

Philip Heirigs, Chevron Global Downstream LLC

Mr. Heirigs, a native of California, holds a B.S. in Engineering and a M.S. in Chemical Engineering from the University of California, Los Angeles and is a licensed Professional Engineer in the state. His professional career began with a short stint in the nuclear power industry, which was followed by nearly seven years with the Mobile Source Division of the California Air Resources Board in El Monte. While at the ARB, he gained expertise in emissions modeling, developing inputs for the EMFAC model as well as developing emissions benefits estimates for a number of rulemakings (e.g., the OBD II regulations in 1989 and the Low Emission Vehicle regulations in 1990). He ended his tenure at the ARB in 1992, at which time he was managing the Alternate Fuels Section in the Mobile Source Division. He then spent 15 years at Sierra Research, a Sacramento-based consulting firm. While at Sierra, he was involved in numerous projects requiring emissions data analysis and emissions modeling. This included on-road vehicles, off-road vehicles, motor vehicle air toxics, assessment of fuel effects, and alternative fuels.

In June 2007, Mr. Heirigs joined Chevron, where his key responsibilities have included the analysis of issues related to the life cycle assessment (LCA) of transportation fuels, vehicle fuel economy, transportation fuel demand, and the impact of fuel specification changes on vehicle emissions. He has developed expertise with the GREET model and has reviewed how model results have been used in the Low Carbon Fuel Standard. He is active in several industry associations, providing input on issues related to the LCA of transportation fuels, vehicle fuel economy, and emissions modeling. He served as co-chair of the “CRC Workshop on Life Cycle Analysis of Biofuels” held at Argonne National Laboratory in October 2009. He is currently participating on the Indirect Impacts Expert Group of the Roundtable on Sustainable Biofuels.

Curriculum Vitae

Philip Heirigs

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Education

1991, M.S., Chemical Engineering, University of California, Los Angeles

1984, B.S., Cum Laude, Engineering, University of California, Los Angeles

Professional Experience

6/2007 to present Staff Engineer
Chevron Global Downstream LLC

Responsibilities include participation in industry associations (e.g., Coordinating Research Council, American Petroleum Institute, and Western States Petroleum Association) with an emphasis on issues related to the life cycle assessment (LCA) of transportation fuels, vehicle fuel economy, and the impact of fuel specification changes on vehicle emissions. Within Chevron, serve as a subject matter expert on the GREET model, life cycle assessment of transportation fuels, fuel demand forecasts, motor vehicle technology, and vehicle emissions modeling.

Experience Specific to Life Cycle Assessment

- Chevron internal expert on the GREET model. This work has included detailed evaluations of many fuel pathways for both biofuels and petroleum-based fuels in which the emissions contribution of each element of the pathway was quantified. Have attended and coordinated several seminars and training courses on the GREET model as well as the Lifecycle Emissions Model (LEM).
- Served as co-chair of the “CRC Workshop on Life Cycle Analysis of Biofuels” held at Argonne National Laboratory on October 20-21, 2009. As part of that effort, also served as co-chair for two of the sessions: (1) “LCA Modeling Overview,” and (2) “Growing of Feedstocks and Soil/Fertilizer Interaction” (see <http://www.crcao.org/workshops/LCA%20October%202009/LCAindex.html>)
- Have attended all CARB workshops on LCA issues associated with the Low Carbon Fuel Standard (LCFS). Early in the rulemaking process (October 2007), provided comments and suggestions to CARB for assessing the impacts of co-

products and land use issues (see <http://www.arb.ca.gov/lists/lcfs-lifecycle-ws/2-102307chevron.pdf>).

- Have critically reviewed several of CARB's fuel pathway documents published as part of the LCFS; comments on those documents have been incorporated into industry association submittals.
- Critically reviewed EPA's Notice of Proposed Rulemaking and Regulatory Impact Analysis for the Renewable Fuel Standard with an emphasis on the life cycle analysis and land use change estimates.
- Have closely followed the work sponsored by the Alberta Energy Research Institute on the life cycle assessment of North American and imported crudes, attending workshops and webinars on the issue.
- Critically reviewed Argonne's life cycle assessment of soy-based biodiesel and renewable diesel while still in draft form (see <http://www.transportation.anl.gov/pdfs/AF/467.pdf>).
- Currently serving on the leadership team for CRC Project E-88, "Review of Transportation Fuel Life-Cycle Analysis," which is being conducted by Life Cycle Associates.

4/1992 to 6/2007 Senior Professional/Partner
Sierra Research, Inc.

