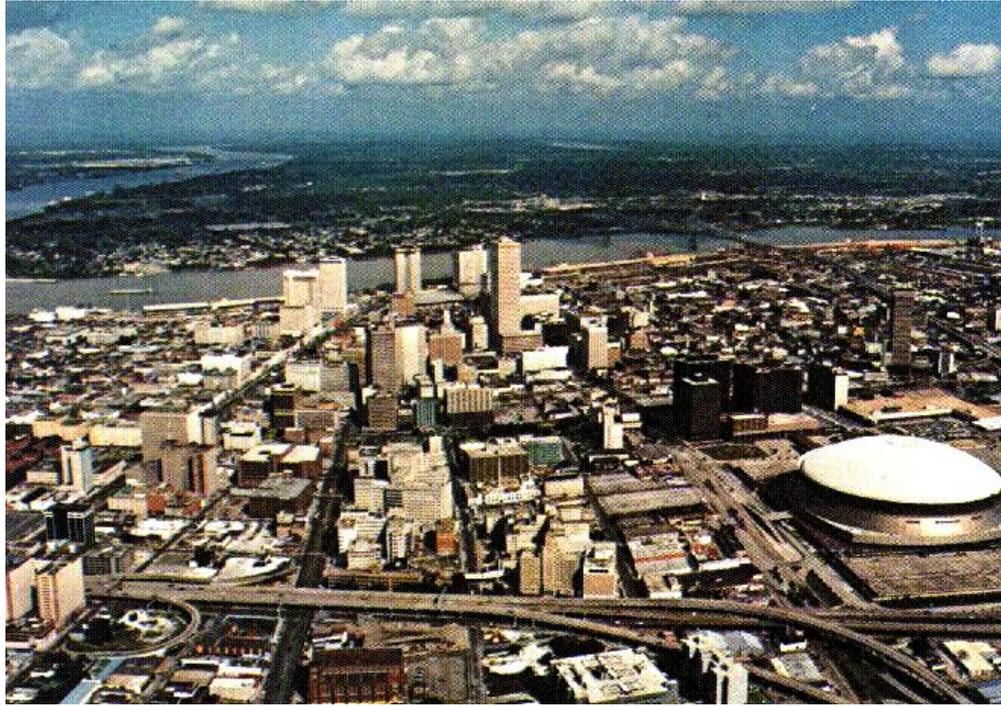


**15th Annual Emission Inventory Conference**

# **Reinventing Inventories New Ideas in New Orleans**



**Courses May 15 - 16, 2006  
Conference May 16 - 18, 2006  
New Orleans, Louisiana - Wyndham Canal Place**



Sponsored by:  
Emission Inventory and Analysis Group  
Air Quality Assessment Division  
Office of Air Quality Planning and Standards



## Message from the General Conference Chair

The U.S. Environmental Protection Agency (EPA) invites you to the 15th Annual Emission Inventory Conference, "*Reinventing Inventories – New Ideas in New Orleans*" to be held May 15 - 18, 2006 in New Orleans, Louisiana. The conference is being organized by EPA's Emission Inventory and Analysis Group of the Office of Air Quality Planning and Standards (OAQPS).

The conference starts on Monday with training courses on several aspects of emission inventory preparation and use. Updated versions of several training courses from earlier years will be presented (see the Training Schedule for course details) and new this year will be a half day session on the EPA's Nonroad Model. On Tuesday morning, we will be conducting a workshop titled *Re-engineering the National Emissions Inventory*. Participants will be able to offer comments on several focused efforts to improve the process for developing emissions data and get a glimpse of the next generation NEI as the components of the new system start to take shape.

Following the format of our last two conferences, the plenary session will begin on Tuesday afternoon. Our goal has been to address topics of regional concern during earlier conference plenary sessions and this year the topic was obvious – the environmental impacts of Hurricanes Katrina and Rita. To start the session, we have invited Howard Feldman, Environmental Coordinator for the American Petroleum Institute to speak about the impacts of the Hurricanes on the oil and gas industry in the Gulf Coast area. Next, will be a presentation by Michael McDaniel, Secretary of the Louisiana Department of Environmental Quality on air, water and waste issues associated with the aftermath of hurricanes. Conference attendees should find the talks fascinating as the speakers provide an inside look at the devastation wrought by these events.

On Tuesday evening we will have a Poster Session and Exhibitor Reception from 6:00 – 8:00, which is being sponsored by MACTEC, Federal Programs (our thanks to Art Werner and Lynn Harwell). Attending the reception is a great way to connect with other conference attendees and you will be able to discuss your air quality needs with several exhibitors. In addition, we have a very interesting lineup of poster presentations and the authors will be available to explain their work and answer your questions.

The heart of the conference unfolds during the technical sessions that follow on Wednesday and Thursday. Some new technical sessions have been added this year in response to changing program needs and the papers to be presented look very interesting.

This is a great opportunity to keep abreast of developments in the world of emissions data so please plan to attend and share your experiences with other emission inventory professionals from federal/state/local and international regulatory agencies, tribal governments, industry and academia. Your attendance will help New Orleans recover from the devastation of Hurricane Katrina so I look forward to seeing you there.

Douglas Solomon  
General Chair  
Emission Inventory and Analysis Group  
Air Quality Assessment Division  
Office of Air Quality Planning & Standards

## Schedule at a Glance

Time	Session	Time	Session
<b>Mon. May 15</b>		<b>Wed. May 17</b>	
8:00 - 5:00	Courses (See Training Schedule)	3:30 - 5:30	Session 4 - Continues
<b>Tue. May 16</b>			Session 7 - Rapid Inventory Development
8:00 - 12:00	Emission Inventory System Workshop		Session 8 - GIS Assisted Emission Inventory Development
12:00 - 1:30	Lunch (On Your Own)	<b>Thur. May 18</b>	
1:30 - 5:00	Plenary Session - Keynote	8:00 - 10:00	Session 9 - Emission Inventory Preparation for Modeling-Issues and Applications
6:00 - 8:00	Poster Session and Exhibitor Reception		Session 10 - Managed Burning and Wildland Fires
<b>Wed. May 17</b>			Session 11 - Greenhouse Gas
8:00 - 10:00	Session 1 - Mobile Sources	10:00 - 10:30	Break
	Session 2 - Tribal Emission Inventories	10:30 - 12:00	Session 9 - Continues
	Session 3 - Web Based Information Systems		Session 10-Continues
10:00 - 10:30	Break		Session 11 - Continues
10:30 - 12:00	Session 1 - Continues	12:00 - 1:30	Lunch (On Your Own)
	Session 2 - Continues	1:30 - 3:00	Session 12 - Nonpoint Emission Inventories
	Session 3 - Continues		Session 13 - Inventory Validation/ Quality Assurance
12:00 - 1:30	Lunch (On Your Own)		Session 14 - Emission Factors
1:30 - 3:00	Session 4 - Emission Inventory Preparation for Modeling-Issues and Applications	3:00 - 3:30	Break
	Session 5 - PM Emissions	3:30 - 5:00	Session 12 Continues
	Session 6 - Ammonia and Agricultural Sources		Session 13 - Continues
3:00 - 3:30	Break		Session 14 - Continues

### Plenary Session

#### **Howard J. Feldman, Director, Regulatory Analysis and Scientific Affairs, American Petroleum Institute**

At the American Petroleum Institute, Mr. Feldman oversees efforts addressing air, water, waste, health and safety issues. His primary areas of interest are air quality and atmospheric sciences, including emissions, pollutant modeling and data analysis. He has served on many government and private sector panels and participated in numerous policy and technical efforts. He has served as co-chair of the NARSTO Executive Steering Committee. He was recognized for his contributions to the Ozone Transport Assessment Group (OTAG) and served as a member of both the NARSTO Ozone and Emissions Inventories Assessment teams.

#### **Mike D. McDaniel, Ph.D., Secretary, Louisiana Department of Environmental Quality**

Dr. McDaniel is an environmental scientist with over 35 years of experience in environmental investigations and regulatory compliance matters. In January, 2004 he was appointed by Governor Kathleen Blanco to serve as Secretary of the Louisiana Department of Environmental Quality.

In addition to his current responsibilities as DEQ Secretary, Dr. McDaniel serves as an advisor to a number of environmental-related councils, boards, and commissions. He has also served as an appointed member of the Governor's Task Force on Environmental Protection and Preservation, the Governor's Mississippi River Corridor Task Force, and the Amite River Basin Commission.

**Monday, May 15, 2006**

## **Training Schedule**

**8:00 – 5:00 pm**

Courses will be offered on a first come, first serve basis. Pre-registration is required. Registered participants will be notified of class locations upon check-in.

### **Inventories for Air Toxics Risk Characterization**

Instructors:

Madeleine Strum, U.S. EPA

This course focuses on the development and use of air toxics inventories in air quality modeling for risk characterization. Hands-on exercises using 1999 NATA results will be provided to students. **LAPTOPS REQUIRED.**

### **PM Fine Emission Inventory Preparation**

Instructors:

Roy Huntley, U.S. EPA

Tom Pace, U.S. EPA

This course will focus on the principal stationary source categories emitting PM fine particles. For each category, we will discuss how the National Emission Inventory (EI) emission estimates are developed, suggest activities States can do to improve upon the EI estimates and locate on-line resources to facilitate State inventory improvement activities. A case study will provide examples.

### **National Mobile Inventory Model (NMIM) (8:00 - 12:00)**

Instructor:

Harvey Michaels, U.S. EPA

EPA's NMIM is an emissions modeling system that generates county inventories using MOBILE6, NONROAD, and a database of county-level inputs. Participants will learn how to use NMIM on a Windows PC and how to work with the output, including how to produce NIF3-formatted output and how to run NMIM in both standalone and distributed processing modes. This is the second NMIM training and, in response to user demand, more emphasis will be placed on understanding the database and modifying it to customize inputs. The course will be organized around hands-on exercises, but persons without computers are also welcome. Computers will not be provided, so **PARTICIPANTS MUST BRING THEIR OWN LAPTOPS** running Windows 2000 or newer operating systems, with a CD drive, a minimum of 128 Mb of RAM, and a minimum of five free gigabytes of hard drive space. Participants must have NMIM pre-installed and running on their machines prior to the course.

### **NONROAD 2005 Inventory Model (1:30 - 5:00)**

Instructors:

Penny Carey, U.S. EPA

Craig Harvey, U.S. EPA

EPA's NONROAD2005 inventory model is an emissions modeling system that generates county, state, or national inventories for all nonroad equipment categories except commercial marine, locomotives, and aircraft. Participants will learn how to use NONROAD2005 on a Windows PC, how to select and modify appropriate inputs, and how to work with the output, including how to produce NIF3-formatted output. Since NONROAD has been in use for a number of years, the course will move quickly through the basics and focus on new features and advanced capabilities. The course will be organized around hands-on exercises, but persons without computers are also welcome. Computers will not be provided, so **PARTICIPANTS MUST BRING THEIR OWN LAPTOPS** running Windows 2000 or newer operating systems, with a CD drive, a minimum of 128 Mb of RAM, and a minimum of one free gigabyte of hard drive space. Participants must have NONROAD2005 (with graphic interface and reporting utility) pre-installed and running on their machines prior to the course. The software and documentation are available for download from the NONROAD model web site: <http://www.epa.gov/otaq/nonrdmdl.htm>.

### **Everything You Wanted to Know About Environmental Information Exchange Network "Nodes" (8:00 – 12:00)**

Instructor:

Chris Clark, U.S. EPA

This class will provide an overview of the Network Node. We will explain how a Node is established, what schema is, how it is validated and what happens to your data when you send it in. We will be discussing what a submitter is and their responsibilities. There will also be a demo of the Node Client and a questions and answers session. If you are just starting with a Node or are a regular user but still have questions this class is for you!

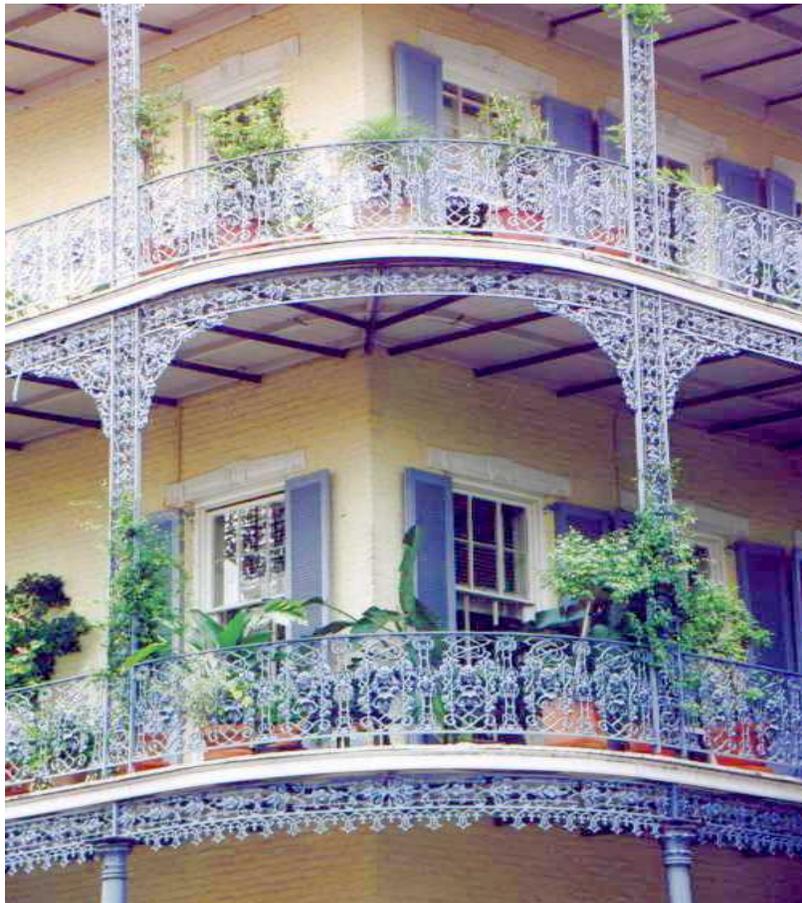
**Tuesday, May 16, 2006**

**Training Schedule**

**8:00 – 12:00 pm**

**Re-Engineering the National Emissions Inventory Process**

This session will provide an overview of EPA's efforts with respect to the National Emissions Inventory process. Attendees will be presented with an overview of the new emissions inventory business process that will take effect starting with the 2008 inventory cycle and learn about their role in the process. There will also be presentations outlining the feedback provided at EPA's regional office visits and on special projects EPA will be undertaking in the coming months.



