Tuition @ \$11,148.80/year (minus 25% campus buy-down)			\$8,361.60
1 Postdoc researcher @ \$4635/month	1		
12 months @ 0.013	\$4,635	100.0%	\$55,620.00
+ Benefits @ 0.013		1.3%	\$723.06
Financial Assistant @ \$3613.24/month			
14 months @ 0.075	\$3,613	7.5%	\$3,251.92
+ Benefits @ 0.36		36.0%	\$1,170.69
Supplies & Expense			\$1,500.00
Travel			\$6,500.00
Direct Costs			\$126,166.51
Modified Total Direct Costs (excludes tuition)			\$117,804.91
Indirect Costs @ 10%			\$11,780.49
TOTAL BUDGET YEAR 2			\$137,947.00

EXHIBIT D

SPECIAL TERMS AND CONDITIONS

1. Termination

- A. This Agreement may be canceled at any time by either party, upon thirty (30) days written notice to the other party.
- B. In the case of early termination, the performing agency will submit an invoice in triplicate and a report in triplicate covering services to termination date, following the invoice and progress report requirements of this Agreement. A copy and description of any data collected up to termination date will also be provided to ARB.
- C. Upon receipt of the invoice, progress report, and data, a final payment will be made to the performing agency. This payment shall be for all ARB-approved, actually incurred costs in accordance with Exhibits A and B, and shall include labor, and materials purchased or utilized (including all non-cancellable commitments) to termination date, and pro rata indirect costs as specified in the proposal budget.

2. Disputes

- A. ARB reserves the right to issue an order to stop work in the event that a dispute should arise, or in the event that the ARB gives the performing agency a notice that this Agreement will be terminated. The stop-work order will be in effect until the dispute has been resolved or this Agreement has been terminated.
- B. Any dispute concerning a question of fact arising under the terms of this Agreement which is not disposed of within a reasonable period of time by agency employees normally responsible for the administration of this agreement, shall be brought to the attention of the Executive Officer or designated representative of each agency for joint resolution.

3. Amendments

ARB reserves the right to amend this agreement for additional time and/or additional funding.

EXHIBIT E

ADDITIONAL PROVISIONS

1. Reports and Data Compilations

- A. ***With respect to each invoice period, University shall forward to the ARB Contract Administrator, one (1) electronic copy of the progress report and mail one (1) copy of the progress report along with each invoice. (Do not use Express Mail). When emailing the progress report, the "subject line" should state the contract number and the billing period. Each progress report will begin with the following disclaimer:***

The statements and conclusions in this report are those of the University and not necessarily those of the California Air Resources Board. The mention of commercial products, their source, or their use in connection with material reported herein is not to be construed as actual or implied endorsement of such products.

- B. Each progress report will also include:

1. A brief narrative account of project tasks completed or partially completed since the last progress report;
2. A brief discussion of problems encountered during the reporting period and how they were or are proposed to be resolved;
3. A brief discussion of work planned, by project task, before the next progress report; and
4. A graph or table showing allocation of the budget and amount used to date.
5. A graph or table showing percent of work completion for each task.

- C. If the project is behind schedule, the progress report must contain an explanation of reasons and how the University plans to resume the schedule.

- D. Six months prior to Agreement termination date, University will deliver to ARB twenty (20) bound copies of a draft final report. The reports may be stapled or spiral bound, depending on size. The draft final report will conform to Exhibit F.

- E. Within forty-five (45) days of receipt of ARB's comments on the draft Final Report (Exhibit F), University will deliver to ARB's Contract Manager two (2) copies of the Final Report incorporating all reasonable alterations and additions requested by ARB. Upon approval of the amended final report approved by ARB in accordance to Exhibit F, University will within two (2) weeks, deliver to ARB two (2) camera ready UNBOUND originals of a Final Report incorporating all final alterations and additions. The final report will conform to the Contract Final Report Format, Exhibit F.

- F. Together with the final report, University will deliver a copy of the report on diskette/CD, using any common word processing software (please specify the software used) and a set of all data compilations as specified by the ARB Contract Manager.

- G. University's obligation under this Agreement shall be deemed discharged only upon submittal to ARB of an acceptable final report in accordance to Exhibit F, report diskette/CD, all required data compilations, and any other project deliverables.
- H. Prior to completion of this Agreement, University shall be entitled to release or make available reports, information, or other data prepared or assembled by it pursuant to this Agreement, in scientific journals and other publications and at scientific meetings, provided however, that a copy of the publication be submitted to ARB for review and comment 45 days prior to such publication. Further, University shall place the disclaimer statement in a conspicuous place on all such reports or publications. Health related reports should include an acknowledgment to the late Dr. Friedman. Nothing in this provision shall be construed to limit the right of State to release information obtained from the University or to publish reports, information, or data in State publications.