Responsibilities included preparing on-road and off-road mobile source emission inventories, evaluating EPA and CARB emission factor models, analyzing emissions and fuel data, and assessing the costs and benefits of alternative mobile source control measures. Under contract to federal agencies and industry associations, evaluations of EPA's MOBILE models and CARB's EMFAC models were performed. Also responsible for the development of training materials and the delivery of over a dozen training sessions throughout the U.S. and Canada on the MOBILE5 and MOBILE6 models. Separate efforts analyzed ambient carbon monoxide (CO) data for a number of western communities, estimated the impact of fuel specification changes on ambient CO levels, and evaluated the emissions benefits of a variety of motor vehicle control strategies (e.g., light- and heavy-duty vehicle scrappage programs, lawn and garden equipment scrappage programs, fuel specification changes, I/M program improvements, etc.).

12/1990 to 4/1992 Senior Air Pollution Specialist
California Air Resources Board

Supervised a staff of four professionals responsible for assessing the emission reduction potential of alternative fuels for motor vehicles. This included the development of low-emission vehicle regulations and reactivity adjustment factors for alternative fuel vehicles; development of emission test programs and analysis of speciated emissions test data to determine the relative reactivity of various fuels; attendance of task force meetings on clean fuels issues; and analysis of the impact of California's motor vehicle program on other states.

7/1985 to 12/1990 Air Resources Engineer
California Air Resources Board

Duties included analysis of emissions test data for development of motor vehicle emission factors, development of high-speed chassis dynamometer test cycles, and preparation of emissions benefit calculations for numerous regulatory packages. Also developed regulations for on-board diagnostic systems, managed research contracts, and provided support for a variety of air quality planning activities.

7/1984 to 6/1985 Systems Engineer
Bechtel Power Corporation

Responsible engineer for gaseous and liquid radioactive waste systems at a nuclear generating station. Duties included preparation of engineering calculations in support of proposed design changes, coordination with equipment vendors and field start-up engineers, and revision of engineering drawings to incorporate "as-built" design.

9/1988 to 12/1990 Graduate Research Engineer
Dept. of Chemical Engineering
University of California, Los Angeles

Research activities included design and execution of a field sampling program at an oil refinery in the Los Angeles area. Both air and water samples were obtained and analyzed. Data were used in conjunction with a chemical mass balance model (CMB7) to determine the relative contribution of a number of waste streams to a dissolved air flotation unit in the wastewater system.

Credentials and Memberships

Society of Automotive Engineers
Registered Professional Engineer, Chemical Engineering (CH4637)

Selected Publications (Author or Co-Author)

“Analysis of Nonroad Engine and Equipment Air Toxics Emissions Data for Use in EPA’s NMIM National Inventory Model,” Sierra Research Report No. SR2007-05-03, prepared for the U.S. Environmental Protection Agency, May 2007.

“Processing of IM240 Data for Use in MOVES,” Sierra Research Report No. SR2007-05-02, prepared for the U.S. Environmental Protection Agency, May 2007.

“Assessment of the Performance of the California Smog Check Program Using Random Roadside Data,” Sierra Research Report No. SR2007-04-01, prepared for the California Air Resources Board and the Bureau of Automotive Repair, April 2007.

“Development of Fleet Characteristics Data for the Idaho On-Road Motor Vehicle Fleet,” Sierra Research Report No. SR2006-01-01, prepared for the Idaho Dept. of Environmental Quality, January 4, 2006.

“Evaluation of Vermont’s Adoption of California’s Greenhouse Gas Regulations on Criteria Pollutants and Precursor Emissions,” Sierra Research Report No. SR2005-09-02, prepared for the Alliance of Automobile Manufacturers, September 19, 2005.

“Effectiveness Assessment of New Jersey Enhanced I/M Program Based on Analysis of In-Program Data,” Sierra Research Report No. SR2005-09-01, prepared for New Jersey Motor Vehicle Services, September 1, 2005.

“Assessment of the Cost-Effectiveness of Compliance Strategies for Selected Eight-Hour Ozone NAAQS Nonattainment Areas,” Sierra Research Report No. SR2005-08-04, prepared for the American Petroleum Institute, August 30, 2005.

“Evaluation of New York’s Adoption of California’s Greenhouse Gas Regulations On Criteria Pollutants and Precursor Emissions,” Sierra Research Report No. SR2005-07-04, prepared for the Alliance of Automobile Manufacturers, July 14, 2005

“Development of the Emissions Impacts of More Stringent ASM Cutpoints in the California Smog Check Program,” Sierra Research Report No. SR2005-07-03, prepared for California Air Resources Board and Bureau of Automotive Repair, July 14, 2005.

“Review of MOVES2004,” Sierra Research Report No. SR2005-07-01, prepared for the Alliance of Automobile Manufacturers, July 11, 2005.

“Comparison of New Jersey OBDII I/M Results to Other States,” Sierra Research Report No. SR2005-04-01, prepared for New Jersey Motor Vehicle Services, April 20, 2005.

