

# DENNIS E. MCNALLY

SENIOR SCIENTIST  
ALPINE GEOPHYSICS, LLC

## EDUCATION:

M.S. Atmospheric Sciences, University of California, Davis, California, 1994.

B.S. Chemical Engineering, Emphasis in Computer Science, University of Colorado, Boulder, Colorado, 1987.

## PROFESSIONAL EXPERIENCE:

Senior Scientist, Alpine Geophysics, Arvada, CO, 1990-Present.

Staff Scientist, Radian Corporation, Sacramento, CA, 1987-1990.

Student Assistant II, National Center for Atmospheric Research, Boulder, CO, 1985-1987.

## FIELDS OF EXPERIENCE:

Dennis McNally is an Atmospheric Scientist interested in applied air quality studies. He provides project management, programming and modeling expertise for advanced photochemical and mesoscale meteorological modeling studies. He possesses a practical knowledge of the physical sciences and the computer science skills essential in mathematical modeling of environmental systems. His education has been strengthened by practical experience in atmospheric transport and process modeling through his participation in the Regional Acid Deposition Model (RADM) development program at the National Center for Atmospheric Research (NCAR). Mr. McNally was honored by being selected as a participant in the 1990 NCAR Summer Colloquium on Mesoscale Data Assimilation. His areas of expertise include the following:

### Photochemical Modeling

Mr. McNally has been a central participant in over 50 studies involving the application of state of science photochemical modeling systems. His experience ranges from chemical mechanism development to modeling to support regulatory issues. Over the last decade Mr. McNally has experience with the CALPUFF, CAMx, UAM-V, UAM-IV, UAM-2, ROM 2.2, MAQSIP, SAQM and Models-3/CMAQ photochemical models. Mr. McNally has conducted numerous photochemical modeling training courses for both industrial and government groups.

### Meteorological Modeling

Dennis has extensive experience with the application of meteorological models *for air quality* applications. His experience ranges from application of fairly simplistic objective/diagnostic models for screening analyses to state of science prognostic models to address regional transport. He has experience with the CSUMM, MM5, RAMS and WRF prognostic meteorological models and the CALMET diagnostic model for applications in numerous government and industry-sponsored studies. Mr. McNally has conducted several training courses for various state and local government agencies.

### Model Performance Evaluation

A key component to the application of meteorological and photochemical models is comparison to observations. As the developer of the MAPS model performance evaluation tool, Mr. McNally has taken evaluation techniques out of academia and made them available to the regulatory community.

### Selected Project Experience

SESARM VISTAS2. Client: Southeastern States Air Resource Managers, Inc. (SESARM), 2017 – Ongoing. Alpine is performing the regional haze photochemical modeling and analysis to assist the southeastern states in crafting regional haze state implementation plans.

North Slope Regional Air Quality Modeling. Client: Bureau of Land Management, 2018 – Ongoing. Alpine is reviewing the BOEM Arctic study and updating the modeling platform for use by BLM reviewing projects in Northern Alaska.

Galveston Bay Refining Inter-pollutant Trade. Client: Blanchard Refining, 2018. Alpine performed an analysis showing the ozone air quality benefit of offsetting the VOC emissions from a refinery modification with NOx emission credits.

Entergy Inter-pollutant Trade. Client Entergy, 2017. Alpine performed an analysis showing the ozone air quality benefit of offsetting the VOC emissions from a power generation turbine with NOx emission credits.

Petronova Inter-pollutant Trade. Client: Petronova, 2013. Using the CAMx photochemical model, Alpine performed an analysis showing the ozone air quality benefit of offsetting the VOC emissions from a flue gas carbon capture project in the Houston area with NOx emission credits.

Celanese Methanol Inter-pollutant Trade. Client: Celanese Ltd, 2013. . Using the CAMx photochemical model, Alpine performed an analysis showing the ozone air quality benefit of offsetting the VOC emissions from a methanol technology project in the Houston area with NOx emission credits.

Ozone NAAQS Analysis. Client: Midwest Ozone Group, 2000 – Ongoing. Generate a base and projection year modeling platform and execute CAMx for ozone in order to provide input on potential technical activities available to support interested parties in the review, analysis, and planning for NAAQS attainment in the Midwestern and eastern U.S. Develop a future year culpability assessment using OSAT/APCA and prepare incremental studies on source apportionment and emissions and air quality trends for domestic and international sources.