2. Copyrightable Materials

In recognition of the policy of ARB and University to promote and safeguard free and open inquiry by faculty, students and the members of the public and in furtherance of such policy, both parties agree to the following with respect to rights in data and copyrights under this Agreement:

- A. The term "Subject Data" shall mean all original and raw research data, notes, computer programs, writings, sound recordings, pictorial reproductions, drawings or other graphical representations, and works of any similar nature, produced by University in performance of this Agreement, but specifically excluding "Reports," as defined in this Agreement. Subject Data also excludes financial reports, cost analyses, and similar information incidental to contract administration.
- B. The term "Reports" shall have the meaning assigned to it in this Exhibit F of this Agreement.
- C. Ownership of all Subject Data and copyrights arising from Subject Data shall be vested in University while ownership of all Reports and copyrights arising from the Reports delivered under this Agreement shall be vested in ARB. University agrees to make available to the public for public benefit, to the extent the University shall have the legal right to do so, without license or fee, any scholarly articles which are published from the Subject Data.
- D. Nothing in this exhibit or Agreement shall be construed to limit the right of University faculty, students or staff to publish the Subject Data in the form of scholarly articles in academic journals nor to affect, abrogate or limit the right of University faculty, staff or students to make use of the Subject Data.

3. Travel & Per Diem

- A. Any reimbursement for necessary travel and per diem shall be at the University's approved travel rates.

- B. No foreign travel shall be reimbursed unless prior written authorization is obtained from ARB.

4. **Meetings**

- A. **Initial meeting.** Before work on the contract begins, the Principal Investigator and key personnel will meet with the ARB Contract Manager and other staff to discuss the overall plan, details of performing the tasks, the project schedule, items related to personnel or changes in personnel, and any issues that may need to be resolved before work can begin.
- B. **Progress review meetings.** The Principal Investigator and appropriate members of his or her staff will meet with ARB's Contract Manager at quarterly intervals to discuss the progress of the project. This meeting may be conducted by phone.
- C. **Technical Seminar.** The Contractor will present the results of the project to ARB staff and a possible webcast at a seminar at ARB facilities in Sacramento or El Monte.

5. **Confidentiality**

- A. It is understood that in the course of carrying out this Agreement, State may wish to provide University with proprietary or confidential information of State (Proprietary Information). University agrees to use its best efforts to hold proprietary information in confidence and shall return it to State upon the completion of the project.
- B. This obligation shall apply only to proprietary information that is designated or identified as such in writing by State prior to the disclosure thereof. All proprietary information shall be sent only to the Principal Investigator. Moreover, this obligation shall not apply to any proprietary information which: a) is or becomes publicly known through no wrongful or negligent act on the part of University; b) is already known to University at the time of disclosure; c) independently developed by University without breach of this agreement; or d) is generally disclosed to third parties by State without similar restrictions on such third parties.

EXHIBIT F

RESEARCH FINAL REPORT FORMAT

The research contract Final Report (Report) is as important to the contract as the research itself. The Report is a record of the project and its results, and is used in several ways. Therefore, the Report must be well organized and contain certain specific information. ARB reviews all draft Final Reports, paying special attention to the Abstract and Executive Summary. If ARB finds that the Report does not fulfill the requirements stated in this Appendix, the document will not be approved for release, and final payment for the work completed may be withheld. This Appendix outlines the requirements that must be met when producing the Report.

Note: In partial fulfillment of the Final Report requirements, the Contractor shall submit a copy of the Report on a CD in PDF format and in a word-processing format, preferably in Word - Version 6.0 or later. This is in addition to the submission of any paper copies required. The diskette shall be clearly labeled with the contract title, ARB contract number, the words "Final Report", and the date the report was submitted.

Legibility. Each page of the approved Final Report must be legible and camera-ready.

Binding. The draft Report, including its appendices, must be either spiral bound or stapled, depending on size. The revised Report and its appendices should be spiral bound, except for two unbound, camera-ready originals.

Cover. Do not supply a cover for the Report. ARB will provide its standard cover.

One-sided vs. two-sided. To conserve paper, both the draft Report and the revised Report, except for the unbound camera-ready copies, should be printed on both sides of the page. The unbound camera-ready copies must be printed on only one side of the page.