“Review of Mobile Source Air Toxics (MSAT) Emissions from On-Highway Vehicles: Literature Review, Database Development, and Recommendations for Future Studies,” Sierra Research Report No. SR2005-03-01, prepared for the American Petroleum Institute, March 4, 2005.

“The Contribution of Diesel Engines to Emissions of ROG, NO_x, and PM_{2.5} in California: Past, Present, and Future,” Sierra Research Report No. SR2005-02-01, prepared for Diesel Technology Forum, February 2005.

“Impacts of Eliminating Maricopa County Wintertime Gasoline Standards on Emissions and Ambient Concentrations of CO in February and March,” Sierra Research Report No. SR2005-01-01, prepared for the Arizona Department of Environmental Quality, January 24, 2005.

“Fuel Effects on Highway Mobile Source Air Toxics (MSAT) Emissions,” Sierra Research Report No. SR2004-12-01, prepared for the American Petroleum Institute, December 23, 2004.

“Development of a Dirty Screen Utility for MOBILE6,” Sierra Research Report No. SR2004-11-01, prepared for the U.S. Environmental Protection Agency, November 5, 2004.

“Evaluation of MOBILE Models: MOBILE 6.1 (PM), MOBILE6.2 (Toxics), and MOBILE6/CNG,” Sierra Research Report No. SR2004-05-01, prepared for the National Cooperative Highway Research Program, May 2004.

“Emissions and Economic Impacts of an Electric Forklift Mandate,” Sierra Research Report No. SR2003-12-01, prepared for the National Propane Gas Association, December 9, 2003.

“Evaluation of Fuel Effects on Nonroad Mobile Source Air Toxics (MSAT) Emissions: Literature Review, Database Development, and Recommendations for Future Studies,” Sierra Research Report No. SR2003-10-01, prepared for the American Petroleum Institute, October 2003.

“Development of a Clean Screen Utility for MOBILE6,” Sierra Research Report No. SR2003-07-01, prepared for the U.S. Environmental Protection Agency, July 2003.

“Review of Current and Future CO Emissions from On-Road Vehicles in Selected Western Areas,” Sierra Research Report No. SR03-01-01, prepared for the Western States Petroleum Association, January 2003.

“Review of CO Compliance Status in Selected Western Areas,” Sierra Research Report No. SR02-09-04, prepared for the Western States Petroleum Association, September 2002.

“MOBILE6 On-Road Motor Vehicle Emissions Model Training Course,” Prepared by Sierra Research for the Federal Highway Administration and the U.S. Environmental Protection Agency, Summer 2002.

“Central Puget Sound CO/Ozone Maintenance Planning Project,” Sierra Research Report No. SR01-11-02, prepared for the Puget Sound Clean Air Agency, November 2001.

“Development of a MOBILE6-Based Emissions Inventory for the Dallas-Fort Worth Nonattainment Area,” Prepared for the U.S. EPA, October 2, 2001.

“WESTAR MOBILE5a/MOBILE5b and MOBILE6 Modeling Course,” Prepared by Sierra Research for the Western States Air Resources Council, April 24-25, 2001.

“Excess Emissions Identification Using the IM147 Test Procedure with ‘Revision 2 Max CO’ Standards,” Sierra Research Report No. SR00-07-01, prepared for the Arizona Department of Environmental Quality, July 2000.

“A Comparative Analysis of the Feasibility and Cost of Compliance with Potential future Emission Standards for Heavy-Duty Vehicles Using Diesel or Natural Gas,” Sierra Research Report No. SR00-02-02, prepared for Californians For a Sound Fuel Strategy, February 2000.

“Analysis of the Impacts of Control Programs on Motor Vehicle Toxics Emissions and Exposure in Urban Areas and Nationwide,” Sierra Research Report No. SR99-11-02, prepared for the U.S. Environmental Protection Agency, November 1999.

“Determination of Emissions Credit and Average Test Times for IM147 Testing,” Sierra Research Report No. SR 99-10-02, prepared for the U.S. Environmental Protection Agency, October 1999.

“Evaporative Emissions from Late-Model In-Use Vehicles,” Sierra Research Report No. SR99-10-03, prepared for the Coordinating Research Council, October 1999.

“Evaluation of Potential MOBILE Revisions on CO Emissions Estimates in Anchorage, Alaska,” prepared for the Alaska Department of Environmental Conservation, Sierra Research Report No. SR98-12-03, December 1998.

“A White Paper on Motor Vehicle Air Toxics,” Sierra Research Report No. SR98-09-04, prepared for the U.S. Department of Transportation, Federal Highway Administration, October 1998.