**Tuesday, May 16, 2006**

**Poster Session and Exhibitors' Reception**  
**Sponsored by MACTEC Federal Program, Inc.**

**6:00 – 8:00 pm**

- “GIS-Based Comparison of Emission Inventories Used for Houston Ozone Simulations,” D. W. Byun and S. Kim, University of Houston.
- “Recent Updates to SMOKE,” B. H. Baek, A. Eyth, and A. Holland, University of North Carolina, Chapel Hill.
- “Development of Emission Factors from Natural Gas-Fired Stationary Internal Combustion Engines in Korea,” Y-K Jang, K. Kim, H. Kim, Y. Sunwoo and J-H. Hong, University of Suwon, KOREA.
- “Recent Changes to EPA's Basic Format and Content Checker for the National Emission Inventory,” S. Dombrowski, U.S. EPA.
- “Studying the Emissions of Air Toxics Compounds in Close Proximity to Highways,” K. N. Black, Federal Highway Administration.
- “Native American Tribal Emission Inventories, A 2006 Update,” S. Kelly and A. Luedeker, Institute for Tribal Environmental Professionals at Northern Arizona University.
- “DIAL Measurement of Fugitive Emissions from Natural Gas Plants and the Comparison with Emission Factor Estimates,” A. Chambers, and M. Strosher, Alberta Research Council, Inc., Canada; T. Wootton, J. Moncrieff, and P. McCready, Spectrasyne Ltd., UK.
- “Rapid Inventory Development Pilot Final Report,” D. Solomon, S. Dombrowski, U.S. EPA and C. R. Tillerson, L. Harwell, J. Paumier, MACTEC, Federal Programs, Inc.
- “Data and Maps – Clean Air Markets Programs Web Based Interface to Emissions, Compliance, and Air Quality Data,” K. D. Patel, S. Young, M. Cohen, U.S. EPA.
- “Preparation of Emission Inventories of Toxic Air Contaminants for the San Francisco Bay Area,” B. M. Penfold, D. C. Sullivan, S. B. Reid, L. R. Chinkin, Sonoma Technology, Inc.
- “Content and Emission Characteristics of Artificial Wax Firelogs,” V. Li, Environment Canada.
- “Recent Advances in Computer Modeling for Developing and Managing Air Emission Inventories in the Chemical Industry,” J. A. Hatfield, Mitchell Scientific, Inc.
- “Processing the Canadian National Emissions Inventory with SMOKE,” M. Sassi, V. Bouchet, R. Moffet, S. Menard, L-P. Crevier, S. Cousineau, Canadian Meteorological Center.
- “Environmental Knowledge and Assessment Tool (EKAT),” R. Green, T. Boguski, L. Erickson, K. Pangburn, J. Fredkin, Kansas State University.
- “Trends in Mercury Air Emissions,” A. Pope, U.S. EPA.
- “The Air Force Project: The Challenges of Multiple Data Customers,” S. Rasmussen, U. S. Airforce; S. Dombrowski, , U.S. EPA.

**Wednesday, May 17, 2006**

**Session 1. Mobile Sources**

Chairs: Laurel Driver, U.S. EPA  
Joel Pedelty, U.S. EPA

8:30 am "Use of Travel Demand Model Data to Improve Inventories in Philadelphia," R. Cook, D. Brzezinski and H. Michaels, U. S. EPA; A. Beidler, Computer Sciences Corporation; J. S. Touma NOAA; M. Strum, U. S. EPA.

Use of local travel demand model (TDM) data to develop air toxic pollutant inventories, rather than estimates based on national default data and "top-down" allocation schemes, can have a very large impact on the magnitude and distribution of air toxic emissions. Such data can be used to significantly improve the accuracy of local scale assessments as well as the county level inventory estimates in the National Emission Inventory (NEI).

This paper provides a comparison of "top down" and "bottom up" approaches for one urban area, Philadelphia, in calendar year 1999. Under the "top down" approach, emissions are estimated at the county level, typically starting from more aggregated information. Metropolitan statistical area or state data on activities are used, and allocated to counties using population information. In addition, average or default inputs to the highway vehicle emissions factor model, MOBILE6, are used. The "bottom up" approach utilizes TDM data, which can include information on the spatial distribution of vehicle activity, speeds along those roads (which can have a large impact on emissions), and the distribution of the vehicle miles traveled (VMT) among vehicle classes for different speed ranges. These data are used in conjunction with a highway vehicle emissions factor model to better estimate levels and spatial distribution of onroad motor

9:00 am "Development of Link-Level Mobile Source Emission Inventories," A. K. Pollack, S. Shepard and J. Haasbeek, ENVIRON Corporation.

Highly resolved emission inventories for on-road mobile sources are needed for air quality modeling to develop the necessary technical support for new State Implementation Plans (SIPs) for ozone, fine particles, and regional haze, and for conformity analyses. Link-level emission inventories can be prepared using vehicle miles traveled, speed, and other activity data provided by state agencies and Metropolitan Planning Organizations (MPOs) using transportation demand models (TDMs), and emission factors from EPA's MOBILE6 model.

This paper will demonstrate the use of the new CONCEPT (Consolidated Community Emissions Processing Tool) Emissions Processor, and additional preprocessor software, to develop link-level emission inventories in an urban area, and also in a broader regional domain. The CONCEPT model was developed as joint project between Alpine Geophysics, LLC and ENVIRON Corporation, with Midwest RPO and joint RPO funding. ENVIRON has also developed software called T3 (TDM Transformation Tool) that takes TDM output from approximately transportation networks using a variety of models, applies appropriate data transformations, and outputs the link-level activity data in a uniform format for input to CONCEPT.

Data inputs and emission inventory results will be shown for the link-level emission inventory for the Las Vegas, NV area using transportation modeling results for the urban area. The application of T3 and CONCEPT to generate link-level emission inventories for 22 urban area and statewide transportation networks in the Upper Midwest states will also be shown.

**Wednesday, May 17, 2006**

**Session 1. Mobile Sources**

Chairs: Laurel Driver, U.S. EPA  
Joel Pedelty, U.S. EPA

9:30 am "Current Methodologies and Best Practices for Preparing Port Emission Inventories," L. Browning, ICF Consulting; K. Bailey, U.S. EPA.

This paper describes current methodologies and best practices used for preparation of a port emission inventory. An emission inventory is necessary for port authorities, those doing business at ports (such as tenants and shipping companies), state/local entities, or other interested parties to understand and quantify the air quality impacts of current port operations, and to assess the impacts of port expansion projects or growth in port activity. This paper focuses on mobile emission sources at ports including oceangoing vessels (OGVs), harbor craft, and cargo tenders that vary by who prepares them and the purpose of the inventory. In addition, emission factors and other operational data on marine vessels continually evolve; thus, the parameters often differ between studies.

Because the rationale and resources to prepare inventories vary between ports, this report provides a range of preparation approaches to provide the appropriate level of detail to meet ports' needs. The three approaches presented in this report are:

- A *detailed approach* in which each ship trip into and out of a port is quantified. Harbor craft and land-side emissions are estimated in detail.
- A *mid-tier approach* in which ship trips are averaged by ship type and dead weight tonnage, and then average trip characteristics are calculated. Harbor craft and land-side emissions also can be averaged by type of ship or equipment.
- A *streamlined approach* in which marine, harbor craft, and land-side emissions are estimated from other detailed inventories.

The report concludes with five recommendations for further study.

10:00 am **BREAK**

10:30 am "Nine Ports in the 49th State: Commercial Marine Inventory for Alaska," K. B. Thesing and A. Mannino, E. H. Pechan & Associates, Inc.; A. Edwards, Alaska Department of Environmental Conservation.

In Alaska, marine travel is an essential part of the interstate transportation system, and marine vessels are responsible for the movement of many goods into the State. In addition, marine tourism is an important contributor to the state's economy. Under contract to the Alaska Department of Environmental Conservation (ADEC), E.H. Pechan & Associates, Inc. (Pechan) prepared 2002 base year and forecast year commercial marine emissions inventories for several key ports. The ports included Anchorage, Dutch Harbor, Homer, Juneau, Ketchikan, Kivalina, Kodiak, Nikiski, and Valdez. Emission estimates were developed for the following pollutants: sulfur dioxide (SO<sub>2</sub>), oxides of nitrogen (NO<sub>x</sub>), particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>), carbon monoxide (CO), ammonia (NH<sub>3</sub>), and volatile organic compounds (VOCs). These inventories will support analyses to characterize the emission reductions that will be needed to achieve and maintain compliance with regional haze standards.

This paper describes the data sources and procedures used to characterize activity for the vessel fleet calling on the ports of interest, including passenger ships, tankers, cargo ships, and fishing vessels. The emissions inventory accounts for cruise-related activity 25 miles out from the breakwater, reduced speed zone (RSZ) and maneuvering activity, and time spent in port (hotelling). Emissions estimates by vessel type and by port are also presented. An emissions inventory for these ports had not been developed prior to this effort. As such, this project was valuable in establishing data availability and inventory data needs with various Alaska State agencies, including the Marine Exchange of Alaska, the Alaska Marine Highway System, and the Commercial Fisheries Entry Commission. Recommendations for future research to improve the inventory are also presented.

**Wednesday, May 17, 2006**

**Session 1. Mobile Sources**

Chairs: Laurel Driver, U.S. EPA  
Joel Pedelty, U.S. EPA

11:00 am "Development of Gridded Ocean-Going Vessel Emission Inventories," C. E. Lindhjem and J. Russell, ENVIRON Corporation; J. Corbett, University of Delaware.

Highly resolved emission inventories for ocean-going vessels are needed for air quality modeling to develop the necessary technical support for new State Implementation Plans (SIPs) for ozone, fine particles, and regional haze.

This paper will describe how ocean-going vessel emission inventories can be spatially resolved near ports and in the major shipping lanes. Emission inventories created from a top down global approach are compared with detailed near-port inventories to provide a seamless understanding of emissions inventories on a broad scale.

A wide scale gridded inventory has been developed using ship positioning information and ship call activity data approaching US waters. This inventory was spatially resolved along informal but typical ship channels in the open ocean following least distance movements between world ports.

The near-port emission inventories are defined by the typical modes of operation: cruise, reduced-speed zone, maneuvering and hotelling which can be resolved spatially for each port. The cruise mode has been defined to end and start at the point where the vessel slows typically to allow harbor or bar pilots to board or disembark and is usually a well-defined spatial point for each harbor or group of harbors (e.g. Puget Sound, Bay Area, Chesapeake Bay) and usually is situated near the boundary of the open ocean. The cruise zone therefore can be placed between the point where the pilots board/disembark and the wide scale gridded emission inventory. The maneuvering zone is usually defined within a short distance of the berths and so can also be placed spatially within a gridded regional inventory. The reduced-speed zone therefore follows well-defined ship channels (ribbons) that can be described by navigational charts and placed in a grid, GIS, or other spatial definition framework.

The resulting combination gridded near-port and offshore marine emissions inventory used in regional air quality modeling will be shown.

11:30 am "U.S. Army Aberdeen Test Center Support of Heavy Duty Diesel Engine Emissions Testing," J. A. Jack, U.S. Army Aberdeen Test Center.

The U.S. Army Aberdeen Test Center (ATC), located at Aberdeen Proving Ground, MD, supports the U.S. Environmental Protection Agency (EPA) in its heavy duty diesel engine emissions compliance program by providing program management, test procedure development, instrumentation application, equipment operation, data collection, reduction, and analysis. Personnel in ATC's Military Environmental Technology Demonstration Center (METDC) work closely with members of the EPA's Certification and Compliance Division (CCD) to plan, perform, and report in-use heavy duty diesel engine compliance testing.

This program originated in 1999 in response to a consent decree settlement between EPA and various heavy-duty diesel engine manufacturers. The settlement resolved claims that manufacturers illegally utilized software control strategies that enabled the engine to comply with emissions standards during laboratory testing, but, not during in-use operations. The manufacturers agreed to pay penalties, meet 2004 standards early, and comply with new in-use not-to-exceed (NTE) standards for Oxides of Nitrogen (NO<sub>x</sub>).

Since 2000, under an Inter-Agency Agreement (IAG) with the EPA, ATC has served as the independent tester for EPA CCD. From 2000 – 2002, ATC performed mainly a data collection function in operating EPA's Real-time On-road Vehicle Emissions Reporter (ROVER) and reporting the raw data directly to EPA. Since 2003, this program has developed into a testing program which requires a team of 3-4 technicians, a chemist for data analysis, and scientist test director. Currently, ATC personnel procure test items, schedule testing, instrument and operate the ROVER system during testing, perform data reduction and analysis, and transfer data to EPA and program participants.

**Wednesday, May 17, 2006**

**Session 1. Mobile Sources**

Chairs: Laurel Driver, U.S. EPA  
Joel Pedelty, U.S. EPA

ROVER testing by ATC involves non-road test procedure development, technology comparison, idle, variable, durability, and marathon testing. Tests on non-road engines has been conducted mainly to study possible ways of loading a non-road engine and reading emissions during these various engine loads. Technology comparisons were conducted with EPA SmartWay in operating two ROVER systems on two identical tractor trailers over predetermined track scenarios. One of the tractor trailers was the control and the other was tested with various aerodynamic and single wide based tire configurations. Idle testing is conducted in ATC cold room test chambers at various temperatures. Variable testing with ROVER involves testing engines with different drivers, altitudes, and during various seasons (temperature differences). Durability testing involves testing the same engines each year to determine if there are any changes in emissions of older engines as they are operated over a long period of time. Marathon tests involve testing an engine from ATC, located in Maryland, to points west, including Colorado and New Mexico. These tests result in emissions data from over three thousand total miles of engine operation under various conditions, including different drivers, wide ranges of temperature, altitude, and traffic patterns.

ATC has been an integral part in EPA's heavy-duty in-use emissions compliance efforts and has contributed program oversight, quality testing, and results to EPA. This program has developed into one which EPA can continually monitor engine manufacturer's NO<sub>x</sub> NTE compliance under various conditions and use results to verify the progress of the manufacturer's efforts to comply with EPA standards.

This presentation will show the above described testing program in more detail, outlining the current testing and future planned testing, as well as ATC automotive and automotive emissions testing capabilities.

12:00 pm **LUNCH**

**Session 2. Tribal Emission Inventories**

Chairs: Sarah Kelly, Institute for Tribal  
Environmental Professionals

8:00 am "The Native American Tribal Emission Inventories, A 2006 Update," S. Kelly and A. Luedeker, Institute for Tribal Environmental Professionals at Northern Arizona University.

In the years between 1990 and 2000, tribes completing emission inventories used them in their own communities and tribal air programs. The main reasons for conducting an EI were to identify sources of air pollution that were affecting the health of community members and to determine the need for a continuing air quality program and/or air quality monitoring. By 2001, tribes and the US EPA were looking for efficient ways to distribute tribal EI data on a regional and national basis. Through a project funded by both US EPA's Office of Air Quality Planning and Standards OAQPS and the Tribal Data Development Working Group (TDDWG) of the Western Regional Air Partnership (WRAP), the Institute for Tribal Environmental Professionals (ITEP) raised the number of tribes represented in the 1999 NEI from 1 to 12.

This project is continuing with efforts to increase the number of tribes represented in the 2002 and 2005 NEI. At the end of 2004, 18 tribes had released their data to the NEI. By the end of 2005, that number had increased to 29. One or more Tribes located in all US EPA Regions, excluding Regions 2, 3 and 7, have completed emission inventories for their reservations and submitted them to the NEI.

This paper presents a summary of the source types and pollutants inventoried by US tribes by the end of 2005. The future of tribal emission inventories will also be discussed. Opportunities for tribes partnering with state, local and federal agencies to improve inventories will be presented.

**Wednesday, May 17, 2006**

**Session 2. Tribal Emission Inventories**

Chairs: Sarah Kelly, Institute for Tribal Environmental Professionals

8:30 am "First Pueblo to Use TEISS for a Baseline Emissions Inventory: United Nations World Heritage Site and a National Historic Landmark, the 1000-Year-Old Pueblo of Taos, New Mexico," F. Espinosa, Taos Pueblo Environmental Office.

Located at 7,600 ft on the foothills of the largest peaks in New Mexico, is the Native Village of Taos Pueblo, New Mexico. We are the only living Native American community designated both a World Heritage Site by UNESCO and a National Historic Landmark. The multi-storied adobe buildings have been continuously inhabited for over 1000 years. Our people have a detailed oral history which is not divulged due to religious privacy. Archaeologists say that our ancestors lived in the valley long before Columbus discovered America and hundreds of years before Europe emerged from the Dark Ages. The multi-storied adobe buildings appeared much as they do today when the first Spanish explorers arrived in Northern New Mexico in 1540. A tribal governor and war chief, along with taffs for each, are appointed yearly by the Tribal Council, a group of some 50 male tribal elders. The governor and his staff are concerned with civil and business issues within the village and relations with the non-Indian world. The war chief and staff deal with the protection of the natural resources and Indian lands outside the Pueblo walls.