Title. The title of the Report should exactly duplicate the title of the contract unless a change is approved in writing by the contract manager.

Spacing. In order to conserve paper, copying costs, and postage, please use single or one-line (1) spacing.

Page size. All pages should be of standard size (8 1/2" x 11") to allow for photo-reproduction.

Large tables or figures. Foldout or photo-reduced tables or figures are not acceptable because they cannot be readily reproduced. Large tables and figures should be presented on consecutive 8 1/2" x 11" pages, each page containing one portion of the larger chart.

Color. Color presentations are not acceptable; printing shall be black on white only.

Corporate identification. Do not include corporate identification on any page of the Final Report, except the title page.

Unit notation. Measurements in the Reports should be expressed in metric units. However, for the convenience of engineers and other scientists accustomed to using the British system, values may be

given in British units as well in parentheses after the value in metric units. The expression of measurements in both systems is especially encouraged for engineering reports.

Section order. The Report should contain the following sections, in the order listed below:

Title page
Disclaimer
Acknowledgment (1)
Acknowledgment (2)
Table of Contents
List of Figures
List of Tables
Abstract
Executive Summary
Body of Report
References
List of inventions reported and copyrighted materials produced
Glossary of Terms, Abbreviations, and Symbols
Appendices

Page numbering. Beginning with the body of the Report, pages shall be numbered consecutively beginning with '1', including all appendices and attachments. Pages preceding the body of the Report shall be numbered consecutively, in ascending order, with small Roman numerals.

Title page. The title page should include, at a minimum, the contract number, contract title, name of the principal investigator, contractor organization, date, and this statement: "Prepared for the California Air Resources Board and the California Environmental Protection Agency"

Disclaimer. A page dedicated to this statement must follow the Title Page:

The statements and conclusions in this Report are those of the contractor and not necessarily those of the California Air Resources Board. The mention of commercial products, their source, or their use in connection with material reported herein is not to be construed as actual or implied endorsement of such products.

Acknowledgment. Only this section should contain acknowledgments of key personnel and organizations who were associated with the project. The last paragraph of the acknowledgments must read as follows:

This Report was submitted in fulfillment of [ARB contract number and project title] by [contractor organization] under the [partial] sponsorship of the California Air Resources Board. Work was completed as of [date].

Table of Contents. This should list all the sections, chapters, and appendices, together with their page numbers. Check for completeness and correct reference to pages in the Report.

List of Figures. This list is optional if there are fewer than five illustrations.

List of Tables. This list is optional if there are fewer than five tables.

Abstract. The abstract should tell the reader, in nontechnical terms, the purpose and scope of the work undertaken, describe the work performed, and present the results obtained and conclusions. The purpose of the abstract is to provide the reader with useful information and a means of determining whether the complete document should be obtained for study. The length of the abstract should be no more than about 200 words. Only those concepts that are addressed in the executive summary should be included in the abstract.

Example of an abstract:

A recently developed ground-based instrument, employing light detecting and ranging (lidar) technology, was evaluated and found to accurately measure ozone concentrations at altitudes of up to 3,000 meters. The novel approach used in this study provides true vertical distributions of ozone concentrations aloft and better temporal coverage of these distributions than other, more common methods, such as those using aircraft and ozonesonde (balloon) techniques. The ozone and aerosol measurements from this study, in conjunction with temperature and wind measurements, will provide a better characterization of atmospheric conditions aloft and the processes involved in the formation of unhealthful ozone concentrations than can be achieved with traditional ground-based monitors.

Executive Summary. The function of the executive summary is to inform the reader about the important aspects of the work that was done, permitting the reader to understand the research without reading the entire Report. It should state the objectives of the research and briefly describe the experimental methodology[ies] used, results, conclusions, and recommendations for further study. All of the concepts brought out in the abstract should be expanded upon in the Executive Summary. Conversely, the Executive Summary should not contain concepts that are not expanded upon in the body of the Report.

The Executive Summary will be used in several applications as written; therefore, please observe the style considerations discussed below.

Limit the Executive Summary to two pages, single spaced.

Use narrative form. Use a style and vocabulary level comparable to that in Scientific American or the New York Times.

Do not list contract tasks in lieu of discussing the methodology.

Discuss the results rather than listing them.

Avoid jargon.

Define technical terms.

Use passive voice if active voice is awkward.

Avoid the temptation to lump separate topics together in one sentence to cut down on length.