Denver/Northern Front Range State Implementation Plan. Client: ENVIRON/Regional Air Quality Council, 2008 – Present. Alpine is conducting SMOKE emissions and CAMx photochemical modeling in support of the Denver/Northern Front Range 8-hour ozone State Implementation Plan (SIP). This SIP modeling includes development of a June 2006 and Summer 2011 baseline photochemical modeling databases, emissions sensitivity testing to assist in developing candidate control strategies and detailed control strategy emissions development and photochemical modeling.

Greater Monument Buttes Oil and Gas Project. Client: Newfield Exploration, 2014. Alpine used the CMAQ air quality model and SMOKE emissions model to examine the impacts of a proposed oil and gas project in the Uintah Basin of Utah.

Marathon Resid Oil Upgrader and Capital Development. Client: Marathon Petroleum, 2014. Using the CAMx photochemical model, Alpine performed modeling to estimate the ozone impact of a proposed refinery expansion in Louisiana.

Uintah Basin 2013 Winter Ozone and Air Quality Study. Client: Utah Division of Air Quality. 2013. Alpine participated in synthesis and presentation of the 2013 Winter Ozone Study examining elevated ozone levels in rural Utah.

Moneta Divide Environmental Impact Statement. Client: BLM Lander Field Office, 2013. Alpine and a team of other consultants are using photochemical modeling to examine the air quality impacts of the Moneta Divide project emissions in central Wyoming.

Sasol Lake Charles. Client: Sasol North America, 2013. Using the CAMx photochemical model, Alpine performed modeling to estimate the ozone impact of a proposed petrochemical complex expansion in Louisiana.

Cameron Liquefied Natural Gas. Client: Cameron LNG, 2013. Using the CAMx photochemical model, Alpine performed modeling to estimate the ozone impact of a proposed liquefied natural gas export terminal in Louisiana.

Uintah Basin 2012 Winter Ozone and Air Quality Study. Client: Utah State University. 2012. Alpine participated in synthesis and presentation of the 2012 Winter Ozone Study examining elevated ozone levels in rural Utah.

BLM Carlsbad Field Office – Permian Basin Air Quality Impacts Analysis, Client: URS/BLM. 2012. Alpine applied the SMOKE emissions model and CAMx photochemical model over the Permian Basin to assist in air quality planning the basin.

Wyoming Meteorological Modeling for Ozone Impact Analysis: Client: Wyoming Department of Environmental Quality. 2011. Alpine was the lead modeling contractor preparing annual Weather Research and Forecasting (WRF) meteorological fields for an annual 2008 simulation and provided assistance for development of higher resolution simulations.

Chukchi Sea WRF Modeling. Client: ConocoPhillips, 2011. Alpine applied the WRF Mesoscale meteorological model over Alaska and the Chukchi Sea for the months of July through November for the years 2007, 2008 and 2009 for subsequent use in the CALMET model to compute air quality impacts of a proposed development operation. Included in the project was an operational model evaluation comparing the model results to available observation data.

Western Regional Air Partnership (WRAP) West-wide Jump Start Air Quality Modeling Study (WestJumpAQMS). Client: Western Regional Air Partnership, 2011. Using the WRF mesoscale meteorological model, the SMOKE emissions model and the CAMx photochemical model, Alpine conducted photochemical modeling in the Western United States to assist in air quality planning.

Cheniere Sabine Pass Liquefaction. Client: Cheniere, 2011. Using the CAMx photochemical model, Alpine performed modeling to estimate the ozone impact of a proposed liquefied natural gas export terminal in Louisiana.

Allegheny County PM2.5 State Implementation Plan. Client: Allegheny County Health Department, 2011. Using the WRF mesoscale meteorological model, the SMOKE emissions model and the CAMx photochemical model, 2 Alpine is conducting both regional and local scale modeling to assess the impact of local and regional scale emissions on the residual non-attainment at monitors in the Liberty/Clairton area.

Houston Stakeholder Modeling. Client: Consortium of Industrial Groups in Greater Houston Area, 2010. Using the WRF Mesoscale meteorological model, the SMOKE emissions model and the CMAQ and CAMx air quality models, Alpine is exploring ensemble meteorological and air quality modeling to develop potential air quality control options in the Houston, TX area.