“Motor Vehicle Emission Model Calibration Using Local I/M Data: Phase 1 - Assessment of Models and Guideline Development,” Sierra Research Report No. SR98-06-02, prepared for the Greater Vancouver Regional District, June 1998.

“Analysis of ASM Data for Preconditioning, Driving Tolerances, and Fast Pass Strategies,” Sierra Research Report No. SR98-03-02, prepared for the U.S. Environmental Protection Agency, March 1998.

“Additional Study of Preconditioning Effects and Other IM240 Testing Issues,” Sierra Research Report No. SR98-02-01, prepared for the U.S. Environmental Protection Agency, Regional and State Programs Division, February 1998.

“Analysis of Real-Time Evaporative Emissions Data,” Sierra Research Report No. SR97-12-01, prepared for the American Petroleum Institute, December 1997.

“Analysis of High-Mileage-Vehicle Emissions Data from Late-Model Fuel-Injected Vehicles,” Sierra Research Report No. SR97-01-01, prepared for the American Petroleum Institute, January 1997.

“Comparison of EPA’s MOBILE5a and MOBILE5b Emission Factors Models,” Sierra Research Report No. SR96-11-01, prepared for the Federal Highway Administration, November 25, 1996.

“Preconditioning Effects on I/M Test Results Using IM240 and ASM Procedures,” Sierra Research Report No. SR96-09-04, prepared for the American Automobile Manufacturers Association, September 1996.

“Analysis of Mid- and Long-Term Ozone Control Measures for Maricopa County,” Sierra Research Report No. SR96-09-02, prepared for the Western States Petroleum Association, September 9, 1996.

“Benefits and Costs of Oxygen Sensor Repairs on High-Emitting Vehicles,” Presented at the 12th Annual Mobile Sources/Clean Air Conference, September 17-19, 1996.

“Analysis of Causes of Failure in High Emitting Cars,” Sierra Research Report No. SR95-10-03, prepared for API, October 1995.

“A Comparison of Dynamometer and Idle Testing Effectiveness in a Vehicle Inspection and Maintenance Program,” Sierra Research Report No. SR95-05-02, prepared for The Coalition for Safer, Cleaner Vehicles, May 1995.

“Investigation of MOBILE5a Emission Factors - Assessment of I/M Program and LEV Program Emission Benefits,” Sierra Research Report No. SR94-06-05, prepared for API, June 1994.

“Investigation of MOBILE5a Emission Factors - Evaluation of IM240-to-FTP Correlation and Base Emission Rate Equations,” Sierra Research Report No. SR94-06-04, prepared for API, June 1994.

“Evaluation of ‘MOBILE’ Vehicle Emission Model,” Sierra Research Report No. SR93-12-02, prepared for the Volpe National Transportation Systems Center, U.S. Department of Transportation, December 1993.

“Evaluation of Proposed Changes to California’s Smog Check Program Utilizing EPA’s Tech5 and MOBILE5a Emission Factor Models (Draft),” prepared for the California I/M Review Committee, August 1993.

“SJVAQS/AUSPEX Agricultural Emissions Inventory,” Sierra Research Report No. SR93-04-01, prepared for the San Joaquin Valleywide Air Pollution Study Agency, April 1993.

“Evaluation of Methodologies to Estimate Nonroad Mobile Source Usage,” Sierra Research Report No. SR93-03-02, prepared for U.S. EPA Office of Mobile Sources, March 1993.

P.L. Heirigs, “The Application of Chemical Mass Balance Techniques to Wastewater Stream Source Allocation,” Master’s Thesis, University of California, Los Angeles, 1991.

P.L. Heirigs, S.G. Albu, and K.D. Drachand, “The Use of On-Board Diagnostic Systems as a Replacement for the Tailpipe Inspection and Maintenance Test,” Paper No. 89-9.2, Presented at the 82nd Annual Meeting of the Air and Waste Management Association, Anaheim, CA, June 1989.

**Low Carbon Fuel Standard
Expert Workgroup Member Application Form
Please submit a CV along with this form**

APPLICANT: Philip Lawrence Heirigs
First Middle Last

Employer: Chevron Global Downstream LLC

Current Job Title: Staff Engineer

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Broad Areas of Expertise:

- Vehicle Emissions Data Analysis/Modeling

- Transportation Fuel Lifecycle Analysis Modeling

- Motor Vehicle Fuels and Emissions Impacts

Years of Relevant Experience: 20+

Comments: I am located in the Sacramento area and therefore will not have travel-related concerns about attending the work group meetings. In addition, over the past two-plus years I have spent significant time reviewing GREET and its inputs and therefore have a very good working knowledge of the model.

Please return to:

Ms. Manisha Singh, Air Pollution Specialist
Alternative Fuels Section
Air Resources Board
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Sacramento, California 95814
or, email: mansingh@arb.ca.gov