In the spring of 2004, Taos Pueblo Environmental Office Air Program expressed interest in developing a baseline emissions inventory for the Pueblo after attending a Northern Arizona University, Institute for Environmental Professions Emissions Inventory workshop. There the TEISS software was introduced to participating Tribes. TEISS software makes it possible for tribes like Taos Pueblo that are funded by EPA for only one air quality employee, to produce a baseline Emissions Inventory. The completion of the EI is scheduled for June 2006. The initial inventory will only include the Pueblo's major emission sources. These sources are: wood burning stoves; fireplaces; agriculture burning; prescribed burns; tractors; logging equipment; bulldozers; dirt roads; outdoor burning; motor vehicles; ATVs; capped landfill; unpaved parking lots; construction fugitive dust.

According to a USEPA Region 6 New Mexico Tribal Air Project Officer, Taos Pueblo is the first Pueblo to use TEISS for an Emissions Inventory. This inventory will possibly portray typical emission sources for most of the Northern Pueblos.

9:00 am Air Emissions Inventory Development of Criteria and Hazardous. Air Pollutants on the Southern Ute Indian Reservation, Colorado for 2002," J. Temte, Southern Ute Air Quality Program.

In 2005, the Southern Ute Air Quality Program along with Air Resource Specialists prepared a 2002 emissions inventory for the Southern Ute Indian Tribe in Southwestern Colorado. The Southern Ute Indian Reservation is located on and surrounded by one of the largest natural gas and oil fields in the United States. The Southern Ute Indian Tribe is experiencing consistent growth in the development and extraction of these natural resources within their reservation's exterior boundaries. This 2002 air emissions inventory can serve as an updated baseline for the Southern Ute Indian Tribe's permitting involvement regarding the regulation of this area's industrial emissions and future developments. Point sources, area sources, mobile sources, and biogenic sources were inventoried and the criteria pollutants, volatile organic compounds (VOC) and hazardous air pollutants (HAP) emissions were quantified for 2002. Point sources include 37 Title V sources, which constitute nearly 1/3 of all Title V sources in U.S. Indian country. Area sources include oil and gas wells, well-head compressors, oil and gas drilling operations, fireplace and wood burning stoves, propane, airports, and landfill gas emissions. Mobile sources include on-road emissions for both paved and unpaved roadways. Emissions estimates were calculated for some of the point, area, mobile, and biogenic sources using various methodologies. This paper will discuss the data collection, calculations, methodologies, and assumptions used in this study to formulate an emissions baseline for 2002.

**Wednesday, May 17, 2006**

**Session 2. Tribal Emission Inventories**

Sarah Kelly, Institute for Tribal  
Environmental Professionals

9:30 am "Bad River Chippewa Emissions Inventory," L. Hall, Bad River Band of Lake Superior Chippewa Indians.

The Bad River Band of Lake Superior Chippewa Indians occupies 124,000 acres in northern Wisconsin, located on the shores of Lake Superior. A total population (both Tribal and non-Tribal) of 2,758 resides on the reservation. The reservation is home to a unique wetland complex known as the Kakagon/ Bad River Sloughs, which provides abundant habitat for a rich assembly of flora and fauna, and notably wild rice, that is highly important to the Tribe's culture. The wetland complex within the Reservation comprise about 40% of all coastal wetlands within the Lake Superior Basin and may be the healthiest fully-functioning estuarine system in the Upper Great Lakes.

In order to have an accurate record of the pollution affecting the air shed and the natural resources of the Bad River Reservation, it was important that the Tribe have a comprehensive accounting of the sources of pollution not only on the Reservation, but in the surrounding area as well. This collection of baseline data would enable the Tribe to rapidly and quantitatively assess current and future air quality changes that may occur and guide the Tribe in its air quality planning. The Tribe compiled data for area, point, and mobile sources within the Reservation and all major point sources within 50 miles of the Reservation based on our Treatment as a State status.

Conducted in 2005, the emissions inventory identified 69-point sources within the Tribes 50 mile radius airshed and 31 separate area sources within the Tribes exterior boundaries. Of the point sources, one of the greatest concerns is the Title V coal fired power plant operated by Xcel Energy located just 4 miles from the reservation border. On Reservation, we struggle with our own pollution sources such as burn barrels, unpaved roads, a casino/gas station/lodge complex and a major U.S. Highway that bisects the Reservation. This presentation will discuss the development of the Tribes EI, methodologies used to estimate the emissions from the various source categories, and will touch upon the Tribes efforts to reduce one of the major area sources on Reservation, burn barrels.

10:00 am **BREAK**

**Wednesday, May 17, 2006**

**Session 2. Tribal Emission Inventories**

Chair: Sarah Kelly, Institute for Tribal Environmental Professionals

10:30 am "Representative Community Emissions Inventory," A. Edwards, Alaska Department of Environmental Conservation; B. Dulla, Sierra Research; J. Pardilla, Western Regional Air Partnership.

A survey of residential and commercial fuel use and related activities was conducted in 12 separate villages in Alaska. The survey was conducted over an 18-month period and relied on local residents to collect detailed seasonal information through home interviews and direct contact with commercial operators. The results were used to construct seasonal estimates of source specific fuel use and emissions for each community. A summary of the results was prepared for each community and used to make presentations to tribal councils, environmental coordinators and interested parties that described the impact of local choices on fuel use and activities on pollutants emitted within the village.

The results were also used to project emission estimates for individual regions within the state and fill in a large gap in the State's understanding of the relative contribution of emissions from the 300+ communities throughout the state to the overall airshed. This information will be used to support regional haze planning and determine where control measures may be needed.

The conduct of the survey required a huge outreach effort. Financial support was provided to each community to support the process of collecting survey data. Regional organizations with local employees were initially contacted to collect the data. Ultimately, village youth were used to conduct most of the home interview surveys. Local staff collected most of the commercial data. Lessons were learned in how to design and interpret survey results and how to coordinate the conduct of the surveys.

Aside from using local data to develop inventory estimates, the principal finding is that decisions about wood use are the primary determinant of the magnitude of local emissions.

11:00 am "Mercury Releases and Tribal Lands, What's in Your Backyard?" J. C. Cain, Institute for Tribal Environmental Professionals at Northern Arizona University; B. Grantham, National Tribal Environmental Council; S. Kelly, Institute for Tribal Environmental Professionals at Northern Arizona University.

To determine the on-reservation population affected by atmospheric mercury (Hg), a spatial analysis of tribal land boundaries and Hg point sources was performed. The project is undertaken to address environmental justice issues, and to provide tribes with the awareness of how much Hg is released near tribal lands. The awareness is particularly relevant to tribes whose members continue a subsistence diet and eat large quantities of fish. The main pathway of Hg to humans is in its methylated form which bioaccumulates in fish tissue.

To determine affected reservation population numbers ITEP used 2003 BIA reservation boundary shapefiles, 2003 BIA population estimates, and 1999 NEI Hg point source emission estimates to spatially query for overlap at 25, 50, and 100 mile radii. Queries were based on BIA classifications of tribal land area for American Indian Reservation (AIR), Oklahoma Tribal Statistical Area (OTSA), and Alaska Native Village Statistical Areas (ANVSA).

Using the 1999 national emissions inventory data set, it is determined that approximately 55% of United States reservation population lives within 50 miles of a source which emits greater than 100 pounds per year of Mercury. Within 50 miles of Tribal lands, approximately 71,000 lbs (35 tons) of Hg is emitted which equates to about 40% of all Hg emitted in the United States. 70% of total reservation population (approximately 530,000 people on 251 reservations) live within 100 miles of 216 facilities which produce more than 100 pounds per year Hg emission. The combined total of the facility output at 100 miles, is 51 tons of Hg which was 57% of the total amount of Hg released in the US in 1999.

12:00 pm **LUNCH**

**Wednesday, May 17, 2006**

**Session 3. Web Based Information Systems** Chair: Sally Dombrowski, U.S. EPA

8:00 am "Power to the People: Public Access and Reporting in the Texas Air Emissions Repository," G. Kitzmiller, W. Gerber, J. Veysey, Eastern Research Group, Inc.; J. Westphal, Texas Commission on Environmental Quality.

To support its state implementation plan (SIP) and EPA reporting processes, Texas must collect, develop, and integrate emissions data from numerous sources. The Texas Commission on Environmental Quality (TCEQ) and Eastern Research Group (ERG) have met this challenge with the Texas Air Emissions Repository (TexAER): a centralized, Web-based system that stores, reconciles, and reports non-point emissions data. With tools for uploading raw emissions estimates, collating and enhancing data, and extracting inventories in various forms, TexAER provides a single, flexible platform for managing non-point information.

Through its publicly available reporting functions, TexAER provides public access to emissions data and inventories for the state of Texas. Interested citizens can log on to TexAER at <http://www4.tceq.state.tx.us/txaer/> and explore its dynamic, user-driven reporting system. The Emissions Data Report allows queries against any emissions inventory in the TexAER repository. Users can focus the content of their report by adding filters—on source classification code (SCC), pollutant, geographic location, and more—and can choose how to summarize, sort, index, and title the report's output. Reports can be run to screen, saved, or exported for offline analysis. At all points the user controls the slices of data presented. Users can also view and apply growth factors and control strategies to baseline emissions inventories.

Underlying the reporting system is a high-performance data warehouse. TexAER takes advantage of the latest data warehousing techniques and technologies to provide rapid, on-line reports that query and summarize millions of inventory records for reports without degrading response time.

In addition to the core Emissions Data Report, TexAER lets public users browse the SCC hierarchy and the Document Catalog, a collection of reference documentation for emissions inventories. Together these functions provide significant access to TexAER data, opening TCEQ's non-point repository to the general public.

8:30 am "Operational Experiences from the WRAP EDMS," S. Roe, E. H. Pechan & Associates, Inc.

The Emissions Data Management System (EDMS) is required to support state and tribal regional haze implementation plan development. This system is used for technical and policy evaluations by Western Regional Air Partnership (WRAP) members, stakeholders, and other interested parties in the region, and is the home of emissions inventories that are the basis for emissions control and management programs to be adopted by agencies in the region. The EDMS went into production in early January, 2005. This paper describes the lessons learned from the first year of production, and discusses plans for automated information sharing with other systems.

9:00 am "Streamlining Modeling Inventory Data Sharing: The RPO Emission Inventory Warehouse," P. Davis, Mid-Atlantic Regional Air Management Association; G. Kitzmiller, Eastern Research Group, Inc.

The Regional Planning Organizations had a need to quickly and easily share the latest quality-assured modeling inventories to support both technical and policy analysis for state implementation plans, as well as to make information available to other interested stakeholders. To meet these goals and balance the needs for a cost efficient approach, the RPOs collaborated to create the Inter-RPO Emissions Inventory Warehouse (RPO EI) web site. This site is available at [www.rpoei.org](http://www.rpoei.org). Anyone can request access to the site by simply clicking the "Would you like to create an account" link on the home page. The site allows users to access national modeling inventories for all source types (point, area, on-road mobile, non-road mobile, and biogenic) to create and download Emissions Summary Reports, Top 10 Sources Reports, Pollutant and/or Stack Parameter Threshold Reports, Mobile Speed and VMT Reports, and NIF 3.0 formatted inventory data. Inventories accessible through the RPO EI are updated quarterly (four times per year) and are generated using the most up-to-date modeling results available to the RPOs.

Given the resource limitations faced by the RPOs, it was decided that a web site based primarily on open-source technology was the best solution. Therefore, the RPO EI web site was built using a PostgreSQL database to store the data ([www.postgresql.org](http://www.postgresql.org)) and Java Server Pages (JSP) for the web interface. The site is hosted on a Linux server. The site does make use of the EPA Format and Content Checker on a separate Windows server. None of these technologies (except the Windows server) requires any licensing fees, allowing the RPOs to focus current resources on developing robust site functionality that meets user needs. This approach also allows others stakeholders with web and database development skills in these open source technologies to contribute to enhancing future site functionality.

**Wednesday, May 17, 2006**

**Session 3. Web Based Information Systems** Chair: Sally Dombrowski, U.S. EPA

9:30 am "Cyber infrastructure for Emissions Data and Tools," S. Falke, Washington University in St. Louis; G. Stella, Alpine Geophysics; T. Keating and B. Hemming, U.S. EPA.

The Networked Environmental Information System for Global Emissions Inventories (NEISGEI, pronounced "nice-guy,") is an EPA supported initiative to develop a web-based global air emissions inventory network in the form of a Web portal that provides a catalog of distributed emission inventory data, tools for processing and analyzing the data, means for registering new data, and an environment for collaboration among international researchers, policy-makers, and the interested public. This paper presents the portal infrastructure and data and tools available through it.

The NEISGEI portal is designed so that emissions community members can contribute to its growth and evolution by posting data, reports, tools, and other content, and contributing to discussion forums, announcements, and feedback on web portal design and content. Initial data sets "registered" with the portal include national and regional emissions inventories and activity data. Web browser tools have been developed for visualizing and comparing data in maps, time series, and tables. Examples using satellite imagery and satellite and ground observed fire occurrence data are presented.

A primary design consideration of the portal is the use of accepted web and data standards, the reuse of existing web infrastructure and that its content be openly available for use in other applications or portals. The portal makes extensive use of the capabilities provided through DataFed, a web service based infrastructure for sharing air quality related data ([www.datafed.net](http://www.datafed.net)). DataFed provides services for registering and integrating data in a spatio-temporal framework and a development environment for building web applications. The data registered and tools built within the DataFed framework are directly accessible through the NEISGEI portal.

10:00 am **BREAK**

10:30 am "Southern Smoke Simulation System - A Framework for Modeling Smoke Impacts from Prescribed Burning in the South," S. Goodrick, G. Achtemeier and Y. Liu, U.S.DA.

Fire is a natural disturbance in many ecosystems, although one that can have adverse impacts, particularly to nearby communities. Prescribed fire is an important tool for land managers as its judicious use can allow fire back into ecosystems to perform its essential role in maintaining ecosystem health and function while minimizing adverse impacts on the local community. Smoke is the prime adverse impact from prescribed burning. Land managers need tools that better help them estimate the impact of their smoke on air quality and public safety. The Southern Smoke Simulation System (4S) is being developed to assist land owners in managing smoke by integrating a series of computer models with database and GIS technologies. For regional smoke issues, 4S brings prescribed burn information into the CMAQ regional air quality model for addressing issues such as regional haze. On a more local scale, 4S makes use of the BlueSky framework, developed by the Pacific Northwest Research Station of the U.S. Forest Service to address potential visibility issues on roadways and possible health impacts due to high concentrations of particulate matter. At even smaller scales, 4S implements local smoke models design to simulate the movement of smoke at night, a severe roadway hazard. Through 4S, the user is presented with a consistent tool for evaluating smoke impacts at multiple scales.

11:00 am "The BlueSkyRAIN Smoke Modeling System," S. Larkin, R. Solomon, J. Hoadley, U.S.DA Forest Service.

BlueSky is a smoke prediction tool used by land managers to facilitate wildfire containment and prescribed burning programs, which are necessary for ecosystem health, while minimizing impacts to human health and scenic vistas. The BlueSky smoke modeling framework links computer models of weather prediction, fuel consumption and emissions by fire, and smoke dispersion into a system for predicting the cumulative impacts of smoke from prescribed fires, wildfires, and agricultural fires. BlueSky is currently functional over the lower 48 states. While differences exist regionally, each night BlueSky obtains regional meteorological predictions and reported burn information from available private, state, and federal agencies, merges these data with models of fuel consumption and emissions, and processes dispersion and trajectory models to produce regional estimates of smoke concentrations for the next 1 to 3 days. Smoke and fire managers access these predictions as a tool to aid their "go/no-go" decisions for burning operations and other decision support.

