PECHAN
E.H. Pechan & Associates, Inc.

MEMORANDUM

Date: February 15, 2008

To: N. Jay Bassin, Environmental Management Support, Inc.

From: Maureen Mullen, E.H. Pechan & Associates, Inc.

CC: Kathleen Aguilar, Pechan

Subject: Purchase Order Number 07-001/B-07/PO-05, Independent Peer Review of Draft "Preliminary Remediation Goals for Radionuclides in Outdoor Surfaces (SPRG)"

This memorandum documents my peer review of the above-referenced web site, user's guide and SPRG search tool. My expertise in this review is limited to issues related to the calculation of the mechanically driven particulate emission factor.

WEB SITE

The web site is generally easy to navigate, with an appealing mix of figures and text. The embedded links in the text to various references are very useful. The layout is useful and easy to follow.

USER'S GUIDE

The silt loading factor (SLF) refers to paved roads while the particle emission factor (PEF) is based on an old equation for unpaved roads.

This guide and the tool should use different PEF formulas based on whether the vehicle activity at the site is occurring on paved or unpaved roads.

Section 4.2.2.1: Mechanically Driven PEF

The equation used to calculate resuspended dust emissions from unpaved roads is out of date. The current equation (based on the AP-42 chapter finalized November 2006) is as follows (http://www.epa.gov/ttn/chief/ap42/ch13/index.html):

Public Unpaved Roads:

$$E = \{[1.8 * (s/12) * (S/30)^{0.5} / (M/0.5)^{0.2}] - 0.00047\} * (365-p)/365 * 281.9 * sum(VKT)$$

Where E is the total resuspended road dust emissions in grams, s is the surface material silt content (%), M is the surface material moisture content (%), p is the number of days in a year with at least 0.01

inches of precipitation, and VKT is the total vehicle kilometers traveled on the road segment. More details on the definitions of the variables and appropriate ranges can be found in the AP-42 chapter.

In addition, the AP-42 document provides a separate equation for resuspended road dust on industrial roads. Since it is expected that many of these sites might have industrial roads rather than publicly traveled unpaved roads, the tool should distinguish between which type of road is located on or near the site, and use the appropriate equation. The current AP-42 equation for resuspended road dust on industrial unpaved roads is as follows:

Unpaved Industrial Sites:

$$E = 1.5 * (s/12)^{0.9} * (W/3)^{0.45} * (365-p)/365 * 281.9 * sum(VKT)$$

Where E is the total resuspended road dust emissions in grams, s is the surface material silt content (%), W is the mean vehicle weight (tons), p is the number of days in a year with at least 0.01 inches of precipitation, and VKT is the total vehicle kilometers traveled on the road segment. More details on the definitions of the variables and appropriate ranges can be found in the AP-42 chapter.

Both of these equations include a conversion factor of 281.9, which was also included in the PEF equation. This is not defined anywhere in the PEF equation description and is not obvious. This should be documented and is the conversion from lb per vehicle mile traveled (VMT) to gram per VKT.

Similar equations should also be provided for paved roads and the tool should have the user select the appropriate road type: paved road; public unpaved road; or industrial unpaved road. The AP-42 equation for resuspended road dust from paved roads is as follows:

Paved Roads:

$$E = [4.6 * (sL/2)^{0.65} * (W/3)^{1.5} - 0.1317] * [1 - p / (4*365)] * sum(VKT)$$

Where E is the total resuspended road dust emissions in grams, sL is the road surface silt loading (g/m^2), W is the mean vehicle weight (tons), p is the number of days in a year with at least 0.01 inches of precipitation, and VKT is the total vehicle kilometers traveled on the road segment. More details on the definitions of the variables and appropriate ranges can be found in the AP-42 chapter.

The Table A1-6 provided in the user's guide is useful, however, as indicated, this table applies to paved roads, not unpaved roads (which is what is currently calculated in the PEF equation). Its utility is much greater than the state purpose of estimating the mean vehicle weight. Mean vehicle weight should be relatively easy to estimate based on the mix of vehicles traveling over the road. The more useful information in this table would be in providing general examples of the other variables needed in the resuspended road dust equation for paved roads, such as silt loadings.