The Executive Summary should contain four sections: Background, Methods, Results, and Conclusions, described below:

THE BACKGROUND SECTION. For the Background, provide a one-paragraph discussion of the reasons the research was needed. Relate the research to the Board's regulatory functions, such as establishing ambient air quality standards for the protection of human health, crops, and ecosystems; the improvement and updating of emissions inventories; and the development of air pollution control strategies.

THE METHODS SECTION. At the beginning of the Methods section, state what was done in general, in one or two sentences.

The methodology should be described in general, nontechnical terms, unless the purpose of the research was to develop a new methodology or demonstrate a new apparatus or technique. Even in those cases, technical aspects of the methodology should be kept to the minimum necessary for understanding the project. Use terminology with which the reader is likely to be familiar. If it is necessary to use technical terms, define them. Details, such as names of manufacturers and statistical analysis techniques, should be omitted.

Specify when and where the study was performed, if it is important in interpreting the results.

The findings should not be mentioned in the Methods section.

THE RESULTS SECTION. The Results section should be a single paragraph in which the main findings are cited and their significance briefly discussed. The results should be presented as a narrative, not a list. This section must include a discussion of the implications of the work for the Board's relevant regulatory programs.

THE CONCLUSIONS SECTION. The Conclusions section should be a single short paragraph in which the results are related to the background, objectives, and methods. Again, this should be presented as a narrative rather than a list. Include a short discussion of recommendations for further study, adhering to the guidelines for the Recommendations section in the body of the Report.

Body of Report. The body of the Report should contain the details of the research, divided into the following sections:

Introduction. Clearly identify the scope and purpose of the project. Provide a general background of the project. Explicitly state the assumptions of the study.

Clearly describe the hypothesis or problem the research was designed to address. Discuss previous related work and provide a brief review of the relevant literature on the topic.

Materials and Methods. Describe the various phases of the project, the theoretical approach to the solution of the problem being addressed, and limitations to the work. Describe the design and construction phases of the project, materials, equipment, instrumentation, and methodology. Describe quality assurance and quality control procedures used. Describe the experimental or evaluation phase of the project.

Results. Present the results in an orderly and coherent sequence. Describe statistical procedures used and their assumptions. Discuss information presented in tables, figures and graphs. The titles and heading of tables, graphs, and figures, should be understandable without reference to the text. Include all necessary explanatory footnotes. Clearly indicate the measurement units used.

Discussion. Interpret the data in the context of the original hypothesis or problem. Does the data support the hypothesis or provide solutions to the research problem? If appropriate, discuss how the results compare to data from similar or related studies. What are the implications of the findings? Identify innovations or development of new techniques or processes. If appropriate, discuss cost projections and economic analyses.

Summary and Conclusions. This is the most important part of the Report because it is the section that will probably be read most frequently. This section should begin with a clear, concise statement of what, why, and how the project was done. Major results and conclusions of the study should then be presented, using clear, concise statements. Make sure the conclusions reached are fully supported by the results of the study. Do not overstate or overinterpret the results. It may be useful to itemize primary results and conclusions. A simple table or graph may be used to illustrate.

Recommendations. Use clear, concise statements to recommend (if appropriate) future research that is a reasonable progression of the study and can be supported by the results and discussion.

References. Use a consistent style to fully cite work referenced throughout the Report and references to closely related work, background material, and publications that offer additional information on aspects of the work. Please list these together in a separate section, following the body of the Report. If the Report is lengthy, you may list the references at the end of each chapter.

List of inventions reported and publications produced. If any inventions have been reported, or publications or pending publications have been produced as a result of the project, the titles, authors, journals or magazines, and identifying numbers that will assist in locating such information should be included in this section.

Glossary of terms, abbreviations, and symbols. When more than five of these items are used in the text of the Report, prepare a complete listing with explanations and definitions. It is expected that every abbreviation and symbol will be written out at its first appearance in the Report, with the abbreviation or symbol following in parentheses [i.e., carbon dioxide (CO₂)]. Symbols listed in table and figure legends need not be listed in the Glossary.

Appendices. Related or additional material that is too bulky or detailed to include within the discussion portion of the Report shall be placed in appendices. If a Report has only one appendix, it should be entitled 'APPENDIX'. If a Report has more than one appendix, each should be designated with a capital letter (APPENDIX A, APPENDIX B). If the appendices are too large for inclusion in the Report, they should be collated, following the binding requirements for the Report, as a separate document. The contract manager will determine whether appendices are to be included in the Report or treated separately. Page numbers of appendices included in the Report should continue the page numbering of the Report body. Pages of separated appendices should be numbered consecutively, beginning at '1'.