BlueSky can utilize a customized version of the EPA's RAINS, the Rapid Access Information System, which offers Internet users the capabilities to use GIS technology to overlay and visualize geographic data and to query GIS databases for information. RAINS allows users to quantify smoke impacts by displaying PM<sub>2.5</sub> concentrations, meteorological parameters, burn information, and trajectories within a GIS environment. When RAINS was combined with BlueSky, the resultant product, BlueSkyRAIN, became a powerful information and

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visualization tool for land managers, air quality managers, regulators, the media, and the general public. Currently, the BlueSkyRAINS systems are available on the Internet for the Pacific Northwest (<http://www.blueskyrains.org>) and a west-wide wildfire implementation (BlueSkyRAINS-West). However, the BlueSkyRAINS systems will soon be available for the entire continental United States, starting with the Southeast.

BlueSky currently relies on reports of planned prescribed and agricultural fires from many agencies in the northwestern United States, including the USDA-FS, U.S. Department of Interior Bureau of Land Management (BLM), some tribes, regional consortia, and states, which include private company information. Agricultural burn information is available from the ClearSky System <http://www.clearsky.wsu.edu> for the Pacific Northwest. In addition, wildfire locations and Department of Forestry. Only the IC-209 reports are nationwide. Other reported data are highly variable as each tribe, state, province, and local regulating body employ different reporting criteria. Therefore, migrating the prescribed and agricultural fire component of BlueSky to other regions has been a slow process. However, because of the consistency of the IC-209 reports, national implementation of BlueSky's wildfire component has been functioning for two seasons, and a west wide implementation of wildfires in BlueSkyRAINS was created in 2005.

11:30 am "Using Satellite-Derived Data to Improve Fire Emission Estimates," S. M. Raffuse, D. C. Sullivan, L. R. Chinkin, Sonoma Technology, Inc.

Wildfires, prescribed burns, and agricultural fires have high spatial, seasonal, and inter-annual variability. Disparate agencies are responsible for tracking and collecting fire activity data. Thus, estimating and allocating emissions from fires can be difficult.

Several satellites produce information that can be used to help address these issues. Satellite-based infrared sensors measure signals that can be interpreted to locate areas of high temperature. These "hot spots" are typically caused by wildland or agricultural fires. The use of satellite-derived fire detections provides temporal and spatial resolution that can be used for smoke emissions modeling and emission inventory development.

BlueSkyRAINS is a system designed to help smoke managers assess the potential air quality impacts of prescribed and agricultural burns. It consists of a collection of computer models of fuel consumption and emissions, fires, weather, and smoke dispersion (BlueSky) connected to a web-based geographic information systems (GIS) interface (RAINS). Currently, BlueSkyRAINS uses wildfire and planned burn information collected from various agencies. We are examining the possible benefits of using thermal anomaly (hot spot) data from the Moderate Resolution Imaging Spectroradiometer (MODIS) instrument to complement or replace the currently collected data. In this paper, we will describe how the new data streams will be incorporated and what the likely benefits will be.

12:00 pm **LUNCH**

**Session 4. Emission Inventory Preparation for Modeling: Issues and Applications** Chairs: Madeleine Strum, U.S. EPA  
Brian Timins, U.S. EPA

1:30 pm "Development of REMSAD Emissions Tagging Scheme in Support of MANE-VU Contribution Assessment," J-H Woo, J. Graham, E. Savelli, S. He, and G. Kleiman, Northeast States for Coordinated Air Use Management (NESCAUM).

Regional haze State Implementation Plans (SIPs) due in April 2008 must include a contribution assessment and pollution apportionment analysis as part of the long-term emissions management strategy for meeting visibility improvement objectives in Class I areas subject to federal haze regulations. In order to adequately determine the degree to which emissions sources located in particular geographic regions or areas are contributing to visibility impairment at Class I areas within the Mid-Atlantic/Northeast Visibility Union (MANE-VU) region, the MANE-VU Technical Support Committee (TSC) has adopted a weight of evidence approach that relies on several independent methods for attributing visibility impairment to different sources and source regions. These include Eulerian source models, Lagrangian source dispersion models, as well a variety of data analysis techniques including source apportionment models, back trajectory calculations, and the use of monitoring and inventory data. The Regional Modeling System for Aerosols and Deposition (REMSAD) is the one of eight techniques used in a weight of evidence approach.



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**Session 4. Emission Inventory Preparation for Modeling: Issues and Applications**      Chairs: Madeleine Strum, U.S. EPA  
Brian Timins, U.S. EPA

4:00 pm      "Including the Emission Effects of Refinery Cases and Settlements in Projections for the EPA's CAAA Section 812 Analysis," J. H. Wilson, Jr. and M. A. Mullen, E. H. Pechan and Associates, Inc.

Through its refinery initiative, EPA has established consent decrees with most of the U.S. refinery companies to reduce their air pollution emissions. As part of the EPA's Second Section 812 Prospective, an analysis of the costs and benefits of the Clean Air Amendments is being performed, and this analysis includes emission projections to 2010 and 2020. Because the petroleum refinery consent decrees are expected to produce significant criteria pollutant emission reductions by 2010, it was important to include their effects in the point source emission projections. This was accomplished by reviewing the consent decrees to determine the expected company-specific emission reduction estimates, prioritizing the companies to evaluate the settlements with the largest expected emission reductions and focusing on the companies, facilities, and units with the most significant expected emission changes. Because the refinery settlements most affect SO<sub>2</sub> and NO<sub>x</sub>, this analysis focuses on the parts of the settlements that affect SO<sub>2</sub> and NO<sub>x</sub> emissions. This paper will describe how the consent decree provisions were translated into refinery and unit-specific SO<sub>2</sub> and NO<sub>x</sub> control requirements for fluid catalytic cracking units, and process heaters and boilers, and incorporated in emission projection files for a national/regional modeling analysis.

4:30 pm      "Development of Mid-Century Anthropogenic Emissions Inventory in Support of Regional Air Quality Modeling under Influence of Climate Change," J-H Woo, S. He, and P. Amar, Northeast States for Coordinated Air Use Management (NESCAUM); K. Manomaiphiboon and A. G. Russell, Georgia Institute of Technology.

A future-year (here, mid-21<sup>st</sup> century) emissions inventory (EI) for North America has been developed in support of a modeling study of regional ozone and fine particle matter concentration levels in the continental U.S under influence of global climate change. Since the time span of such a long projection is beyond that of regular EI's used in typical regional air quality modeling, it is necessary to identify a practical approach that allows the future-year projection to account for possible emission controls and climatic and socio-economic changes. However, a technical challenge arises because doing so requires considering and combining various different types of information (with which emissions from human activities are associated) in an integrated way. Often, information given or generated for global-scale studies has less detail and uses coarser spatial-temporal resolution. We have extensively researched and reviewed a number of existing regional- and global-scale emissions projection efforts and then finally set up a methodology, which, we believe, can be a good candidate for the current application, based on data availability and accessibility, spatial-temporal coverage and resolution, and future-scenario consistency (i.e. IPCC SRES A1B, the driving future emissions scenario adopted). The method consists mainly of two steps: 1) Near-future EI projection (up to year 2020) and 2) Distant-future EI projection (up to mid-century). The former is based closely on both the US EPA CAIR EI and the Environment Canada EI while the latter follows approaches given by the RIVM IMAGE EI. In this work, we describe the methodology of the above-mentioned development and present its results.

**Session 5. PM Emissions**

Chairs: William Kuykendal, US EPA  
Wayne Boulton, RWDI

- 1:30 pm "Development of an Emission Reduction Term for Near-Source Dust Depletion," C. Cowherd, and M. A. Grelinger, Midwest Research Institute; D. L. Gebhart, U.S. Army Engineering Research and Development Center.

Vehicle movement on unpaved surfaces generates significant particulate matter (PM) emissions consisting mostly of fugitive dust. These sources are found in rural areas, on construction sites and at in military training areas. However, localized terrain features, topography, groundcover, wind, and other atmospheric conditions can have significant impact in limiting the portion of PM/dust emissions that are regionally transportable. In particular, recent MRI dust plume profiling tests show that tall vegetation (oak and cedar trees) bordering an emission source captures fugitive dust (PM<sub>10</sub> and PM<sub>2.5</sub>) in the range of 50 percent over a transport distance of 25 m from the source (e.g., unpaved road). These rates significantly exceed the levels represented in standard air plume dispersion models used for regulatory compliance purposes. Accordingly, these compliance models over predict the PM impacts of military training exercises, typically by a factor of four.

Subsequent to the field tests of tall trees as deposition receptors for fugitive dust, field testing and modeling representation were performed by MRI to assess the effectiveness of tall prairie grass in capturing particulate matter emissions from military training exercises. Field testing was performed in 2005 at Fort Riley, Kansas. The measured PM-10 capture efficiencies on tall grass were in the range of 35 percent over a travel distance of 25 m from the source (training site access road). Once again, the capture efficiencies for the coarse and fine fractions of PM<sub>10</sub> (i.e., particles between 2.5 and 10 microns and particles smaller than 2.5 microns) were in the same range. The types of grasses tested, in addition to the trees previously tested, provide a range of vegetative characteristics that are thought to relate to dust capture efficiency

The desired product of the series of studies described above is a modeling representation of dust capture on vegetation bordering traffic on unpaved surfaces. The modeling representation approximates the observations from on-site testing of dust capture on vegetation in three particle size ranges (PM-30, PM-10 and PM-2.5). Incorporation of an appropriate particle removal term for pre-processing the emission inventory will improve the accuracy of these models by removing a cause of characteristic over-prediction of the air quality impacts of dust emissions from training activities and other open dust sources.

- 2:00 pm "Determination of PM Emission Rates from Leaf Blowers," D. R. Fitz, D. V. Pankratz, S. Pedersen, and J. Bristow, University of California, Riverside.

Leaf blowers are an obvious source of particulate matter (PM) emissions. The emission rates, however, have never been quantitatively measured and there is no default emission factor in AP-42 for this source. A system was designed and evaluated for determining emissions from leaf blowing/vacuuming, raking and sweeping activities. The system consisted of a large portable enclosure to trap PM emissions during these activities and used real-time PM analyzers to measure PM concentrations. Measurements were made for PM<sub>2.5</sub>, PM<sub>10</sub> and total suspended particulate matter (TSP). In this enclosure the leaf blower could be used in a normal manner while allowing the PM emissions to be confined for quantification. The horizontal and vertical distribution of the PM cloud was characterized as a function of time after the blowing operation ceased in order to optimize sampling locations and times. The concentration of a hydrocarbon tracer gas released during the blower operation was measured with a photoionization detector to determine the exchange rate. Experiments were conducted during calm wind periods to minimize the exchange rate.

Emission rates were calculated from measured concentrations, enclosure dimensions, and area over which the activities were performed. To directly compare the PM emission characteristics of tools, clean pavement was spiked with surrogate debris. To derive the composition of this surrogate, samples were collected from areas on campus where leaf blowing was about to be conducted to determine the mass of soil and vegetative matter present where these cleaning activities are conducted. The test system was then used to measure emissions from leaf blowing over both surfaces where leaf blowing is typically conducted and over surfaces where a surrogate mixture of dirt and soil was deposited using the data obtained from the sample collection work. Emission tests were also performed using the natural/indigenous material and surrogate material. Emission factors were characterized by soil type, cleaning tool (leaf blower, leaf vacuum, rake and broom), surface (asphalt, concrete, grass and packed soil).

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**Session 5. PM Emissions**

Chairs: William Kuykendal, US EPA  
Wayne Boulton, RWDI

2:30 pm "Control of Open Abrasive Blasting Emissions through Improved Materials," G. E. Muleski and Jason Downing, Midwest Research Institute.

Abrasive blasting is widely used to clean and prepare metallic target materials. Particulate matter emissions from traditionally used abrasive materials (such as silica sand and coal slag) have long attracted the attention of regulatory agencies. This paper describes a field test program that compares particulate emissions from new Sponge Media with that from traditional abrasives. Sponge Media consists of polyurethane sponge material that has been impregnated with an abrasive material. The pliable nature of the sponge material allows it to surround the point of abrasive impact, thus forming a "microcontainment" to capture dust and airborne emissions. The sponge also increases worker safety by dramatically reducing ricochet of the abrasive particles.

The current test program compared particulate matter emissions from Sponge Media with emission data for abrasive material that form the basis for AP-42 Section 13.2.6. To the extent practical, MRI mimicked the prior program to enable direct comparison with the AP-42 emission factors. Testing employed "exposure profiling" which has been recognized as the technique most appropriate to characterize the broad class of open anthropogenic particulate sources. Because the exposure profiling method isolates a single emission source, the open source emission factors with the highest quality ratings in AP-42 are typically based on this approach. The program found that Sponge Media produces up to two orders of magnitude less total particulate and PM-10 emissions than traditionally used abrasives.

3:00 pm **BREAK**

**Session 6. Agricultural and Ammonia Sources** Chair: Thomas Pierce, NOAA / U.S. EPA

1:30 pm "A Program to Determine Reactive Organic Gas Emissions from Different Manure Handling Methods at California Dairies," C. Krauter, M. Beene, D. Goorahoo, California State University; D. Blake, University of California at Irvine.

A study of ROG emissions related to dairy operations was conducted at two Central California locations in 2003-04. Results from that study were presented at the '05 EPA Emissions Inventory Conference. The monitoring and modeling methods developed for that project will be applied to a more comprehensive study to be conducted in 2005-08. The development of that program and data from the initial monitoring events will be presented in this paper.

Modeling of ambient samples collected upwind and downwind of various components of the two dairies in the initial study indicated there were differences that might be attributed to different management and techniques for collecting, separating, storing and disposing of the liquid and solids from the cows. There were not enough sites or sampling events in the initial study to provide more than an indication that these differences might exist. In order to evaluate different methods of manure handling at dairies with regard to the emissions of ROG, a more intensive study to include additional sites and additional monitoring methods was proposed and funded by the CARB with matching funding from the CSU Agricultural Research Initiative. A monitoring project to collect N and C data at the same sites was funded by the University of New Hampshire from a USDA grant.

Six dairies with different manure handling systems have been selected for a three year monitoring program. The sites will be sampled three times, winter, early summer and early fall, each year to determine emission differences due to weather and other factors related to seasonal variation. The monitoring program will include day and night or continuous sampling to determine diurnal emission differences. Emissions will be estimated using both ambient canister sampling (upwind and downwind) as well as flux chambers at appropriate locations. The components of the dairies to be monitored include the animal housing, manure collection system, manure separation, treatment and storage systems, feed storage, and land application of effluent and manure. Emissions will be modeled using the Gaussian plume dispersion model, ISC-ST v.3.

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Dairies selected for the study include:

1. A "typical" free stall, flush lane dairy that is the most common type of large, modern operation in California.
2. The second type is similar to the first but has a series of lagoons and more complex management, similar to USDA guidelines for an anaerobic lagoon.  
These two dairies were in the preliminary study so considerable background data was available. The other four manure handling systems included in the new study are:
3. A lagoon complex designed and operated according to USDA guidelines for an aerobic lagoon with no artificial aeration devices.
4. A lagoon complex designed and operated according to USDA guidelines for an aerobic lagoon that includes artificial aeration devices.
5. A tank type digester system to digest manure slurry prior to land application of the liquid and solid material.
6. An additional alternative not yet selected.

The first year of monitoring will focus on development of the monitoring, analytical and modeling procedures. The initial sampling will begin in December, 2005 and be completed by February, 2006. Data and modeled emissions from the initial monitoring will be available to present in the paper.

2:00 pm

"Ammonia Fluxes from Animal Housing at a California Free Stall Dairy," M. Beene, and C. Krauter, California State University; B. Goodrich, Texas A & M; D. Goorahoo, California State University.

Ammonia is known to be emitted from confined animal facilities in large amounts. Ammonia sampling was conducted upwind and at various locations on a commercial, free stall, 3500 head dairy in the San Joaquin Valley of California during the fall of 2003 and spring of 2004. Samples were collected at sites upwind of the dairy, downwind of lagoon, downwind of animal housing, and 380 m downwind of the dairy. An active chemical filter pack method was used to measure ammonia at heights of 0.5, 1, 2, 4, and 10 m. Ammonia fluxes were calculated using the USEPA approved ISC-STv3 dispersion model. Fluxes from the facility ranged from 128 to 319 mg NH<sub>3</sub>-N/m<sup>2</sup>-h. Concentrations monitored 380 m downwind of the dairy were near or equal to upwind concentrations.