The text in section 4.4.2.1 should be updated to be specific to the equations presented above, and the tool should be updated to allow the user to select the type of road (public unpaved, industrial unpaved, or paved).

4.3.10 Silt Loading Factor

It would be useful to copy the sentence from section 4.4.2.1 that provides the definition of silt into this section, since this section is focused on the silt loading factor. Table 2 is probably not useful for this discussion. Table 2 is looking at the aggregation of vehicle travel by roadway class across all roadways of the same type in a state. Since the purpose of the SPRG calculator is for more site-specific calculations, the user should have a pretty good idea of the type of road and traffic volume on the road. Therefore, Table 2 should be replaced with the silt loading factor defaults shown for the baseline by average daily travel category from Table 13.2.1-3 in the paved road section of AP-42.

The paragraph at the end of this section seems extraneous. It is not necessary to know the road class to estimate the default silt loading factor if the table referenced in the above paragraph (13.2.1-3 from AP-42) is included. The information in Table 13.2.1-4 is useful and should be retained.

General

For the PEF equation presented in the green box in section 4.4.2.1, it doesn't make sense that some of the variables are defined but some aren't. I realize that all the variables are defined in a later table, but it would be helpful to have the PEF variables all defined in the green box, if possible.

I am not sure I understand why the SLF is divided by the PEF, when (at least for paved roads) the SLF is used in calculating the PEF. The overall calculations shown in sections 4.1 and 4.2 are outside the area of my expertise, but this is just puzzling to me, and it would be good if someone with expertise in this part of the process can verify that this portion of the equations makes sense. Also, I am not sure what should be used in place of the SLF for unpaved roads, which are generally defined by a silt content percent rather than a loading factor.

SPRG SEARCH TOOL

The width of the Variable field should be shortened so that the Value field doesn't start to disappear off the end of the computer screen.

The user should be able to enter the silt loading factor (SLF) in units of g/m^2, since this is the set of units that SLFs are generally expressed in. The tool should then convert these units as needed.

The dropdown menus for "Most Likely State Road Conditions" (when State Specific SPRGs is selected) could be replaced by a user entry box for the SLF, if the recommendations from the User's Guide section are implemented.

When Site Specific SPRGs is selected, default values should be included for the tons/car and tons/truck fields.

In addition, these fields would need to be updated to capture the variables needed for the revised AP-42 equations.

Reflecting the input variables and values selected in the output section is very useful.

Some range checks should be performed on the values entered in the tool, and the user should be alerted if an entered value is outside of the expected range. Typical ranges could be listed next to the variables.

E.H. PECHAN & ASSOCIATES, INC.
MAUREEN A. MULLEN

Professional Background

May 1998-Present Senior Chemical Engineer, E.H. Pechan & Associates, Inc. (Pechan).

1988-May 1998 Chemical Engineer, Pechan.

Summary of Professional Experience

- Managing the development of greenhouse gas emission inventories and reference case projections for Arkansas, Florida, Iowa, and Kansas for the transportation, waste, agriculture, forestry, residential/commercial/industrial (RCI) fuel consumption, and non-fossil fuel industrial processes sectors. This also includes an evaluation of emission reductions associated with recent or planned actions (Pechan, 2007-Present).

- Developed greenhouse gas emission inventories and reference case projections for the transportation sector for New Jersey. Managed the development of greenhouse gas emission inventories and reference case projections for Maryland, Michigan, and Virginia for the transportation, waste, agriculture and forestry sectors (Pechan, 2007).

- Developing the onroad travel-related portion of a greenhouse gas emission inventory for the Port Authority of New York and New Jersey. This includes components related to the Port Authority's airports, port commerce facilities, bridges/tunnels/terminals, and fleet vehicles (Pechan, 2007-Present).