Single Source Ozone Impact Analysis in the Gulf Coast. Client: Trinity Consultants/Cheniere Energy, Inc., 2011 Using the Baton Rouge Louisiana SIP photochemical modeling system Alpine assessed the potential ozone impacts of a proposed natural gas liquefaction facility in Cameron Parish, Louisiana.

Mesoscale Model Interface Formatter (MMIF) Statistical Software Development. Client: General Services Administration (GSA), 2010. Developed a statistical package to compare the MMIF model results against routinely available meteorological observations.

Chapita Wells Oil and Gas Project. Client: EOG Resources, 2009. Alpine is using CMAQ air quality model and SMOKE emissions model to examine the impacts of a proposed oil and gas project in the Uintah Basin of Utah.

EPA 2005 MM5/WRF. Client: EPA Office of Air Quality Planning/GSA, 2008. Applied the MM5 mesoscale meteorological modeling for calendar 2005 to develop base case meteorology for future air quality modeling and to apply the WRF model to select periods during the year to intercompare WRF and MM5 model performance.

Pennsylvania Biofuels. Client: E.H. Pechan and Associates/Pennsylvania DEP, 2009. Using the Mobile 6/SMOKE emissions models and the CMAQ air quality model, Alpine assessed the ozone and particulate air quality impact of increased biofuel penetration within the commonwealth.

Nucor Steel Louisiana. Client: Environmental Resource Management/Nucor Steel, 2008. Using a preliminary release of the Baton Rouge Louisiana SIP photochemical modeling system Alpine assessed the potential ozone impacts of a proposed pig iron facility.

Greater Natural Buttes. Client: AECOM/Anadarko Petroleum, 2008 – 2012. Under the NEPA process Alpine is applying the CMAQ model for base years 2005 and 2006, and a future year of 2018 to examine alternative development scenarios in the Uinta Basin. In addition to the CMAQ modeling, this study involved application of the Western Regional Air Partnership (WRAP) emissions database using the SMOKE emissions modeling system.

Four Corners Ozone Task Force CAMx. Client: ENVIRON/New Mexico Environment Department, 2007 – Present. As a subcontractor to ENVIRON, Alpine is assisting in developing a summer 2005 CAMx photochemical modeling episode over the Four-Corner region of Arizona, Colorado, New Mexico and Utah. This modeling database will then be used to assess a variety of emissions sensitivity experiments to determine both the current causes of high ozone in the area and to assist in future air quality planning.

Baton Rouge Stakeholder Air Quality Modeling. Client: Industry Consortium, 2006-Present. Under contract to a consortium of industrial clients, Alpine has developed and evaluated a summer 2005 CAMx modeling database over Baton Rouge, LA to examine ozone culpability in the region and to assist the State of Louisiana in developing an 8-hour ozone State Implementation Plan. Included in this project are source apportionment simulations and future year emissions sensitivity assessments.

VISTAS Emissions and Air Quality Modeling. Client: VISTAS, 2003 - Present. VISTAS is a collaborative effort of state governments, tribal governments, and various federal agencies established to initiate and coordinate activities associated with the management of regional haze, visibility, and other air quality issues in the southeastern United States. Alpine Geophysics, LLC, is part of a team performing the Phase II Emissions and Air Quality Modeling for VISTAS. The cornerstone of the Phase II activities is performing annual emissions and regional PM/ozone modeling of 2002, 2009, and 2018 using the SMOKE/CMAQ/MM5 modeling system.

SIP Strategy Comprehension Plan (SSCP). Client: Industry Consortium, 2005 - 2007. The objective in developing this plan was to describe the components of an integrated 8-hour ozone and annual PM<sub>2.5</sub> modeling study for the five-state Upper Midwest region. The aim of the SSCP is to develop a process allowing the project sponsors insight and assurance that best modeling practices are being utilized to identify effective emission reduction controls to address the residual nonattainment issues in this region, and that if alternate and credible information is developed independently outside of the scope, timelines, or budgets of the RPO recommendation process, that these data are introduced to the states in a constructive manner for consideration in SIP development timelines. This plan was implemented by Alpine in preparing MM5 meteorological, SMOKE and photochemical modeling of 2002, 2005, 2008 and 2015 and presentation of the results to both the regulators and the regulated industry.