**Results**

- Ammonia fluxes ranges from 128 to 319 mg NH<sub>3</sub>-N/m<sup>2</sup>-h
- Ammonia fluxes were generally higher in April than in September
- Concentrations of ammonia monitored 380 m downwind of the facility were near upwind concentrations (background)
- Fluxes of ammonia from the lagoon was not derived because the layout of the facility complicated modeling efforts
- Recent work conducted by Schmidt et al. 2004, using an USEPA surface isolation flux chamber gave results similar those presented here, with an average ammonia flux from the exercise pens of 216 mg NH<sub>3</sub>-N/m<sup>2</sup>-h
- Concentrations of ammonia 380 m downwind of the dairy across a field were close to upwind (background) concentrations

**Conclusions**

- Dispersion modeling technique seems to provide accurate results for quantifying ammonia emissions from dairy facilities
- Ammonia disperses downwind of a facility close to background concentrations within approximately 380 m

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**Session 6. Agricultural and Ammonia Sources**    Chair: Thomas Pierce, NOAA / U. S. EPA

2:30 pm    "Developing Manure-DNDC: Building a Process Based Biogeochemical Tool for Quantifying NH<sub>3</sub> and Greenhouse Gas Emissions from California Dairies," W. Salas, Applied Geosolutions, LLC; C. Li, University of New Hampshire; F. Mitloehner, University of California, Davis; C. Krauter, California State University; and J. Pisano, University of California, Riverside.

Assessing the air emissions from animal feeding operations is difficult due to high variability in the quality and quantity of animal waste, and in the numerous factors affecting the biogeochemical transformations of manure during storage, treatment and field application. There is an urgent need for scientifically sound, mass balance based, process models for quantifying air emissions from animal feeding operations. Measurement programs are essential, but must be supplemented by process-oriented modeling that incorporates mass balance constraints to extrapolate in both space and time (NRC, 2003). The time is right for moving beyond the emission factor. The dynamics of CH<sub>4</sub>, N<sub>2</sub>O and NH<sub>3</sub> production/consumption is always controlled by several biochemical and geochemical reactions, namely decomposition, hydrolysis, nitrification, denitrification, ammonium adsorption, chemical equilibriums of ammonium/ammonia, and gas diffusion. These biogeochemical processes are currently simulated in our existing model called DeNitrification-DeComposition, or DNDC. DNDC simulates these processes under both aerobic and anaerobic conditions, thus is well suited for estimating C and N dynamics and air emissions associated with manure production, storage, treatment and land application.

The current DNDC model has detailed processes for quantifying CH<sub>4</sub>, N<sub>2</sub>O and NH<sub>3</sub> emissions from agroecosystems with fertilizer/manure application or animal grazing conditions but lacks algorithms for specifying fluxes under drylot, housing and storage conditions. We are now extending DNDC's applications by integrating the fundamental biogeochemical processes with housing and storage management practices. The new developments for our process-based, mass balance approach include (1) characterization of environmental factors under drylot, housing or storage conditions; (2) characterization of quantity and quality of dairy waste; and (3) integration of detailed biogeochemical processes into a tool for estimating GHG emissions and NH<sub>3</sub> volatilization under drylot, housing or storage conditions. The presentation will provide an overview of our field data collection, model development, and how this GIS modeling tool can be used to compile emission inventories from California dairies at multiples ranging from the farm level to counties or air districts.

3:00 pm    **BREAK**

**Session 7. Rapid Inventory Development**    Chairs: Martin Husk, U.S. EPA  
Grace Kitzmiller,  
Eastern Research Group, Inc

3:30 pm    "Diamonds in the Rough: Creating Optimal, Composite Inventories in the Texas Air Emissions Repository," G. Kitzmiller, W. Gerber, and J. Veysey, Eastern Research Group; J. Westphal, Texas Commission on Environmental Quality.

To support its state implementation plan and EPA reporting processes, Texas must collect, develop, and integrate emissions data from numerous sources. The Texas Commission on Environmental Quality (TCEQ) and Eastern Research Group (ERG) have met this challenge with the Texas Air Emissions Repository (TexAER): a centralized, Web-based system that stores, reconciles, and reports non-point emissions data. With tools for uploading raw emissions estimates, collating and enhancing data, and extracting inventories for EPA, stakeholders, and the public, TexAER provides a single, flexible platform for managing non-point information.

A key problem facing emissions data managers is how to assemble an optimal inventory from multiple sources of varying quality. TexAER addresses this issue in two innovative ways, both of which rise from its repository of source data.

- *The TexAER Inventory Builder* allows users to traverse the emissions data repository, select the best parts of different inventories, compare them side-by-side, and compile them into a new, composite inventory. The new inventory is then available for analysis and reporting—including exports in the NEI Input Format (NIF) for EPA.
- To maximize data quality, the Inventory Builder incorporates workflow checks and balances, NIF validation, and other data reasonableness measures. It focuses users' work with powerful analytic functions, offering spreadsheet-like capabilities through a rich client Web interface. At all steps in the inventory development cycle, the tool maintains comments and traceability information.

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- **TexAER Projection Reports** combine baseline inventories, economic growth factors, and control scenarios to produce emissions forecasts. Users can layer multiple growth and control conditions on baseline data, creating a nuanced picture of probable emissions. Projection reports run entirely on the Web and return results in near real time—fast enough to support screening-level, what-if analyses. After a forecast is generated, it can be built into a new inventory that in turn can feed reports/exports or the Inventory Builder.

By facilitating data selection, development, and arrangement, the Inventory Builder and Projection Reports help users distill quality inventories from extensive source data. They provide a unified Web toolset for quickly and transparently creating reliable inventories.

4:00 pm "Rapid Inventory Development Pilot: Final Report," D. Solomon, S. Dombrowski, U.S. EPA; C. R. Tillerson, L. Harwell and J. Paumier, MACTEC, Federal Programs, Inc.

The Rapid Inventory Development Pilot began in September, 2004 to investigate the shortening of the time needed to prepare a state/local/tribal agency inventory submittal without compromising data quality or completeness. Eleven state/local agencies participated in the pilot. This is a report of the findings of that pilot.

4:30 pm "New Approach for Timely Development of the 2005 Emissions Inventory," C. Y. Wu, M. Smith, B. Todd and K. Paul, Minnesota Pollution Control Agency.

With the U.S. Environmental Protection Agency's new schedule for the 2005 National Emission Inventory (NEI), State, local and tribal agencies must submit their final emissions data in 17 months, as compared to 29 months for the 2002 NEI. In Minnesota, where there are zero non-attainment areas, resource constraints in the Emission Inventory Program will make this new deadline difficult to meet. To increase its chances for success, the Minnesota Pollution Control Agency (MPCA) has developed a strategy that will attempt to maintain emission inventory quality, while meeting the new time requirement.

In 2004, an internal survey was conducted to identify the needs of emission data users for in-state activities, in addition to regional and national activities. Following the analysis of survey results, MPCA emission inventory staff prioritized inventory development tasks. Emissions for point sources (particularly large point sources) and nonpoint sources that have state-specific activity data are the highest priorities. To accelerate the point source emission inventory, all aspects of the current approach have been scrutinized, including procedures for the criteria air pollutant inventory, when and how to collect data for the toxic air pollutant inventory, how to integrate the efforts on criteria and toxic air pollutant inventories, possible rule updates, and creative changes in staff work distribution. This paper presents the new approach Minnesota will use for emission inventory development, and discusses its rationale and expected outcomes.

**Wednesday, May 17, 2006**

**Session 7. Rapid Inventory Development**      Chairs:      Martin Husk, U.S. EPA  
Grace Kitzmiller,  
Eastern Research Group, Inc

5:00 pm      "Pechan Introduces New Web-Based Inventory System." M. Salhotra, D. Divita, S. Boone, S. M. Roe, and R. P. Strait, E. H. Pechan and Associates, Inc.

E.H. Pechan & Associates, Inc. (Pechan) has developed a web-based system for developing, analyzing, and reporting non-point source emission inventories. The system is called the Nonpoint Data Management System (NDMS). The system was developed with two primary objectives: 1. *Developing Comprehensive and U.S. EPA National Emissions Inventory Format (NIF) Compliant Non-Point Inventories*: inventories developed with the system will be comprehensive in terms of both source and pollutant coverage. The system supports the development of inventories for criteria air pollutants (CAPs), toxic air pollutants (TAPs), and greenhouse gases (GHGs); and 2. *Incorporating the Data Needed for Air Quality Modeling*: the system is populated with temporal allocation profiles (monthly, weekly, diurnal), volatile organic compounds (VOC) and particulate matter (PM) speciation profiles, and spatial allocation data. These data are often used in the development of emission estimates and be exported in formats needed by air quality modelers.

The system comes loaded with emission factors for all pollutant types, temporal profiles, speciation data, growth factors, and control factors. Input tools are also provided along with default activity data sets for many source sectors. These input data are used by the system to calculate annual, summer season daily, and winter season daily emission estimates. The system features a geographic information system (GIS) interface that allows users to review the spatial allocation of emissions, activity data, and control data for their area of interest. The system requirements are simply a computer and web browser. During the summer of 2005, 10 state and local agencies reviewed NDMS as a part of EPA's "Rapid Inventory Development Pilot Project" for improving the development and reporting of nonpoint source inventory data.

5:30 pm      "More Emissions Inventory with Less Time and Money Invested," C. P. Ramsdell, Idaho Department of Environmental Quality

Idaho DEQ (IDEQ) is using technology to overcome budgetary and personnel shortfalls in emissions inventory projects. High-tech tools and inter-agency cooperation allow IDEQ to complete required work with fewer people and in less time. IDEQ created an in-house software program to gather point source data for annual and periodic emissions inventories, ran Vehicle Identification Number (VIN) decoding software to improve fleet-mix over MOBILE6.2 defaults, and is currently working with the Idaho Transportation Department (ITD) to improve heavy-duty vehicle fleet-mix and vehicle miles traveled (VMT) estimates. The in-house software allows facilities to log into an IDEQ Web server using a unique username and password provided by the agency. The program's layout follows the 44 data elements in the Consolidated Emission Reporting Rule (CERR); therefore, providing the exact data that the Environmental Protection Agency (EPA) is wanting in the National Emissions Inventory (NEI). The program also limits the amount of quality assurance (QA) needed on the data by "controlling" user entry in each submission field. Once the data is submitted by the facility, it is automatically placed into a SQL server database. From there, the data tables can easily be exported into Access, in the NIF eight-table format, in order to run the EPA QC tools. The mixture of these elements allows IDEQ to complete and submit a periodic emissions inventory in the amount of time proposed in 2011, less than 12 months; all while using only two full-time and three part time employees.



**WYNDHAM AT CANAL PLACE**

**Wednesday, May 17, 2006**

**Session 8. GIS Assisted Emission Inventory Development**    Chairs:    Tom Pace, U.S. EPA  
Tom Pavlovic, CAPCOG

3:30 pm    "Updated GIS Data for Use in WRAP Regional Modeling," A. Hoats and G. Mansell, ENVIRON International Corporation.

The Western Regional Air Partnership (WRAP) is a collaborative effort of tribal governments, state governments and various federal agencies to implement the recommendations of the Grand Canyon Visibility Transport Commission (GCVTC) and to develop the technical and policy tools needed by western states and tribes to comply with the U.S. Environmental Protection Agency's (EPA) regional haze rule (RHR). Other common western regional air quality issues raised by the WRAP membership may also be addressed. WRAP activities are conducted by a network of committees and forums composed of WRAP members and stakeholders who represent a wide range of viewpoints.

The air quality and emission inventory development efforts of the WRAP require a variety of Geographic Information System (GIS) databases. Specific uses of these data include the following:

- air quality analysis and support of source attribution/apportionment activities;
- improvement of near-field activity data and analysis of emissions strengths; and
- provide more uniform landuse and demographic data to make temporally consistent regional estimates of biogenics, ammonia, and windblown dust emissions, as well as providing a consistent baseline for area source activity data and planning

Current GIS data used in these modeling efforts are generally based on information from the early 1990's and include various limitations with respect to the attributes represented. The WRAP funded a project to identify, evaluate and assemble updated GIS databases for use in the WRAP's emissions and air quality modeling efforts. This paper describes and summarizes the updated GIS databases developed during the project. Examples are presented illustrating the impacts associated with utilizing the updated databases in some emission inventory development models currently in use by the WRAP.

4:00 pm    "Ongoing Development of a Multi-User GIS-Based Emission Inventory Tool," M. Van Altena, J. W. Boulton, M. Lepage, RWDI AIR Inc.; C. diCenzo, Environment Canada.

This paper presents an update on the current status of an ongoing project to develop a multi-user, GIS-based Emission Inventory Tool (GIS-EI Tool). The fundamental goal behind the GIS-EI Tool is to allow a number of simultaneous users to create high resolution area and mobile source emission inventories more efficiently. To accomplish this, the GIS-EI Tool was developed using a bottom-up approach such that it is possible to produce updated or scenario inventories based on changes in science (e.g., emission factors), feature-based activity data (e.g., road traffic volumes, population density), and geography (e.g., changes in the location and/or magnitude of emissions that are based on physical characteristics of geographic features such as roads or land use). The Tool can also be used to analyze data, generate reports and prepare model input files from the computed emissions inventories.

The GIS-EI Tool underwent a rigorous design phase involving input and feedback from a number of different stakeholder groups. This was followed by the development of an initial prototype capable of defining and calculating emissions at the activity level in the Greater Vancouver Regional District in southern British Columbia. Since that time, a number of components within the Tool have been upgraded and added, including a partial revision of the underlying database structure upon which the Tool is based. A next generation version of the Tool is now in the development and testing phase.

**Session 8. GIS Assisted Emission Inventory Development**    Chairs:    Tom Pace, U.S. EPA  
Tom Pavlovic, CAPCOG

4:30 pm    "Using GIS to Allocate Ground Level and Elevated Aircraft Emissions," S. Smeltzer and P. Nazem, Alamo Area Council of Governments.

Aircraft emissions from commercial airports are often a major source of emissions in urban centers. To allocate 2005 aircraft emissions accurately, temporal and spatial factors must be applied. This necessitates assigning airport emissions to the modeling grid cell system. These emissions vary by mode of aircraft operation: landing, take off, and climb out up to 1000 meters.

Information for landing and take-off patterns at each of the San Antonio International Airport runways was obtained from the San Antonio department of aviation. Obtaining the percentage of flights that take place at each end of a runway made it possible to assign the Emission and Dispersion Modeling System (EDMS 4.2) generated aircraft emissions to each runway for arrival and departure flights. The aircraft emissions for take-off, climb out, and approach flight modes were then allocated to the photochemical model grid-cell system. This was accomplished by using GIS to calculate the height, latitude, and longitude of multiple nodes within the grid system at 8 incremental ground distances from the end of runways. As a final step, the aircraft emissions for each runway were equally distributed and allocated to these nodes using GIS.

5:00 pm    "Use of Satellite Imagery to Inventory Erodible Lands in the Las Vegas Valley," C. Cowherd, Midwest Research Institute, M. Borengasser, Private Consultant; F. D. Hall and W. F. Kemner, Environmental Quality Management, Inc.

The rapid growth of the semiarid southwest U.S. has increased land disturbances and led to the destruction of natural soil crusts that inhibit wind erosion. For example, in the Las Vegas Valley, windblown dust contributes to exceedances of PM10 air quality standards. This paper discusses the spectral analysis methods that use satellite imagery to remotely identify different types of vacant land parcels. A suite of "training sites" and "validation sites" in two 10 km<sup>2</sup> pilot areas established firm relationships between the ground surface data and remote satellite images of the same area. The training sites were validated for soil stability by field observations of vegetation types and coverage, amount of loose surface material, surface crust strength, and presence of non-erodible elements.