- Prepared a critical review of the paved and unpaved road fugitive dust portion of the draft 2005 Maricopa County, Arizona PM_{10} emission inventory (Pechan, 2007).

- Managed a contract to compile a database of speciated emissions from onroad diesel vehicles under the sponsorship of the Coordinating Research Council and the National Renewable Energy Laboratory (Pechan, 2005-2007).

- Managed contract to provide technical analysis and support to the Ozone Transport Commission in the development of a multi-pollutant emission reduction program in the Ozone Transport Commission (OTC) States. Performed an analysis of electricity generating unit emissions on high electric demand days (Pechan, 2006-2007).

- Provided technical assistance to the Baltimore Metropolitan Council in evaluating a set of 50 potential onroad emission control strategies. These control strategies are intended to assist the area in attaining the 8-hour ozone National Ambient Air Quality

Standards (NAAQS) and the particulate matter with an aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$) NAAQS (Pechan, 2006).

- Performed analysis of the potential increases in local PM concentrations that might result from the building of the Inter-County Connector in Maryland (Pechan, 2006).

- Provided technical and facilitative support to the Transportation and Land Use (TLU) Technical Work Groups (TWGs) in Arizona and New Mexico to assist these States in developing and analyzing policy recommendations that could reduce greenhouse gas emissions from the transportation sector (Pechan, 2005-2006).

- Prepared baseline inventory and reference case projections of greenhouse gas emissions from the transportation sector in North Carolina (Pechan, 2005).

- Assisted in the preparation of a document for the Lake Michigan Air Directors Consortium that provides guidance in assessing the quality and applicability of the output from travel demand models (TDMs) for use as input for MOBILE6.2 and for regional air quality models (Pechan, 2005).

- Managing project to prepare computer tool for the Metropolitan Washington Council of Governments (MWCOG) to automate and track development of MOBILE6 input files and related post-processing tasks. The MOBILE6 data are used in the development of ozone and PM State Implementation Plans (SIPs) and for transportation conformity analyses (Pechan, 2005-Present).

- Managing development of onroad emissions inventories for the U.S. Environmental Protection Agency's (EPA's) Second Section 812 Prospective Analysis. This includes historical year emission inventories and the development of 2000, 2010, and 2020 emission inventory projections with and without the provisions of the Clear Air Act included (Pechan, 2003-Present).

- Prepared the paved and unpaved road fugitive dust portion of EPA's National Emission Inventory, and for earlier years in EPA's *Trends* analysis. This most recently includes updates to the 2002 National Emission Inventory to account for revisions to EPA's AP-42 emission factor calculation documentation, as well as the preparation of documentation and training materials (Pechan, 1992-2006).

- Managing annually the preparation of national highway vehicle criteria pollutant emission inventories for historical years for EPA's National Emissions Inventory and *Trends* analysis, incorporating local vehicle miles traveled (VMT) and emissions data, where available. This has also included the calculation of hazardous air pollutant (HAP) emissions using MOBILE6.2 for several key years (Pechan, 1992-Present).

- Managed development of an hourly, link-level onroad benzene emission inventory for the 8-county Houston nonattainment area, with and without the effects of the Clean

Air Act (CAA) for EPA's Second Section 812 Prospective Analysis. Years of analysis include 1990, 2000, 2010, and 2020 (Pechan, 2005).