San Juan County Early Action Compact. Client: Air Quality Bureau, New Mexico Environment Division, 2003 - 2004. Performed MM5 meteorological, emissions, and photochemical modeling for multiple ozone episodes to assist the state in application of an Early Action Compact to EPA. Included preparation of protocol documents, quality assurance documents, and community outreach presentations, and delivery of comprehensive training to division staff and interested parties.

Central California Ozone Study (CCOS) Ambient Ozone. Client: Valleywide Air Pollution Study Agency, 2005-2006. The primary object of this study was to advance the present understanding of air quality in central California, with specific emphasis on ozone formation and ozone levels in the San Joaquin Valley. The geographic domain of interest included the entire region of Central California Ozone Study, which in addition to the San Joaquin Valley incorporates the Sacramento Valley, the San Francisco Bay Area, and the central California coast. In order to do this, we needed to clarify the relationships between trends in ambient ozone data and trends in the stationary, area, on-road mobile, non-road mobile, and biogenic sources emissions inventories. This study involved application of the MM5 model, the EMS-95 emissions model and the CAMx photochemical model instrumented with advanced process analysis.

Holnam Evaluation. Client: U.S. EPA, Region 7, 2002. Performed CAMx photochemical modeling to assess the potential ozone air quality impacts of a proposed Portland cement manufacturing plant upwind of the St. Louis non-attainment area. Tasks performed during this project included:

- Obtaining all relevant modeling databases and proposed facility emissions estimates from the Missouri Department of Natural Resources and confirm proper operation of the model on the Alpine Geophysics computer network;
- Modifying the inputs to UAM-V to include the nitrogen oxide and hydrocarbon emissions from the proposed facility;
- Running the UAM-V with the modified emission files;
- Interpreting the results of the modeling on the ozone attainment status in St. Louis

Peninsular Florida Ozone Study. Client: Florida Department of Environmental Protection (FL DEP), 2000 - 2002. The objectives of this study were to: (1) set up and evaluate advanced emissions, meteorological, and photochemical modeling tools for up to nine 8-hour ozone episodes affecting the Tampa, Orlando, and Jacksonville areas (three episodes per area); (2) examine potential emissions control strategies that would attain and/or maintain the new 8-hour standard in the region; and (3) assist in the development of the technical analyses supporting a "weight of evidence" attainment demonstration to be used by FL DEP for regulatory decision-making and in developing its State Implementation Plan (SIP) submittal to the EPA. To accomplish these objectives, the following technical approach was implemented:

- Assess the nature and extent of ozone episodes in the central Florida region and develop a quantitative procedure for classifying and selecting modeling episodes for 8-hour modeling;
- Prepare an Ozone Modeling Protocol that guides the adaptation, evaluation, and use of emissions, meteorological, and photochemical models for the region;
- Prepare appropriate emissions, meteorological, and air quality model input data sets for up to nine multiple-day episodes suitable for 8-hour ozone attainment demonstration modeling in the individual Tampa, Orlando, and Jacksonville areas or across the entire Peninsular Florida region as a whole;
- Conduct model evaluation analyses following draft EPA 8-hour ozone guidelines (EPA, 1999) in order to estimate the adequacy and reliability of the photochemical modeling system and datasets;

- Develop future year baseline emissions projections in the Peninsular Florida region based on the best projections of emissions growth and control in the region;
- Exercise the photochemical modeling system with the future-year emissions estimates for the selected episodes to ascertain whether the new 8-hour standard is attained. If attainment is not modeled in the baseline scenario, examine pertinent emissions reduction scenarios aimed at demonstrating attainment for the episode; and
- Develop a suitable "weight of evidence" analysis supporting the ozone attainment demonstration, consistent with EPA guidance.

#### **PROFESSIONAL SOCIETIES:**

Air and Waste Management Association  
 American Meteorological Society  
 American Chemical Society

#### **PUBLICATIONS:**

##### **Journal Papers:**

"Ethylene Source Attribution Modeling in the Greater Houston Area", *Atmospheric Pollution Research*, (with others), Vol. 8, pp. 1016-1022.

"Preliminary Evaluation of the Community Multiscale Air Quality Model for 2002 over the Southeastern United States", *Journal of the Air & Waste Management Association*, (with others), Vol. 65, pp. 1694-1708, 2005.