Both aerial photography and geostationary satellite imagery (IKONOS, LandSat) were used in the analysis to identify vacant lands in the Las Vegas Valley. Spectral signatures were developed for a number of land categories including native desert and disturbed land. In addition, almost 200 miles of previously uninventoried private unpaved roads were identified and traffic was counted on a sample of the roads. Stratified random sampling, used with aerial photography, was used to generate reference data for accuracy assessment.

The analysis of remote imagery and associated "ground truthing" has resulted in the development of an inventory of vacant lands according to surface characteristics. Land areas of native desert, disturbed vacant land, stabilized vacant land, and private unpaved roads were documented in GIS layers that provide the basis for calculating wind generated emissions of suspended wind-blown dust.

5:30 pm    "Using Aerial Imagery and GIS Data to Improve Quarry Equipment Emission Inventories," S. Smeltzer, Alamo Area Council of Governments.

In the past, off-road emission inventories collected for quarries were often incomplete and contained inaccuracies. The NONROAD model default values are inappropriate for quarries because these sites contain larger construction equipment, operating at almost constant usage rates. Non-road equipment emissions can be calculated with greater accuracy using local surveys, GIS, and aerial photography. A two-stage survey of local quarry equipment activity was conducted to determine local equipment population, usage rates, and equipment characteristics in 2005. The survey yielded a 34 percent response rate. Since quarries vary greatly by size and procedure, further analysis was required to improve the results of the equipment inventory and increase accuracy in emission calculations. For the quarries that did not respond to the survey, aerial photography was used to determine equipment counts. The equipment for each quarry was identified, marked, and counted using 6-inch resolution imagery with GIS software. Once emissions were calculated using survey data, aerial counts, and the NONROAD 2004 model, the emissions were geo-coded to each quarry site.

**Thursday, May 18, 2006**

**Session 9. Emission Inventory Preparation for Modeling: Issues and Applications**      Chairs: Madeleine Strum, U.S. EPA  
Brian Timins, U.S. EPA

8:00 am      "New Tools to Generate Spatial Surrogate and Speciation Profile Inputs to SMOKE," A. M. Eyth, L. Ran, University of North Carolina at Chapel Hill; G. Yarwood, M. Jimenez, S. Rao, ENVIRON International; M. R. Houyoux, U.S. EPA.

As part of the development of EPA's new Emissions Modeling Framework (EMF), two new tools have been developed to aid emission modelers in the development of SMOKE input files for spatial surrogates and speciation profiles. The surrogate tool can create dozens of spatial surrogates for multiple regions without requiring the user to do any scripting. The surrogate tool is driven using comma separated value files that describe the surrogates to be created and the Shapefiles to be used. The spatial surrogates can be created using a wide variety of map projections. As part of this work, support for the creation of polygon-based surrogates was added to the Multimedia Integrated Modeling System (MIMS) Spatial Allocator, which is used to actually generate the spatial surrogate fractions. This new type of spatial surrogate is used to interface with models such as AERMOD, which needs surrogate fractions for each census tract as opposed to each grid cell. The speciation tool reads VOC and PM2.5 speciation information from the SPECIATE 4.0 database and also from precomputed profiles for other pollutants. The user also must specify a chemical mechanism to be used by CMAQ that includes VOCs and toxics, and a set of inventory pollutants to include in the modeling. The speciation tool will then compute the speciation factors for the specified chemical mechanism and will create the speciation profiles and VOC-to-TOG factors that will be used by SMOKE. Both tools are integrated with the EMF.

8:30 am      "Updating SMOKE to Create AERMOD--Ready Inputs for Urban-Scale Air Dispersion Modeling," R. Mason, M. Houyoux, M. Strum, U.S. EPA; A. Eyth, University of North Carolina at Chapel Hill.

The SMOKE emissions processor is being updated to create AERMOD-ready run stream files. Currently SMOKE processes emissions for the CMAQ and CAMx atmospheric grid models. Modifying SMOKE to process multipollutant, community-scale inventories will be accomplished using existing SMOKE report features and several new SMOKE input ancillary files and new environment variables. The user will have the ability to process any emission source as an AERMOD point, area, or volume source. Local, state, and regional agency data can be incorporated into the inventories using new SMOKE ancillary files that will also enable source-specific AERMOD release parameters. SMOKE, coupled with a new spatial allocation tool will enable spatial allocation to fine resolution of any leftover county-level emissions not allocated to discrete locations. For optimization purposes, the user can also utilize the newly released Emissions Modeling Framework to subset the counties and pollutants of interest. The user will dictate the AERMOD domain and SMOKE will create one AERMOD-ready run stream file for each user-defined pollutant.

9:00 am      "Processing Mobile Emissions in SMOKE: Is it Worth Simulating Everyday Onroad Mobile Emissions to Support 8-Hr Ozone Modeling?" M. Abraczinskas, North Carolina Department of Environment and Natural Resources; C. Loomis and G. Stella, Alpine Geophysics, LLC.

The most computationally limiting step in emissions modeling is typically the generation of on-road mobile sources. Motor vehicle emissions are influenced by meteorological variability and the processing requirements for daily motor vehicle emissions have been determined to be rate limiting under most modeling schedules. Rather than utilizing averaged meteorological data or pre-calculated motor vehicle emissions, the Visibility Improvement State and Tribal Association of the Southeast (VISTAS) modeling team developed an emissions processing approach that models a representative week for each month of the year in order to make the SMOKE processing time more manageable and consistent with VISTAS Phase II schedule. This representative week was selected from mid-month, to try to best represent the average temperature ranges for the month, and also adjusted to exclude holidays that would require atypical processing.

The purpose of this paper is to describe processing options for onroad mobile source emissions using the MOBILE module of the SMOKE emissions processor and to determine, based on air quality predictions and time and resource expenditure, benefits of simulating everyday for onroad mobile emissions to support 8-hr ozone modeling. We will present 12km evaluations of everyday vs. representative week emissions and associated air quality for a number of domains and discuss the benefits and limitations of the various methods relative to ozone and regional haze prediction.

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**Session 9. Emission Inventory Preparation for Modeling: Issues and Applications**      Chairs: Madeleine Strum, U.S. EPA  
Brian Timins, U.S. EPA

9:30 am      "Constructing Base and Future Year Regional Inventories for SIP Model Development," M. Janssen, LADCO.

This paper will outline the activities conducted by the Midwest Regional Planning Organization that exceed standard SIP development standards. These include Improved NH<sub>3</sub> temporal emissions based on process based models, enhanced nonroad inventories, link based network modeling, enhanced biogenic processing for secondary biogenics, and electric generation CEM and cost model integration.

10:00 am      **BREAK**

10:30 am      "EPA's Multipollutant Modeling with the 2002 National Emission Inventory: Integrating Criteria and Toxics," M. Strum, R. Mason and M. Houyoux, U.S. EPA.

The most computationally limiting step in emissions modeling is typically the generation of on-road mobile sources. Motor vehicle emissions are influenced by meteorological variability and the processing requirements for daily motor vehicle emissions have been determined to be rate limiting under most modeling schedules. Rather than utilizing averaged meteorological data or pre-calculated motor vehicle emissions, the Visibility Improvement State and Tribal Association of the Southeast (VISTAS) modeling team developed an emissions processing approach that models a representative week for each month of the year in order to make the SMOKE processing time more manageable and consistent with VISTAS Phase II schedule. This representative week was selected from mid-month, to try to best represent the average temperature ranges for the month, and also adjusted to exclude holidays that would require atypical processing.

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11:00 am      "Comparison of National and State Emissions Inventories Used for Houston Ozone Simulations," S. Kim and D. W. Byun, University of Houston.

National Emissions Inventory for year 1999 (NEI99) from the U.S. EPA and Texas emissions inventory (TEI) developed by the Texas Commission on Environmental Quality (TCEQ) were processed with SMOKE (Sparse Matrix Operator Kernel for Emissions version 2.1) to prepare inputs to CMAQ (Community Multiscale Air Quality) simulations for Houston ozone studies. These emissions inventories were compared for each source category before and after the emissions processing with SMOKE. Biogenic emissions based on BEIS3 (Biogenic Emissions Inventory System version 3.12) and GloBEIS3 (Global Biosphere Emissions and Interactions System version 3.1) were compared as well. During TEI processing, the state-specific cross-reference tables and profiles for spatial and temporal allocations, and chemical speciation were used with SMOKE. For spatial distribution, the inventory emissions were first examined using GIS tools to check the locations and amounts and then the results on the grid cells were compared after spatial allocation with different spatial surrogates. Emissions of VOC (Volatile Organic Compounds) were examined before and after chemical speciation for a chemical mechanism, like CB4, to quantify the fractions originated from the inventory differences and those from the application of different speciation profiles. Diurnal variations of model species after temporal allocation were also compared. CMAQ simulations were first made with national and state inventories for TexAQs 2000 (August 23<sup>rd</sup> ~ 31<sup>st</sup>, 2000) and then evaluated with surface and aircraft observations for ozone and its precursor concentrations. In addition to the base emissions, CMAQ simulations were made with the TEI imputed emissions in which supplementary VOC emissions are added.

**Thursday, May 18, 2006**

**Session 9. Emission Inventory Preparation for Modeling: Issues and Applications**      Chairs: Madeleine Strum, U.S. EPA  
Brian Timins, U.S. EPA

11:30 am      "EPA's New Emissions Modeling Framework," M. Houyoux, U.S. EPA.

The Office of Air Quality Planning and Standards (OAQPS) has created a data management tool for use in emissions modeling as part of its new Emissions Modeling Framework (EMF). This "Data Manager" supports emissions modeling data using a PostgreSQL database to store and edit data, as well as to generate input files formatted for input to the Sparse Matrix Operator Kernel Emissions (SMOKE) modeling system. The Data Manager allows emissions modelers to track and access multiple versions of the same data using a version-enabled database created for the project. The Data Management part of the EMF runs on a data server, which permits multiple users to access and edit the data in real time. The Data Manager keeps track of which users make changes, when they are made, and stores user-supplied metadata about changes to data. This paper will demonstrate this new tool, and provide examples of how OAQPS is using this tool to support air quality modeling using the 2002 National Emission Inventory.

**Session 10. Managed Burning and Wildfires**      Chairs: Tom Pace, U.S. EPA and Amber Soja, NASA

9:00 am      "FUMAR: Fire Utility for Mexican Atmospheric Releases," D. Williams, M. Murphy, U.S. EPA.

9:30 am      "Comparing Satellite-Based Area Burned Data to Ground-Based Data: An Effort to Enhance Biomass Burning Emissions Estimates to the NEI," A. Soja, National Institute of Aerospace; D. J. Williams, T. Pace, J. Kordzi, U.S. EPA; J. Al-Saadi, J. Szykman, B. Pierce, NASA Langley Research Center, L. Giglio, Goddard Space Flight Center.

Biomass burning is a major contributor of particulate matter and regional haze, particularly on the 25 worst air quality days. It is essential to monitor and accurately quantify fire emissions in an effort to attain the National Ambient Air Quality Standards (NAAQS). Currently, the United States does not have a standard methodology to track fire occurrence or area burned, which are necessary components to estimating fire emissions. One problem is the ownership and management of the land belongs to multiple organizations (i.e. USDA Forest Service, Bureau of Land Management) and private individuals, so there is not one organization that is responsible for thoroughly monitoring fire. Satellite imagery provides the opportunity to remotely sense fire across boundaries within the United States. The purpose of our presentation is to describe the available satellite-based fire data and the ability of satellite-based products to accurately define fire and area burned. We have compared Moderate Resolution Imaging Spectroradiometer (MODIS) thermal anomaly data and Geostationary Operational Environmental Satellite (GOES) Automated Biomass Burning Algorithm (ABBA) data to ground-based data from the southeast and northwest United States. Also, we have derived a cumulative fire database using both the MODIS and GOES data products, which will also be compared to the ground based data.

10:00 am      **BREAK**

**Thursday, May 18, 2006**

**Session 10. Managed Burning and Wildfires** Chairs: Tom Pace, U.S. EPA and Amber Soja, NASA

10:30 am "Recent Changes to the Hazard Mapping System," M. Ruminski, S. Kondragunta, R. Draxler, National Oceanic and Atmospheric Administration; J. Zeng, Earth Research Technology, Inc.

The Hazard Mapping System (HMS) was developed in 2001 as an interactive tool to identify fires and the smoke emissions they produce over North America in a timely manner. The system utilizes 2 geostationary and 5 polar orbiting environmental satellites to provide a continuous monitoring capability. Automated fire detection algorithms are employed for each of the sensors. An analyst quality controls the automated fire detects by eliminating those that are deemed to be false and adding hotspots that the algorithms have not detected via a thorough examination of all of the satellite imagery.

Areas of smoke are outlined by an analyst using animated visible channel imagery. A quantitative assessment of the smoke density is not performed at this time. However, integration of automated aerosol and smoke products into the HMS, such as the GOES Aerosol and Smoke Product (GASP) and the MODIS aerosol product in early 2006 and the aerosol product from the Ozone Monitoring Instrument (OMI) later in 2006 are expected to aid in determining a value as well as provide another tool for the analyst in identifying areas of smoke.

HMS analysts also denote fires that are producing smoke emissions detected in satellite imagery. These fire locations are used as input to the HYbrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model. In 2005 the model was upgraded to adjust emission rates based on land use as opposed to using a constant emission rate. Additional improvements that are being considered include duration of fire and start/end time of emissions. It is felt that these will increase the accuracy of the total amount of emissions as well as areal dispersion.

11:00 am "Fire Emissions from North America: A Simple Modeling Approach," C. Wiedinmyer, National Center of Atmospheric Research; C. Geron, U.S. EPA; A. Belote, National Center of Atmospheric Research; B. Quayle, USFS Remote Sensing Applications Center; D. McKenzie, U.S. Forest Service; X. Zhang, NOAA, S. O'Neill, U.S. Forest Service; K. K. Wynne and A. Guenther, National Center of Atmospheric Research.

Fires, both naturally occurring and those ignited by human-induced processes, emit significant amounts of trace gases and aerosols to the atmosphere. These emissions can impact air quality, reduce visibility, and influence atmospheric processes that control regional and global climate. Not only do emissions from fires impact local and regional airsheds, but they can be transported long distances to affect regions downwind. To accurately simulate air quality and climate on local, regional, and global scales, fire emissions must be quantified and included in those simulations.

A simple modeling framework to estimate the emissions from fires in North and Central America has been developed. This framework uses satellite data to determine fire location and timing as well as fuel loading. The MODIS Fire and Thermal Anomalies Product is the primary source of data used to determine fire location. Other satellite data, such as the MODIS Vegetation Continuous Fields Product and the SPOT Global Land Cover 2000 dataset, are used to describe fuels. Emission factors and fuel loadings from published literature are applied to the satellite-detected fires. Daily fire emissions for a several year period (2002-2005) have been calculated using this model framework. Improvements to the method, including more accurate determination of fire size, diurnal cycles of emissions, and inclusion of fuel conditions, will be discussed. This simple modeling approach produces reasonable estimates of fire emissions with little cost to the user. The emissions can be used as input to regional and global chemical transport models. Methods to use these emissions within regional chemical transport model simulations, particularly CMAQ, will be provided.

**Thursday, May 18, 2006**

**Session 10. Managed Burning and Wildfires** Chairs: Tom Pace, U.S. EPA and Amber Soja, NASA

11:30 "Satellite Derived PM<sub>2.5</sub> Emissions from Prescribed and Wildfires," S. Kondragunta, NOAA; X. Zhang, Earth Resources Technology, Inc.