- Managed work order to prepare 2002 onroad and nonroad emission inventory for the Mid-Atlantic/Northeast Visibility Union (MANE-VU). For the onroad sector, incorporated significant amounts of State and local VMT and MOBILE model inputs and also prepared SMOKE modeling input files (Pechan, 2003-2006).
- Managed project to update EPA's National Mobile Inventory Model (NMIM) county-level database with 2002 onroad and nonroad inputs supplied by State and local agencies and to develop a quality assurance tool to assure that the updated data are valid (Pechan, 2003-2005).
- Reviewed available growth methodologies for projecting emissions from electricity generating units and onroad vehicles for the Lake Michigan Air Directors Consortium (LADCO) (Pechan, 2003).
- Managed contract to prepare 2002 onroad and nonroad emissions inventory for the Visibility Improvement-State and Tribal Association of the Southeast (VISTAS). For the onroad sector, incorporated significant amounts of State and local VMT and MOBILE model inputs (Pechan, 2002-2004).
- Prepared 2002 and 2003 onroad criteria pollutant and toxic air pollutant emissions inventory for Delaware at the link level of detail (Pechan, 2003-2004).
- Managed the development of databases for tracking mobile source control measures and other data needed for developing the 2002 draft and final onroad emission inventories for EPA's National Emission Inventory for criteria and hazardous air pollutants. This involved analyzing MOBILE6 input files, VMT and speed data, and other local input parameters submitted to EPA by State, local, and tribal agencies, and converting the data for input to the NMIM county-level database (Pechan, 2004-2005).
- Managed project to provide the Central Regional Air Planning Association (CENRAP) with growth and control factors that could be applied in projection year emission modeling for regional haze (Pechan, 2004-2005).
- Managed development of an onroad emission controls module for EPA's AirControlNET model. This involved developing streamlined methods to estimate the emissions benefits and costs of implementing a number of onroad control measures (Pechan, 2003).
- Performed analysis of 1999 and 2000 hourly utility emissions data from eleven Midwestern States for LADCO. This analysis included the development of emission profiles by hour, day, and season and an evaluation of the sensitivity of utility emissions to ambient temperature (Pechan, 2003).

- Provided technical support to the MWCOG in issues related to transportation conformity and ozone attainment. Prepared MOBILE5b and MOBILE6 emission factor files for counties in modeling domain, presenting results and highway vehicle-related modeling issues to MWCOG's technical committees (Pechan, 2001-2003).

- Managed development of a highway vehicle base year emission inventory for Sedgwick County, Kansas and provided training to local and State air quality staff on the development of highway vehicle emission inventories and the use of MOBILE6. This inventory was based on MOBILE6 and incorporated the available local data (Pechan, 2002).

- Managed a contract with the Southern Appalachian Mountains Initiative (SAMI) to develop emission inventory projections through the year 2040 for all anthropogenic emission sources within the eastern United States, evaluate emission control strategies, prepare direct cost analyses of emission control strategies, and analyze emission uncertainties. Assembled and facilitated workgroups of experts in the highway vehicle and electric utility sectors to solicit and incorporate their expectations of technology development and activity through the year 2040 (Pechan, 1997-2002).

- Managed development of highway vehicle emission inventory for a 1996 baseline and forecasts through 2018 for a multi-State area in support of the Western Regional Air Partnership's Mobile Sources Forum. Also projected paved and unpaved road fugitive dust emissions nationwide for 2018. These inventories were developed for use in modeling in response to the regional haze rule, and include the incorporation of significant State-supplied input data. Used EPA's MOBILE6 model to estimate highway vehicle emission factors (Pechan 2000-2001).

- Managed the evaluation of vehicle inspection and maintenance program emission benefits for two Pennsylvania cities based on 1999 emissions test data (Pechan, 2001).

- Managed the development of a national highway vehicle criteria pollutant emission inventory using EPA's MOBILE6 model for 1999, 2000, 1996, 1990, and 1978 for EPA. The 1999 inventories included the incorporation of State-provided VMT data, where provided, and were provided to States for review. Emissions were developed at the monthly level of detail by county, roadway type, and vehicle type for each of the 28 MOBILE6 vehicle types. Similar inventories were also prepared for 1999 and 2000 using MOBILE5b (Pechan, 2001).

- Managed the development of 1996, 2007, 2020, and 2030 highway vehicle emission inventories for EPA's heavy-duty vehicle/low sulfur diesel rulemaking. Emission calculations incorporated MOBILE5b to MOBILE6 adjustment factors. Inventories and modeling files for EMS-95, SMOKE, and EPS2.5 were prepared from start to finish in a short turnaround time (Pechan, 2000).