"Evaluation of CALGRID Using Two Different Ozone Episodes and Comparison to UAM Results", *Atmospheric Environment*, (with others), Vol. 28, No. 17, pp. 2823-2845, 1994.

"Photochemical Modeling of Two SCCAMP Ozone Episodes," (with T. W. Tesche), *Journal of Applied Meteorology*, Vol. 30, pp. 745-763.

##### **Conference Proceedings and Presentations:**

"Application of EPA's Flexible Attainment Demonstration Guidance to the Pittsburgh-Beaver Valley Ozone Nonattainment Area", (with T. W. Tesche) 10<sup>th</sup> Joint Conference on Applications of Air Pollution Meteorology, Phoenix, AZ, 11-16 January, 1998.

"Assessment of the Reliability of the OTAG Modeling System", (with others), 10<sup>th</sup> Joint Conference on Applications of Air Pollution Meteorology, Phoenix, AZ, 11-16 January, 1998.

"Final Evaluation of the MM5 Model for the 3-6 August 1990 SARMAP Episode over Central California", (with others), 10<sup>th</sup> Joint Conference on Applications of Air Pollution Meteorology, Phoenix, AZ, 11-16 January, 1998.

"Nested Regional Photochemical Modeling in Support of the Pittsburgh-Beaver Valley Ozone SIP", (with others), 10<sup>th</sup> Joint Conference on Applications of Air Pollution Meteorology, Phoenix, AZ, 11-16 January, 1998.

"Evaluation of the MM5, SAQM, UAM-IV, and UAM-V Models Over the Northeast U.S. for Four Ozone Episodes Using Routine and Intensive NARSTO-NE and LMOS Aerometric Data Sets", (with T. W. Tesche), First NARSTO-NE Data Analysis Symposium and Workshop, Washington, D.C., 10-12 December, 1996.

"Application of the SAQM, URM, and UAM-V Photochemical Models to the Southern California SCAQS-97 Domain", (with others), Ninth Joint Conference on Applications of Air Pollution Meteorology, Atlanta, GA, 28 January-2 February 1996.

"Evaluation of the MM5 Model for the July 1988 and July 1995 Episodes and Comparison with the OTAG Meteorological Model, RAMS", (with T. W. Tesche), 89th Annual Meeting of the Air and Waste Management Association, 23-28 June 1996, Nashville, TN.

"Relationships Between Ozone Precursor Controls Needed to Meet 1-Hr and 8-Hr Ozone NAAQS in San Francisco and Chicago", (with T. W. Tesche), 89th Annual Meeting of the Air and Waste Management Association, 23-28 June 1996, Nashville, TN.

"Evaluation of the URM, UAM-V, UAM-IV, and ROM2.2 Photochemical Models Over Lower Lake Michigan for Two 1991 LMOS Oxidant Episodes", (with others), Ninth Joint Conference on Applications of Air Pollution Meteorology, Atlanta, GA, 28 January-2 February 1996.

"Application of the Emissions Modeling System EMS-95 to the Southern California SCAQS-97 Domain", (with others), Ninth Joint Conference on Applications of Air Pollution Meteorology, Atlanta, GA, 28 January-2 February 1996.

"Numerical Simulation of Mesoscale Circulation Development in the San Diego Air Basin", Tropospheric Ozone and the Environment II, Air and Waste Management Association, 5-7 Nov. 1991, Atlanta, GA.

"Development of the Annual Average Urban Airshed Model (3AM) with Application to the Los Angeles Basin," (with T. W. Tesche), presented at the Symposium on Atmospheric Modeling, American Chemical Society, 10-15 Sept. 1990, Miami, FL.

"Ozone Control Implications Revealed by Airshed Model Isoleths," 82nd Annual Meeting of the Air and Waste Management Association, 25-30 June, 1989, Anaheim, CA.

"Role of Windfield Estimation in Airshed Modeling for Ozone Non-Attainment Planning," (with others) 81st Annual Meeting of the Air Pollution Control Association, 21-25 June, 1988, Dallas, TX.

"Importance of Boundary Layer Measurements for Urban Airshed Modeling," (with others) 81st Annual Meeting of the Air Pollution Control Association, 21-25 June, 1988, Dallas, TX.