NOAA/NESDIS developed a new algorithm to derive biomass burning emissions of PM<sub>2.5</sub> from remotely sensed fire products in near real time for regional and global air quality applications. The algorithm for deriving emissions from forest fires depends on several key inputs such as fuel load, fraction of fuel consumed, emissions factors in addition to fire location, size, and severity. The algorithm development involved developing (a) a new live fuel load database using maximum monthly MODIS Leaf Area Index (LAI) and allometric models that relate leaf foliage mass with other biomass types such as branches, shrubs etc., (b) a fuel moisture category using AVHRR Normalized Vegetation Index (NDVI) product, and (c) emission factors database.

The algorithm was applied to hourly observations of fire events in 2002 over the Contiguous United States (CONUS) to test and evaluate the algorithm. PM<sub>2.5</sub> emissions for 2002 were derived using our fuel load database, fuel moisture category, emissions factors, satellite (GOES) observed fire location and size. The 2002 PM<sub>2.5</sub> emissions derived using this new algorithm were compared to those available from other sources including those from EPA's National Emissions Inventory. These comparisons and assessments of uncertainties in satellite-derived emissions will be presented.

**Thursday, May 18, 2006**

**Session 11. Greenhouse Gas**

Chairs: Wiley Barbour, Environmental Resource Trust  
Thomas Peterson, Center for Climate Strategies

8:00 am "Emissions Inventory Considerations for Supporting the Development of State and Local Climate Change Mitigation Plans," S. M. Roe, M. A. Mullen, and R. P. Strait, E. H. Pechan; T. D. Peterson, K. Hausker, and K. Colburn, Center for Climate Strategies; M. Lazarus, A. Bailie, Tellus Institute.

This paper presents a discussion of greenhouse gas (GHG) emissions inventory issues that have arisen during the development of state and local climate change mitigation plans (CCMPs). Recommendations for addressing these issues are provided. The authors will present inventory issues and recommendations based on CCMP work performed in several U.S. states including – Arizona (AZ); New Mexico (NM); and North Carolina (NC). A team of consultants, led by the Center for Climate Strategies (CCS), is acting as a facilitator and technical analyst for the development of CCMPs in each of these states. .

For the purposes of these CCMP processes, the GHG sources have been aggregated into four sectors: Energy Supply; Transportation & Land Use; Residential/Commercial/Industrial; and Agriculture & Forestry. For the AZ CCMP process, a black carbon emissions inventory covering all sectors was also developed. As part of the development of the CCMPs in AZ and NM, over 200 policy options have been considered by stakeholders in each state.

Inventory tools such as EPA's State GHG Inventory Tool (SGIT) or STAPPA/ALAPCO's Clean Air and Climate Protection software (CACP) are often used as a starting point for CCMP inventory development. Often, during the development of policy options, data gaps in the base year inventory or forecasts are identified which require further analysis. The paper will explore many of the inventory issues that have arisen during CCMP development processes and methods/data sources that have been used to resolve these issues. The lessons learned from these projects should help other developers of CCMPs during the development of their emissions inventories and forecasts.

8:30 am "Voluntary Commitment to Stabilizing Greenhouse Gas Emissions," J. L. Williams, Entergy, Inc.

In May, 2001, Entergy became the first US Utility to make a voluntary commitment to stabilize its GHG emissions at 2000 levels through 2005. This commitment was made in partnership with Environmental Defense. At that time Entergy defined its footprint as CO2 emissions from its ownership share of US power plants. This footprint was chosen because CO2 emissions from fossil power plants were the largest source of greenhouse gas emissions, because CO2 emissions were measured by Continuous Emission Monitors (CEMs) and because CEMs data had a great deal of QC required by regulation and could be readily certified by independent third party verifiers.

Early in 2006 Entergy will announce its 2nd commitment to stabilize its GHG emissions. This commitment was made in partnership with the EPA Climate Leaders Program. Since the first commitment, the WRI/WBCSD GHG Protocol has been developed that provides a much more rigorous method for establishing an entities GHG inventory. This protocol has been adopted as part of the Climate Leaders Program. Entergy conducted a baseline inventory using the WRI/WBCSD protocol during 2005 and has also developed an Inventory Management Plan that details how the inventory will be measured and verified in future years. We will describe results from this inventory, describe the management plan and show how it's being integrated into Entergy's Second Voluntary GHG Stabilization Commitment.

**Thursday, May 18, 2006**

**Session 11. Greenhouse Gas**

Chairs: Wiley Barbour, Environmental Resource Trust  
Thomas Peterson, Center for Climate Strategies

9:00 am "Transportation GHG Emissions 1990-2003: Trends, Uncertainties and Future Methodological Improvements,"  
J. Davies, U.S. EPA.

The transportation sector accounted for 27 percent of total U.S. greenhouse gas emissions in 2003. Transportation represents one of the fastest-growing sources of GHGs, having increased by 24.8 percent since 1990, compared with all other sources, which collectively increased by 9.5 percent over the same period. Using data from the official *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2003* document, this paper analyzes the relative contribution of various modes to the growth in GHG emissions over this timeframe. These data reveal a number of surprising trends. GHGs from passenger cars and light trucks increased less rapidly than the transportation sector as a whole, and GHGs from heavy duty trucks increased the most rapidly of any major transportation source. The data also show that GHG emissions from aircraft decreased from 1990 to 2003, despite a significant increase in the amount of passenger air travel. While these summary trends are helpful in identifying strategies to reduce transportation GHG emissions, they call attention the need for further methodological improvements in the estimating emissions from specific sources, especially heavy duty trucks. The paper discusses existing methods used to calculate transportation GHG emissions and characterizes sources of uncertainty in the estimates. It concludes by discussing recent interagency efforts to improve the overall accuracy and credibility of these estimates.

9:30 am "Constructing State and Local Scale Inventories of Forest and Soil Emissions and Sinks," G. Smith,  
Environmental Resources Trust.

This presentation gives an overview of methods and important cautions for constructing a state or local scale inventory of greenhouse gas emissions and sinks from forests and soils. A very brief overview of standard methods is given, with references to detailed written methodologies and data sources. Gaps and uncertainties in standard methods are described, and methods for addressing these gaps and uncertainties are outlined. Types of emissions and sinks addressed include forest carbon, soil carbon, soil nitrous oxide, soil methane, and methane from fires. Standard inventories often cover only lands classified as forest or agricultural use. Sequestration and emissions from suburban and urban lands may be significant and methods for estimating these fluxes are provided. Forest and soil emissions and sinks vary from year to year. Causes of annual variation are described and use of multi-year accounting periods is discussed.

10:00 am **BREAK**

10:30 am "Local Efforts to Monitor and Mitigate Greenhouse Gas Emissions: Case Studies from the University park Campus of the Pennsylvania State University and Montgomery County, PA.," B. Nagle, S. Knuth, Pennsylvania State University; C. Steuer, ICF Consulting; B. Yarnal, Pennsylvania State University.

This paper summarizes research to establish a process for conducting stakeholder-based GHG inventories and subsequently developing mitigation action plans to reduce local carbon emissions. The paper illustrates the process using two case studies—one for the Pennsylvania State University campus and another for Montgomery County, Pennsylvania. The Pennsylvania State University is a large campus with over 42,000 students and thousands of faculty and staff; Montgomery County is an important suburban county in the Philadelphia metropolitan area. In both cases, the process required working closely with local officials, agency or institutional staff, and other stakeholders to obtain data and to seek their opinions on which mitigation options are physically possible, economically feasible, socially desirable, and of the highest priority. Making stakeholders an integral part of the process proved to be crucial to ensuring its success.

**Thursday, May 18, 2006**

## **Session 11. Greenhouse Gas**

Chairs: Wiley Barbour, Environmental Resource Trust  
Thomas Peterson, Center for Climate Strategies

11:00 am "An Integrated Emissions Data Management Framework for Government and Corporate Greenhouse Gas Data Management, Modeling, and Reporting," P. A. Hoyte and J. D. Johnson, Caiteur Group, Inc.

Responses to climate change include a multitude of related legislation, regulation, and voluntary programs. These include the Kyoto Protocol, the Asia-Pacific Partnership for Clean Development, regional programs within the U.S. such as the Regional Greenhouse Gas Initiative (RGGI) and individual state programs such as those in California and New Mexico. The types of greenhouse gas (GHG) emission data work required to make these programs successful include access to and from disparate emission data sources, data measurement and management, data analysis, predictive data modeling, risk calculations and reporting. Business-as-usual GHG emissions data and data from emission reduction programs such as carbon dioxide (CO<sub>2</sub>) sequestration and energy efficiency initiatives must also be captured, analyzed, maintained, and shared among federal agencies, international agencies, and corporations. Furthermore climate change programs will require scalable and integrated systems architecture and standards as the U.S. and other countries have begun to adopt a ten to twenty year near-term view for their emissions data infrastructure development.

The Integrated Emissions Data Management (IEDM) Framework addresses these challenges by utilizing advanced decision support systems, modeling tools and methodologies in a systematized way, allowing comprehensive, faster and more cost-effective integration of emission data collection and measurement with emission modeling, estimation, and reporting. The IEDM Framework will allow government agencies and corporations to handle the explosive growth in current and historical emissions data that will occur with the deployment of Continuous Emissions Monitoring (CEM) systems for both point and mobile sources. The IEDM Framework also allows for the handling of emissions data growth due to the integration of regional U.S. emissions data with intercontinental global measurements under current and future partnerships such as the Global Earth Observation System of Systems (GEOSS).

The IEDM Framework provides additional benefits by integrating the requirements of emissions data measurement and management systems with the requirements of emissions modeling programs, including direct and indirect emissions modeling and climate and weather data modeling. This paper will summarize the ten-step plan to realize the IEDM Framework for baseline and experiential emission data and inventories, emission modeling data, and emission monitoring and risk management data.

11:30 am Panel Discussion – climate Change: Q&A with Expert Panel

## **Session 12. Nonpoint Sources**

Chairs: Roy Huntley, U.S. EPA  
Lynn Barnes, South Carolina DHEC

1:30 pm "Air Quality Modeling and Health Benefits of a Woodstove Change-Out Program," B. Timin, R. Huntley, M. Houyoux, L. Brockman, G. Wood, E. Crump and Z. Pekar, U.S. EPA.

The United States Environment Protection Agency (USEPA) has embarked on a nationwide effort to promote the use of EPA certified woodstoves and fireplace inserts. These newer woodstoves emit approximately 70% less fine particulate matter (PM<sub>2.5</sub>) compared to conventional woodstoves. In this paper we attempt to calculate the potential air quality and health benefits from a woodstove change-out program.

The nationwide benefits of a woodstove change-out program were estimated using a series of emissions inventories and models. These included several versions of the National Emissions Inventory (NEI), the Sparse Matrix Operator Kernel Emissions (SMOKE) model, the Community Multi-Scale Air Quality Model (CMAQ), and the Environmental Benefits Mapping and Analysis Program (BenMAP).

The modeling effort was completed using two different versions of the National Emissions Inventory (NEI). We started with a top down nationwide EPA inventory developed for the 1999 NEI. We then used 2002 NEI data which was supplemented with State calculated data. The modeling study revealed important differences in the way the residential wood combustion (RWC) emissions were temporally and spatially allocated. The difference in methods used to estimate and spatially distribute the emissions had a profound impact on the estimated air quality and health benefits from the change-out program. We found that in many cases, the State submitted RWC emissions data gave more reasonable results than the EPA calculated data. But we also found large inconsistencies among the States that submitted RWC data. Further work is needed to promote improvements and consistency in the RWC emissions inventories.

Thursday, May 18, 2006

**Session 12. Nonpoint Sources**

Chairs: Roy Huntley, U.S. EPA  
Lynn Barnes, South Carolina DHEC

2:00 pm "Oregon DEQ 2002 Residential Wood Combustion Emissions Inventory," C. Swab, S. Aalbers, J. Stocum, Oregon Department of Environmental Quality.

Oregon woodstove emissions estimates have historically been very high compared to neighboring states and most other areas of the country. This paper outlines the Oregon Department of Environmental Quality's approach for estimating the 2002 annual residential wood combustion emissions by county. Wood burning activity data was obtained from an EPA funded statewide residential wood combustion survey, completed in 2001. Survey questions included but were not limited to: wood burning device used, temporal patterns, and type and amount of wood burned by household. The survey received replies from 856 respondents from all areas of Oregon. A large component of the methodology consisted of estimating the distribution and number of wood burning device types by county. An additional challenge was in calculating the typical mass of a species-weighted cord of wood for areas in Oregon both east and west of the Cascade mountain range. Emissions were estimated for 84 pollutants, emission factors used are from a variety of sources, including AP-42, EIIP, OMNI Environmental Services, and the 2002 NEI documentation. Inventory results indicate that residential woodstove emissions were approximately 39,000 tons PM10, 122,000 tons VOC, 267,000 tons CO, and 4,000 tons of NOX emissions in Oregon in 2002. Wood burning devices for the inventory include conventional, catalytic, pellet, and non-catalytic woodstoves as well as fireplaces. The inventory does not encompass emissions from manufactured firelog combustion or outdoor wood furnaces.



**Thursday, May 18, 2006**

**Session 12. Nonpoint Sources**

Chairs: Roy Huntley, U.S. EPA  
Lynn Barnes, South Carolina DHEC

2:30 pm "Residential Wood Combustion Emission Inventory for the South Coast Air Basin and Coachella Valley Portion of the Salton Sea Air Basin of California," J. E. Houck, OMNI Environmental Services, Inc.; J. Crouch, Hearth, Patio, and Barbecue Association.

Residential wood combustion (RWC) emission inventories were prepared for the South Coast Air Basin (SCAB) and the Coachella Valley portion of the Salton Sea Air Basin (SSAB) of California. Both the number of wood-burning appliances that were used and the number that were owned were estimated by category for the 2002 base year.

American Housing Survey Current Housing Reports for the Anaheim – Santa Ana, Riverside – San Bernardino – Ontario, and Los Angeles – Long Beach metropolitan areas were a key source of data. Other surveys conducted in the state of California, nationwide surveys, forestry fuelwood reports, and hearth industry records supplied supplemental data.

The wood-burning categories were: (1) free-standing conventional pre-EPA certification cordwood stoves, (2) conventional pre-EPA certification cordwood fireplace inserts, (3) certified free-standing catalytic cordwood stoves, (4) certified catalytic cordwood fireplace inserts, (5) certified free-standing non-catalytic cordwood stoves, (6) certified non-catalytic cordwood fireplace inserts, (7) freestanding pellet stoves, (8) pellet fireplace inserts, and (9) cordwood fireplaces without inserts. The fireplace without insert category was further subdivided into those that were used primarily for aesthetic purposes and those that were used for heating. The relative contribution of manufactured wax/fiber firelogs and cordwood used in fireplaces was also assessed. The average amount of fuel (cordwood, pellets, or wax/fiber firelogs) burned in each category of appliance was estimated from previous surveys conducted in California and from the heating demand of the region as measured by Heating Degree Days (HDD). Updated particulate emission factors (mass particulate emissions/mass dry fuel burned) were obtained from recent literature reviews and testing reports and were in turn applied to each category of appliance to produce the overall particulate emission inventory.

3:00 pm **BREAK**

3:30 pm "An Emission Inventory of Nonpoint Oil and Gas Emissions Sources in the Western Region," J. Russell, A. Pollack and G. Yarwood, ENVIRON International Corporation.

**Thursday, May 18, 2006**

**Session 12. Nonpoint Sources**

Chairs: Roy Huntley, U.S. EPA  
Lynn Barnes, South Carolina DHEC

4:00 pm "An Emission Inventory of Nonpoint Oil and Gas Emissions Sources in the Western Region," J. Russell, A. Pollack and G. Yarwood, ENVIRON International Corporation.