- Managed development of an emissions calculation model to be incorporated into transportation models for the Illinois Department of Transportation for use in transportation conformity analyses (Pechan, 1997-2000).

- Managed the development of 1996, 2007, and 2030 highway vehicle emission inventories for EPA's Tier 2/low sulfur gasoline rulemaking. Emission calculations incorporated MOBILE5b to MOBILE6 adjustment factors. Inventories and modeling files for EMS-95, SMOKE, and EPS2.5 were prepared from start to finish in a 2-month turnaround time (Pechan, 1999).

- Assisted the Mid-Atlantic Regional Air Management Association (MARAMA) in evaluating the contribution of highway vehicles to monitored ozone values at two selected study sites (Pechan, 1999).

- Prepared the 2007 ozone season highway vehicle emission budgets used by EPA in its Supplemental Notice of Proposed Rulemaking (NPRM) for the NO_x SIP Call. Evaluated, analyzed, and incorporated comments received by the EPA Docket from this NPRM related to the highway vehicle sector (Pechan, 1998-1999).

- Prepared the highway vehicle portion of the 1996 Periodic Inventory for the Georgia Department of Environmental Protection (Pechan, 1998).

- Provided technical assistance to the Atlanta Regional Commission (ARC) in the development of the long range (20 year) Regional Transportation Plan for the 13-county Atlanta metropolitan region. Estimated the emission benefits of planned, and potential, motor vehicle emission strategies for the region, with the objective of having a transportation plan that conforms to SIP budgets that allow the region to meet the ozone NAAQS. Worked with ARC staff to integrate highway vehicle emission calculations in their transportation planning process (Pechan, 1997-1999).

- Participated on a team to provide the U.S. Department of Energy's National Renewable Energy Laboratory with information on the air quality impacts from diesel- and gasoline-powered vehicles (Pechan, 1997-1999).

- Participated in analysis to determine the cost of various emission control strategies being considered by the Ozone Transport Assessment Group (OTAG). Managed cost analyses of highway vehicle and nonroad sectors; provided quality assurance and guidance for the utility sector. Developed and implemented methodology for incorporating State data into electric utility emission projections, including estimation of growth and controls for use in ozone modeling by OTAG. Also, managed the development of the highway vehicle inputs to the OTAG air quality modeling (Pechan, 1996-1997).

- Managed study to evaluate the potential emission benefits of a national heavy-duty engine standard, in support of EPA's proposed rulemaking. Included the development of 2025 emission inventories for highway vehicles, nonroad engines, utility, point, and area sources, with varying levels of controls for the highway vehicle and nonroad engine sectors (Pechan, 1996-1997).

- Provided technical support to the Pittsburgh Ozone Stakeholders Working Group, a group charged with developing a control plan to bring the area into attainment of the ambient ozone standard. Support activities included delivering monthly presentations at stakeholder meetings, providing data on air quality monitor data, emissions data, control options and emission reduction potentials and costs, and supplying emission input files for air quality modeling (Pechan, 1996).

- Prepared ozone redesignation requests, including emission and control projections, for all moderate and marginal nonattainment and incomplete data areas in Pennsylvania. Also analyzed emission effects of a number of alternative enhanced inspection and maintenance (I/M) programs and prepared the evaluation of the selected program for Pennsylvania's enhanced I/M SIP. (Pechan, 1993, 1995-1997).

- Developed methodology to incorporate IM240 emission data in the calculation of basic emission rates that can be used in EPA's MOBILE model (Pechan, 1995-1996).

- Managed projections of criteria pollutant emissions from electric utilities, simulating CAA controls, as well as additional incremental controls that could be applied to bring areas into attainment of the PM NAAQS (Pechan, 1995).