"Incorporation of Monte Carlo Simulation Techniques into the R-RAM II Health Risk Assessment Model," 81st Annual Meeting of the Air Pollution Control Association, 21-25 June, 1988, Dallas, TX.

## Company Reports (Selected)

"Regional Haze Modeling for Southeastern VISTAS II Regional Haze Analysis Project: Final Modeling Protocol", (with others), prepared for SESARM, Inc., Stockbridge, GA, June 2018.

"Regional Haze Modeling for Southeastern VISTAS II Regional Haze Analysis Project: 2011el and 2028el CAMx Benchmarking Report", (with others), prepared for SESARM, Inc., Stockbridge, GA, August 2018.

"Regional Haze Modeling for Southeastern VISTAS II Regional Haze Analysis Project: 2011el CAMx Version 6.32 and 6.40 Comparison Report", (with others), prepared for SESARM, Inc., Stockbridge, GA, December 2018.

"Regional Haze Modeling for Southeastern VISTAS II Regional Haze Analysis Project: 2011el CAMx Version 6.40 12km VISTAS and EPA 12km Continental Grid Comparison Report", (with others), prepared for SESARM, Inc., Stockbridge, GA, December 2018.

"Regional Haze Modeling for Southeastern VISTAS II Regional Haze Analysis Project: 2028 CAMx Version 6.32 and 6.40 12km Comparison Report", (with others), prepared for SESARM, Inc., Stockbridge, GA, April 2019.

"Regional Haze Modeling for Southeastern VISTAS II Regional Haze Analysis Project: 2028elv2 CAMx Version 6.40 12km VISTAS and EPA 12km Continental Grid Comparison Report", (with others), prepared for SESARM, Inc., Stockbridge, GA, May 2019.

"Ozone Impact Analysis of the Proposed Resid Oil Upgrader Expansion and Capital Development Project", (with Cynthia Loomis), prepared for Sage Environmental Consulting, Metairie, LA, 11 December 2014.

"Ozone and PM<sub>2.5</sub> Impact of the Proposed Sasol Lake Charles Gas-to-Liquids and Lake Charles Cracker Projects", (with Cyndi Loomis), prepared for Sasol North America Inc., Houston, TX, 15 November 2013.

"Ozone Impact Analysis of the Proposed Cameron LNG Facility", (with Cyndi Loomis), prepared for Cindy Thompson, C-K Associates, Baton Rouge, LA, 29 April 2013.

"Application and Evaluation of WRF for August through October 2010" (with Cyndi Loomis) prepared for Louisiana Foundation for Excellence in Science, Technology and Education, (2012).

"Western Regional Air Partnership (WRAP) West-wide Jump Start Air Quality Modeling Study (WestJumpAQMS) WRF Application/Evaluation" (with others), prepared for Western Regional Air Partnership, (2012).

"Evaluation of 36/12 km WRF for Calendar Year 2008 over the Continental and Western United States", (with others), prepared for Wyoming Department of Environmental Quality (2011).

"Winter 2008 WRF Modeling of the Upper Green River Basin", (with others), prepared for Wyoming Department of Environmental Quality, (2011).

"Application and Evaluation of WRF for Calendar Year 2007", (with Cyndi Loomis), prepared for Allegheny County Health Department, (2011).

"ConocoPhillips Chukchi Sea WRF Modeling Application, Model Application and Evaluation", (with J.G. Wilkinson), prepared for AECOM, (2011).

"Ozone Impact Analysis of the Proposed Cheniere Sabine Pass Liquefaction Facility", (with Cyndi Loomis), prepared for Trinity Consultants, (2011).

"Evaluation of Air Quality Impacts of Biofuels in Pennsylvania", (with others), prepared for Commonwealth of Pennsylvania Department of Environmental Protection Bureau of Air Quality, (2009).

"Technical Support Document for VISTAS Emissions and Air Quality Modeling to Support Regional Haze State Implementation Plans". (with others), prepared for Visibility Improvement State and Tribal Association of the Southeast (VISTAS), (2009).

“Technical Support Document for the Association of Southeastern Integrated Planning (ASIP) Emissions and Air Quality Modeling to Support PM<sub>2.5</sub> and 8-Hour Ozone State Implementation Plans”, (with others), prepared for Southeastern States Air Resource Managers, Inc. Association for Southeastern Integrated Planning, (2009).