- Participated in several low-emission vehicle (LEV) analyses: (1) Managed analysis of the emission benefits of the OTC-LEV program and of the competing national LEV program. Results of the analysis were used by EPA in preparing their Regulatory Impact Analysis (RIA) (Pechan, 1994-1995); (2) Analyzed the potential of the California LEV program to reduce criteria pollutant and air toxic emissions in Texas and the Mid-Atlantic States. Modified the source code of EPA's MOBILE models to allow the modeling of California reformulated gasoline and to allow the light-duty gasoline truck 2 class to be included in the LEV program (Pechan, 1992-1993); (3) Analyzed the potential of the California LEV program to reduce emissions in the Northeastern States, included developing sets of emission factors to model this program, preparing all input for the MOBILE4.1 emission factor model, and modifying the MOBILE4.1 program where needed (Pechan, 1991).

- Prepared all motor vehicle emission factors for use in the Washington, DC nonattainment area's base year inventory and 15 percent reduction plan (Pechan, 1993-1994).

- Managed the development of a computer model to automate the process of calculating motor vehicle emissions by component (start-up exhaust, running loss, resting loss,

diurnal, and hot soak) to quickly evaluate the effectiveness of transportation control measures (Pechan, 1993-1994).

- Managed a project to provide EPA with the tools to evaluate mobile source emission inventory submittals; entailed the development of a computer model to evaluate MOBILE4.1 or MOBILE5 input files submitted with SIPs, documentation of the sensitivity of MOBILE4.1 emission factors to major variables, and the development of a computer model to estimate sensitivity of emissions to changes in key input variables. Presented workshop on the use of MOBILE4.1 to EPA staff (Pechan, 1992-1994).

- Disaggregated EPA's MOBILE and TECH models to examine alternative ways to analyze and express motor vehicle emissions; included analysis of effects of enrichment in high speed cycles (Pechan, 1992-1993).

- Evaluated emission reductions achievable with EPA's model enhanced I/M program for 51 areas required to implement such a program, and compared cost effectiveness and reductions attainable from enhanced I/M with other control alternatives available for each area (Pechan, 1992-1993).

- Managed analysis of incremental benefits of motor vehicle controls required for severe ozone nonattainment areas under the 1990 Amendments to the CAA; analysis included evaluation of the ability of these areas to meet their reasonable further progress (RFP) and attainment deadlines (Pechan, 1992).

- Analyzed effects of traffic congestion and transportation control measures on criteria pollutant emissions and greenhouse gas emissions in the metropolitan Washington area; included developing mobile source emission factors for a base year and two projection years (Pechan, 1991-1993).

- Prepared mobile source emission factors for input to the Regional Oxidant Model (ROM); included modifying the MOBILE4.1 mobile source emission factor model and modeling the provisions of the 1990 Amendments to the CAA and the California LEV program with this revised model (Pechan, 1991-1992).

- Analyzed the electric utility SO_2 allowance market that would develop under the proposed CAA amendments, which included determining the expected allowance trading price, identifying expected buyers and sellers of allowances, and quantifying the number of allowances that would be bought or sold by each utility. Participated in an analysis of the potential market and future role of natural gas as an alternative to traditional acid rain abatement strategies through the control of SO_2 and NO_x emissions from electric utility sources. Analyzed Congressional and EPA acid rain policy proposals for the electric utility industry using the AIRCOST/PC model to develop a set of control costs, emission reduction potentials, and control strategy options. Participated in development of AIRCOST/PC, a computer model used to

analyze the costs, emission reductions, and control options of acid rain legislation imposing SO_2 controls on electric utilities; model is capable of optimizing available control options, consisting of both fuel and technology controls, at the unit, plant, State, utility, State/utility, or national level to achieve the required SO_2 reduction (Pechan, 1988-1990).

- Participated in analyzing and quantifying the factors that led to nonattainment of the NAAQS for ozone in a study of 10 urban areas (Pechan, 1988-1989).
- Performed an analysis to determine cost-effectiveness of various SO_2 control scenarios for electric utility and industrial sources in Pennsylvania; included the development of a computer program to aggregate and optimize the control costs (Pechan, 1988).

Academic Background

B.S., (Chemical Engineering with Computer-Aided Design Option) Carnegie Mellon University, 1986.

Publications and Presentations
Technical Papers

Roe, S.M., M. Mullen, R. Strait (Pechan); T.D. Peterson, K. Hausker, and K. Colburn (The Center for Climate Strategies); M. Lazarus (Stockholm Environment Institute); and A. Bailie (Pembina Institute), "Emissions Inventory Considerations for Supporting the Development of State and Local Climate Change Mitigation Plans," presented at the 15th Annual Emission Inventory Conference - Reinventing Inventories - New Ideas in New Orleans, LA, May 2006.

Wilson, J.H., Jr. and M. Mullen, "Including the Emission Effects of Refinery Cases and Settlements in Projections for EPA's CAAA Section 812 Analysis," presented at the 15th Annual Emission Inventory Conference – Reinventing Inventories – New Ideas in New Orleans, LA, May 2006.

Roe, S.M., M. Mullen, R. Strait (Pechan); T.D. Peterson, K. Hausker, and K. Colburn (The Center for Climate Strategies); M. Lazarus (Stockholm Environment Institute); and A. Bailie (Pembina Institute), "Progress in Climate Change Mitigation Action Plan Development for Several U.S. States," presented at Air and Waste Management Association Specialty Conference - Planning for the Future: Climate Change, Greenhouse Gas Inventories & Clean Energy Linkages, San Francisco, CA, March 2006.

Fees, D., S.M. Roe, R. Strait, K. Thesing, M. Mullen, and J. Outten, "Delaware State-Wide Criteria and Toxic Air Pollutant Emissions Inventory," presented at EPA's Annual Emission Inventory Conference, Clearwater, FL, June 2004.

M. Mullen, L. Driver, and J. Somers, "Use of MOBILE6 in Preparing National Onroad Emission Inventories," presented at the 11th Annual Emission Inventory Conference: Emission Inventories - Partnering for the Future, Atlanta, GA, April 2002.

Mullen, M. and J.H. Wilson Jr., "Emissions Modeling Improvements for Source Categories with Significant Ozone Precursor Emissions," One Atmosphere, One Inventory, Many Challenges, Denver, CO, May 2001.

Ogburn, C., M. Mullen, and P. Brewer, "Emissions Inventories for Southern Appalachian Mountains Initiative," presented at the 2000 Annual Meeting of the Air and Waste Management Association, June 2000.

Wilson, J.H., Jr., M. Mullen, and E.J. Laich, "Emission Projections - The Long and Short of It," The Emission Inventory: Regional Strategies for the Future, Raleigh, NC, October 26-28, 1999.

Mullen, M.A., J.H. Wilson Jr., L. Gottsman, R.B. Noland, and W.L. Schroeer, "The Emissions Impact of Eliminating National Speed Limits: One Year Later," presented at the 1997 Annual Meeting of the Transportation Research Board, Washington, DC, January 1997.

Wilson, J.H., Jr., M.A. Mullen, and C.T. Ripberger, "Vehicle Enrichment Effects on MOBILE5 Emission Rates," presented at the Air & Waste Management Association Specialty Conference," The Emission Inventory: Applications and Improvement, Raleigh, NC, November 1-3, 1994.

Nizich, S.V., D.C. Misenheimer, W.R. Barnard, P.M. Carlson, D.Y. Linderman, S. Rothschild, D.A. Solomon, and M. Mullen, "Preparation of a National Emission Data Base for Trends and Other Analyses," presented at the Air & Waste Management Association Specialty Conference, "The Emission Inventory: Applications and Improvement," Raleigh, NC, November 1-3, 1994.

Laich, E.J., M. Mullen, P.G. Fields, G.M. Stella, R.D. Atkinson, and C. Knopes, "Emission Projections for Precursors to Atmospheric PM," presented at the Air & Waste Management Association Emission Inventory Specialty Conference, Raleigh, NC, October 1994.

Mullen, M., D.A. Solomon, J.H. Wilson Jr., "Effectiveness of Motor Vehicle Control Initiatives in Meeting Clean Air Act Goals," presented at the Air & Waste Management Association Specialty Conference, "Ozone Control Strategies for the Next Decade (Century)," San Francisco, CA, April 11-13, 1994.