“Final 2010 Ozone Attainment Demonstration Modeling for the Denver 8-Hour Ozone State Implementation Plan”,(with others), prepared for the Denver Regional Air Quality Council, (2009).

“Ozone Impact Analysis of the Proposed Nucor Steel Louisiana Facility”, (with Cyndi Loomis), prepared for Environmental Resource Management, (2008).

“Evaluation of 36/12/4 km MM5 for Calendar Year 2004 over the Continental and Western United States with Emphasis in Western Colorado, (with J.G. Wilkinson), prepared for Arcadis-US, Inc. (2008).

“Evaluation of 36/12/4 km MM5 for Calendar Year 2005 over the Continental and Western United States with Emphasis in Western Colorado, (with J.G. Wilkinson), prepared for Arcadis-US, Inc. (2008).

“Evaluation of 36/12/4 km MM5 for Calendar Year 2006 over the Continental and Western United States with Emphasis in Western Colorado, (with J.G. Wilkinson), prepared for Arcadis-US, Inc. (2008).

“Evaluation of 36/12/4 km MM5 for Calendar Year 2004 over the Continental and Western United States with Emphasis in Southwestern Wyoming, (with J.G. Wilkinson), prepared for Arcadis-US, Inc. (2008).

“Evaluation of 36/12/4 km MM5 for Calendar Year 2005 over the Continental and Western United States with Emphasis in Southwestern Wyoming, (with J.G. Wilkinson), prepared for Arcadis-US, Inc. (2008).

“Evaluation of 36/12/4 km MM5 for Calendar Year 2006 over the Continental and Western United States with Emphasis in Southwestern Wyoming, (with J.G. Wilkinson), prepared for Arcadis-US, Inc. (2008).

“Evaluation of 36/12 km MM5 and WRF for February and August 2005 over the Continental and Western United States”,(with J.G. Wilkinson), prepared for USEPA Office of Air Quality Planning and Standards (OAQPS), (2008).

“Evaluation of 36/12 km MM5 for Calendar Year 2005 over the Continental and Western United States”, (with J.G. Wilkinson), prepared for USEPA Office of Air Quality Planning and Standards (OAQPS), (2008).

“2010 Ozone Attainment Demonstration Modeling for the Denver 8-Hour Ozone State Implementation Plan Control Strategy”, (with others), prepared for the Denver Regional Air Quality Council, (2008).

“2010 Ozone Projections for the 2010 Base Case and 2010 Sensitivity Test and 2010 Ozone Source Apportionment Modeling for the Denver 8-hour Ozone State Implementation Plan”, (with others), prepared for Denver Regional Air Quality Council, (2008).

“Model Performance Evaluation for the June-July 2006 Ozone Episode for the Denver 8-hour Ozone State Implementation Plan”, (with others), prepared for Denver Regional Air Quality Council, (2008).

“Evaluation of Preliminary MM5 Meteorological Modeling Simulation for the June-July 2006 Denver Ozone SIP Modeling Period Focused on Colorado, (with others), prepared for Denver Regional Air Quality Council, (2008).

“Modeling Protocol for the Denver 8-Hour Ozone Attainment Demonstration Modeling”, (with others), prepared for Denver Regional Air Quality Council, (2007).

“Evaluation of 36/12 km MM5 For Calendar Year 2006 Over the Continental and Western United States”, (with G. J. Schewe), prepared for ENSR Corporation, (2007).

“Evaluation of 36/12/04 km MM5 for Calendar Year 2005 focused on the Upper Midwest”, (with G. J. Schewe), prepared for the Midwest Ozone Group, (2006).



"Evaluation of 36/12/04 km MM5 for Calendar Year 2003, (with G. J. Schewe), prepared for New Mexico Environment Department, (2006).

"Evaluation of 36/12/04 km MM5 for Calendar Year 2004, (with G. J. Schewe), prepared for New Mexico Environment Department, (2006).

"Evaluation of 36/12/04 km MM5 for Calendar Year 2005, (with G. J. Schewe), prepared for New Mexico Environment Department, (2006).

"CENRAP BART Modeling Guidelines", (with others), prepared for Central Region Air Planning Association, (2005).

"Annual Application of MM5 to Support 1994 Calpuff Air Quality Modeling, Final Report", (with T. W. Tesche), prepared for USEPA, Region XIII, (2003).