Mullen, M., J.H. Wilson Jr., et al., "Transportation and Emissions Modeling of Congestion Mitigation Measures in Washington, DC," presented at the Air & Waste Management Association/EPA Emission Inventory Conference, "The Emission Inventory, Perception and Reality," Pasadena, CA, October 18-20, 1993.

Laich, E.J., M. Mullen, J.H. Wilson Jr., "Utilizing NO_x Controls in an Attainment Strategy," presented at the Air & Waste Management Association Specialty Conference, "Tropospheric Ozone: Nonattainment and Design Value Issues," October 1992.

Wilson, J.H., Jr., M. Mullen, and K.G. Duleep, "Adopting the California Motor Vehicle Program in the Northeast States," presented at the Air & Waste Management Association annual meeting, Kansas City, MO, June 1992.

Wilson, J.H., Jr., M.J. Bradley, K.G. Duleep, E.J. Laich, and M. Mullen, "Adopting the California Motor Vehicle Program in the Northeast," presented at the Air & Waste Management Association Specialty Conference, "Emission Inventory Issues of the 1990s," September 1991.

Wilson, J.H., Jr., M. Mullen, J.K. Wagner, R. Miles-McLean, and E.C. Durman, "Analysis of Factors in Ozone Nonattainment," presented at Air & Waste Management Association annual meeting, Anaheim, CA, June 1989.

Wilson, J.H., Jr., E.J. Laich, J.P. Childress, M. Mullen, R. Miles-McLean, and E.C. Durman, "National Assessment of VOC, CO, and NO_x Controls, Emissions, and Costs," presented at the New England Section Air Pollution Control Association annual meeting, Northampton, MA, November 1988.

Technical Reports

Hsu, Y. and M. Mullen, "Compilation of Diesel Emissions Speciation Data," final report, prepared for Coordinating Research Council (CRC) and National Renewable Energy Laboratory (NREL), October 2007.

Peterson, T., A. Bailie, K. Colburn, K. Hausker, M. Lazarus, L. Lem, H. Lindquist, M. Mullen, S. Roe, A. Rose, W. Schroeer, D. von Hippel, and E. Williams, "Draft New Mexico Climate Change Action Plan," prepared for the New Mexico Climate Change Advisory Group, November 2006.

Strait, R., M. Mullen, and K. Thesing, "Technical Support Document for 2002 MANE-VU SIP Modeling Inventories, Version 3," prepared for Mid-Atlantic/Northeast Visibility Union (MANE-VU), November 20, 2006.

Peterson, T., A. Bailie, K. Colburn, K. Hausker, M. Lazarus, L. Lem, H. Lindquist, M. Mullen, S. Roe, A. Rose, W. Schroeer, D. von Hippel, and E. Williams, "Arizona Climate Change Action Plan," prepared for the Arizona Climate Change Advisory Group, August 2006.

Wilson, J.H., Jr., A. Bollman, M. Mullen, K. Thesing, and M. Salhotra, "Emission Projections for the Clean Air Act Second Section 812 Prospective Analysis," draft report, prepared for Industrial Economics, Inc., June 2006.

Wilson, J.H., Jr., A. Bollman, M. Mullen, K. Thesing, and D. McKenzie, "Section 812 Clean Air Act Cost-Benefit Study - Air Toxics Case Study of Benzene Emission Reductions in Houston," prepared for the Office of Air and Radiation, U.S. Environmental Protection Agency, February 2006.

Wilson, J.H., Jr., M. Mullen, J. Everett, and A. Chatterjee "Using Travel Demand Model Data with MOBILE6.2 - Guidance Document (Draft)," prepared for the Lake Michigan Air Directors Consortium, Des Plaines, IL, September 2005.

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Peer Review: Preliminary Remediation Goals for Radionuclides in Outdoor Surfaces (SPRG)

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