"Operational Evaluation of the MM5 Meteorological Model Over the Continental United States: Protocol for Annual and Episodic Evaluation", (with others), prepared for the U. S. EPA, Office of Air Quality Planning and Standards, (2002).

"Annual Application of MM5 to Support 1994 Calpuff Air Quality Modeling, Modeling Protocol", (with T. W. Tesche), prepared for USEPA, Region XIII, (2002).

"Modeled Effects of SO<sub>2</sub> and NO<sub>x</sub> Emissions Controls on Power Plants in and Upwind of New York on Annual and Seasonal Sulfate and Nitrate Deposition at Sensitive Receptors", (with T.W. Tesche), prepared for NRG Energy, Inc., (2002).

"Meteorological Modeling for the Southern Appalachian Mountains Initiative (SAMI), (with others), prepared for the Southern Appalachian Mountain Initiative, (2002).

"Operational and Scientific Evaluation of the MM5 Meteorological Model over the Continental United States: Protocol for Annual and Episodic Evaluation", (with others), prepared for the U.S. EPA, Office of Air Quality Planning and Standards, (2002).

"A Comparison of MM5 Model Estimates for February and July 2001 Using Alternative Model Physics Options". (with T. W. Tesche), prepared for the U.S. EPA, Office of Air Quality Planning and Standards, (2002).

"A Comparison of MM5 Model Estimates for February and July 2001 Using Alternative Input Databases". (with T. W. Tesche), prepared for the U.S. EPA, Office of Air Quality Planning and Standards, (2002).

"Peninsular Florida Ozone Study (PFOS): Volume 3: Final Report", (with others), prepared for the Florida Department of Environmental Protection. (2002).

"Development of Base Year and Future Motor Vehicle Emissions for the 25 August-1 September 2000 Episode", (with others), prepared for the BCCA-AG, (2001).

"CAMx Flexi-Nesting Simulations of Short Duration VOC Emissions on 8 September 1993 in Houston", (with T. W. Tesche), prepared for the BCCA-AG, (2001).

"Comparative Evaluation of MM5 and RAMS Meteorological Simulations of the 6-11 September 1993 Episode", (with T. W. Tesche), prepared for the BCCA-AG, (2001).

"CAMx Model Sensitivity to Choice of Horizontal Advection Scheme: Tests with the 6-11 September 1993 COAST Episode", (with T. W. Tesche), prepared for the BCCA-AG, (2001).

"Assessment of the Ozone Impacts of Rescinding the 55 MPH Speed Limit and Lawn Care and Construction Ban Control Measures in the 8-County Houston/Galveston Nonattainment Area", (with others), prepared for the BCCA-AG, (2001).

"Initial Evaluation of the MM5/MAQSIP-RT Forecast Model for the 27 August-1 September 2000 Modeling Episode", (with others), prepared for the BCCA-AG, (2001).

"Evaluation of Recent CAMx Simulations of the 6-11 September 1993 Episode Using Alternative Meteorological Drivers", (with T. W. Tesche), prepared for the BCCA-AG, (2001).

"Ozone Source Apportionment Modeling of the 6-11 September 1993 Episode", (with T. W. Tesche), prepared for the BCCA-AG, (2001).

"CAMx and MAQSIP Model Performance Evaluation with THOE Hours and Modeling Artifact Stations Removed", (with T. W. Tesche), prepared for the BCCA-AG, (2001).

"Relationships Between Concentrations of Highly Reactive VOCs and Concentrations of Photochemical Oxidants in the 8-County Houston/Galveston Nonattainment Area", prepared for the BCCA-AG, (2001).

"Analysis of the Ozone Air Quality Impacts of the Proposed Holnam, Inc. Portland Cement Manufacturing Plant", (with T. W. Tesche), prepared for the USEPA, Region VII, (2001).

"Uncertainty in Ozone Model Predictions", prepared for the Midwest Ozone Group, (2001).

"Evaluation of CAMx and Models-3/CMAQ Over the Lower Lake Michigan Region with Inputs from the RAMS3c and MMS Models", (with others), prepared for the Coordinating Research Council, (2001).

"Weight of Evidence Analyses Suggesting Attainment of the 1-hr Ozone Standard in the Baton Rouge Region", (with T. W. Tesche), prepared for NRG Energy, (2001).

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