As part of an effort undertaken by the Western Regional Air Partnership (WRAP) to consolidate and improve on the 2002 state and tribal emission inventories, ENVIRON developed an emission inventory of non-point emission sources associated with the production of oil and gas. In the preparation of the non-point oil and gas emission inventory, primary emphasis was placed on the estimate of emissions of nitrogen oxides (NO<sub>x</sub>) from compressor engines, drill rig engines and coalbed methane pump engines. To support WRAP's regional haze modeling, the 2002 inventory was combined with oil and gas development forecasts to project emissions from oil and gas sources in the year 2018.

Non-point oil and gas emissions sources have been largely unaccounted for in state emission inventories, though they are a significant source of emissions in some states. Considerable effort was dedicated to developing a methodology that could be applied consistently across the western region, without overlooking the variability in local production characteristics, control requirements and inventory thresholds. Application of this methodology resulted in the addition of almost 120,000 tons of NO<sub>x</sub> emissions to the 2002 WRAP emission inventory. New spatial surrogates were generated based on well locations to appropriately distribute these emissions.

The 2018 inventory was estimated by growing the 2002 inventory using growth factors derived from resource management plans produced by the Bureau of Land Management and regional forecasts made by the Energy Information Administration. Additional effort was made to estimate emissions in new development areas where the absence of emissions in the base year barred use of a growth factor. This combined approach incorporated the most complete information available on the anticipated oil and gas development in the western region to produce an inventory that predicts a doubling of non-point oil and gas NO<sub>x</sub> emissions between 2002 and 2018. A complementary project recently completed by the authors in Northeast Texas has demonstrated a control technology for compressor engines with the potential to eliminate approximately 80 percent of the 2002 to 2018 growth in NO<sub>x</sub> emissions at cost of less than \$200 per ton.

**Session 13. Emission Inventory Validation  
And Quality Assurance**

Chairs: Marc Houyoux, U.S. EPA  
Mark Janssen, LADCO

1:30 pm "A Quantitative Analysis of the Uncertainty of Emissions Data: A Limited Study," W. B. Kuykendal, U.S. EPA; J. Filipkowski, North Carolina State University; T. P. Mc Mullen, U.S. EPA/SEEP.

The emission inventory community has long struggled with the issue of the uncertainty of emissions estimates and how to quantify it. The basic difficulty is that for the most part there is not a known standard value of emissions data against which various estimates of emissions can be evaluated for uncertainty. This paper presents an analysis of the robust continuous emissions monitoring (CEM) utility data base from Southern Company Services and compares these data with emissions estimates that are made using AP-42 emission factors. We posit that the quality assured CEM data approach the true value. The emission factor derived emission estimates are then compared to the CEM emissions. The analysis will examine SO<sub>2</sub>, NO<sub>x</sub> and CO<sub>2</sub> data for multiple source classification codes (SCC) both with and without emission control devices. The analysis will show results of variation within groupings of sources by SCCs and by individual sources. The analysis will evaluate whether or not there is bias in the emission factor derived estimates. Conclusions will be presented regarding the uncertainty associated with emission factor derived estimates from these source categories. These conclusions will be caveated to note that they are limited to the emission factors analyzed and do not characterize the uncertainty of emission inventories in general.

**Thursday, May 18, 2006**

**Session 13. Emission Inventory Validation  
And Quality Assurance**

Chairs: Marc Houyoux, U.S. EPA  
Mark Janssen, LADCO

2:00 pm "Comparison of Ambient Measurements to Emissions Representations for Modeling in California's San Joaquin Valley," S. B. Reid, S. G. Brown, M. McCarthy, T. Funk, and Lyle Chinkin, Sonoma Technology, Inc.

As part of the Central California Ozone Study (CCOS), the San Joaquin Valley wide Air Pollution Study Agency (SJVAPSA) is investigating why preliminary CCOS photochemical modeling results appear to differ significantly from ambient observations. To further this goal, emissions and ambient data were compared with a view toward making recommendations for meaningful improvements to emission inventories that will, in turn, benefit photochemical ozone modeling performance.

Preliminary work involved a review of the organic gas profiles used to prepare emissions for input to the photochemical model and an analysis of available ambient data. Ambient measurements collected in Central California during the summer of 2000 were analyzed to identify monitoring sites with valid 1-hour or 3-hour speciated VOC, NO<sub>x</sub>, and CO, and meteorological data. An assessment was also made of the emission sources likely to be impacting each site. The results of these analyses were used to select sites that would be used for subsequent comparisons of ambient to emissions data.

For each selected monitoring site, hourly winds were used to identify the target emission inventory grid areas for comparison and assessment. The targeted grid areas' emissions of CO, NO<sub>x</sub>, total VOC, and speciated VOC were then compared to the ambient data by calculating pollutant ratios and weight fractions. Comparisons were also made by hour and by wind quadrant. This paper will discuss the results of these analyses, including similarities and differences between the ambient data and the EI, as well as recommendations for areas of further investigation and possible improvements to the EI.

2:30 pm "Quality Assurance of Emissions Inventory and Modeling Data with the Emissions Modeling Framework and EmisView," A. M. Eyth, R. Partheepan, University of North Carolina at Chapel Hill; M. R. Houyoux, U. S. EPA.

EPA's new Emissions Modeling Framework (EMF) supports the tracking and automation of quality assurance steps for emission inventories and other SMOKE input files using the features of the EMF combined with those of EmisView. The EMF tracks a set of steps that must be performed for each type of data that will be quality assured, such as emission inventories and ancillary SMOKE input files. The EMF will track the steps performed for each dataset, who performed them, when they were performed, their success or failure, and any notes the quality assurance staff wishes to make about the steps. Both manual and automated quality assurance steps will be supported. Automated steps will be available using EmisView and other tools. EmisView is an open-source visualization tool that supports the generation of plots and tables from emission inventories and other related data. The tables and plots created by EmisView can be configured and repeated in an automated fashion. Updates to EmisView since the fall 2005 version include a comparison tool and script-based interface. An updated version of EmisView will be released in late Spring 2005, in conjunction with a version of the EMF that supports data management and quality assurance.

3:00 pm **BREAK**

**Thursday, May 18, 2006**

**Session 13. Emission Inventory Validation  
And Quality Assurance**

Chairs: Marc Houyoux, U.S. EPA  
Mark Janssen, LADCO

3:30 pm "Review of the Arkansas Emission Inventory Improvement Effort," W. Hodan and L. Williams, MACTEC Federal Programs.

MACTEC has worked with the Arkansas Department of Environmental Quality (ADEQ) to conduct a complete assessment of their emission inventory program. The assessment included a complete review of the emission data and structure of the *i*-STEPS database. (*i*-STEPS is the program developed by MACTEC for use in building and tracking emissions inventories) Based on the assessment changes were recommended to the input procedures and database structure. Necessary changes were made and a customized user's manual was prepared to assist ADEQ staff with future inputs.

The onsite assessment of the emission inventory program in Arkansas was initiated by conducting interviews with emission inventory and permitting staff to determine how the emission inventory data are collected and maintained. The forms sent out by the department to collect emission inventory data, and the methodologies used by the department to assemble and submit the emission inventory to EPA and develop internal reports were reviewed. The emission inventory forms sent to ADEQ by industry were quality assured and the data in the *i*-STEPS database were audited. Using the knowledge gained in this assessment, procedures were recommended to modify the data collection and input procedures and improve the *i*-STEPS data structure. The recommendations were specifically designed to accommodate the needs of ADEQ and other departments that depend on the quality and availability of emission inventory data, while improving the quality of the inventory for submittal to EPA.

As a final step towards incorporating upgrades to the emission inventory program, a customized user's manual was developed for use by ADEQ staff to assist with adoption of updated data entry procedures.

4:00 pm "Quality Assurance and Quality Control Approach for Local and Regional Air Pollutant Emission Inventories in Italy," C. Trozzi, R. Vaccaro, A. Bernetti, C. Melis, M Pantaleoni, Techne Consulting, Italy

In the paper the approach followed in Italy for quality assurance (QA) and quality control (QC) in some local and regional emission inventories will be presented. Particular attention will be devoted to the completeness of data, the quality control of data and the validation of results.

The methodology used for emission inventory preparation at local level is at first reviewed. The inventory introduces point, linear/nodal and diffuse sources. The fixed sources for which the total annual emissions of one pollutant are larger than a upper (lower) fixed threshold value, are considered main (minor) point sources. Linear/nodal sources correspond to the main communication ways (road, river, railway, and seaway): all highways, main extra-urban roads, ports and airports are included. All the other sources are defined as area sources.

Next will be introduced the QA/QC procedures followed in Italy at local and regional level to guarantee the quality of the inventories. The following main topics will be discussed:

- Definition of data collection plan
- Procedures for documentation of data collection ("contacts file")
- Validation procedure for point sources data

Usually point sources data are collected through a direct census and in this case the following activities are:

- comparison of emission data with emission factors estimates,
- comparison of emission data with data of similar plants,
- integration of emission data, when not declared, with estimates through emission factors;
- Validation procedure for area and line activities data collection and storage (check on data entry errors, check on double counting of activities, etc.)
- Validation procedure for appropriate use of emission factors for area and line sources
- Internal validation on emission inventory results

In this field a complete tests program has been elaborated in the frame of ISO 9001:2000 quality normative through a check list containing procedure for:

- Computerized check to compare estimates with other similar territorial units,
- Computerized check to compare estimates between activities,
- Independent review of calculations, assumptions, and/or documentation by other experts
- External validation on emission inventory results

**Thursday, May 18, 2006**

**Session 13. Emission Inventory Validation And Quality Assurance**      Chairs:      Marc Houyoux, U.S. EPA  
Mark Janssen, LADCO

- As we operate as consultants of local or regional boards an external independent audit from administration functionary often follows
- Air quality models application
- Finally often emission inventories are used as input on air quality models (diffusion and statistical models) and comparison of models results with monitoring data is useful to individuate possible errors in inventory data.

Finally the paper reports the use of APEX (Air Pollutants Computer System) to support the QA/QC procedures. APEX system was originally developed, ten years ago, in the Windows environment; recently the new 4.1 release introduces tools for evaluating uncertainty in emission inventories. Work is in progress to develop a new version of the system, *APEX.com*, in web environment as a part of a more general project to develop a complete tool to manage air quality (*AirSuite.com*). More than fifteen local public administrations (regions, provinces, municipalities, local Environmental Protection Agency offices) use today the software.

**Session 14. Emission Factors**      Chairs:      John Bosch, U.S. EPA  
Arthur Werner,  
MACTEC Federal Programs

1:30 pm      "Emissions Factor Program Re-Engineering Update," M. Ciolek, R. Myers, B. Parker, U.S. EPA.

The Emissions Factors Policy Applications Group (EFPAG) in the Emission, Monitoring, and Analysis Division (EMAD) of the Office of Air Quality Planning and Standards (OAQPS), was formed in 2003 to revamp the U. S. Environmental Protection Agency's (EPA's) emissions factors program. Program changes are necessary to meet stakeholder concerns over not enough emissions factors, over the emissions factor development process taking too long, and over the potential inaccuracy of using emissions factors. This paper describes what EFPAG determined to do to address these stakeholder concerns and provides an update on EFPAG's activities.

EFPAG enacted a three-part strategy to address stakeholder concerns. That strategy includes developing an electronic reporting tool (ERT), determining whether and what adjustments apply to emissions factors for non-emissions inventory use, and creating an interactive internet-based website for emissions factors. The ERT establishes a standardized format for supplying emissions test data. Through the use of such a format, data can be assessed for quality assurance and can be readily shared after initial input. Should OAQPS managers decide that emissions factors be adjusted according to their use to account for uncertainty, statistical work underway will provide a basis for reducing that uncertainty. Finally, an interactive internet website that collects, screens, and adapts never-before-captured emissions data with existing data for a specific program at a particular site will ensure stakeholder concerns are met.

2:00 pm      "Exploration of Emissions Factor Adjustments for Using Emissions Factors in Non-Inventory Applications,"

R. Neulicht, B. Munoz, and K. Schaffner, RTI International; B. Parker, U.S. EPA.

The U.S. Environmental Protection Agency (EPA) and its predecessors have used emissions factors since 1968 to quantify emissions from point and area sources. Because of program priorities and goals, the emissions factor program primarily supported the development of the national trends emissions inventory and other inventories used for state and regional implementation plans. Over the last 10 years, however, the number of programs that use emissions factors has increased beyond the intended and supported national emissions inventory program use. In 2003, EPA began a complete reevaluation of the emissions factor program. Part of this reevaluation includes identifying ways to make the program more responsive to the broad and diverse range of emissions factors users. This paper presents the results of a study funded by and conducted for the U. S. EPA to evaluate and develop adjustments for using emissions factors in non-inventory applications. The adjustments will enable users to apply the AP-42 emissions factors, which are based on mean values, in applications where other values (e.g., maximum or minimum values) would be more appropriate. For example, in estimating emissions data inputs for risk assessment analysis or for determining the applicability of a rule to a single source, an upper boundary emissions factor might be more appropriate than an average emissions factor to calculate the emissions from a single source. During the study, the data sets for 44 A-rated and B-rated AP-42 emissions factors from four industries were analyzed. Emissions factors evaluated included particulate matter (PM); sulfur dioxide (SO<sub>2</sub>); oxides of nitrogen (NO<sub>x</sub>); carbon monoxide (CO); and HAPs, including acetaldehyde, arsenic, benzene, cadmium, chromium, formaldehyde, hydrogen chloride, lead, mercury, and nickel. Examination of the data for each of the emissions factor data sets indicates that the data are either log-normal or weibull distributed. A statistical analyses based on Monte Carlo technique was conducted on each of the emissions factor data sets to simulate the hypothetical population density of the emissions factor for the specific pollutant. Using the hypothetical population, default emissions factor adjustments were developed. The emissions factors analyzed, statistical procedures used, and the default emissions factor adjustments developed are presented and discussed.

**Thursday, May 18, 2006**

**Session 14. Emission Factors**

Chairs: John Bosch, U.S. EPA  
Arthur Werner,  
MACTEC Federal Programs

2:30 pm "Alternative Technologies for Evaluating Paved-Road Dust Emission Potential - Mobile Sampling Methodology as an Alternative to Traditional AP-42 Silt Measurements," R. Langston and R. S. Merle, Jr., Clark County Department of Air Quality and Environmental Management; D. James, University of Nevada; H. Kuhns and V. Etyemezian, Desert Research Institute; D. Fitz and K. Bumiller, University of California, Riverside.

Clark County Department of Air Quality and Environmental Management (DAQEM) is investigating alternative methods to estimate paved road dust (PM<sub>10</sub>) emissions. DAQEM, in 2004, began a comprehensive research program to demonstrate that vehicle-based mobile systems can be used as an alternative to traditional paved road silt sampling (AP-42). To gain U.S. Environmental Protection Agency (EPA) acceptance of the data collected, DAQEM has completed three phases of this study. Vehicle-based mobile technologies allow for measurements of actual PM<sub>10</sub> emissions over a complete range of paved roadway classifications (local, collectors, arterials, and highways) and can sample hundreds of lane miles within a few days.

The ability to measure PM<sub>10</sub> emissions from paved roads on a Valley-wide basis in a matter of days provides a realistic assessment of paved road emissions for emission inventory purposes and assessment of control measure effectiveness. Unlike traditional paved road silt sampling, which is labor intensive and time consuming, vehicle-based mobile systems provide a cost effective, scientifically defensible method to compile data to improve emission inventories.

The College of Engineering, Center for Environmental Research and Technology (CE-CERT), University of California, Riverside and Nevada's Desert Research Institute (DRI) have developed vehicle-based mobile technologies for sampling PM<sub>10</sub> emissions of re-entrained paved road dust.

3:00 pm **BREAK**

3:30 pm "Proposed Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors," C. Cowherd, J. Donaldson and R. Hegarty, Midwest Research Institute; D. Ono, Great Basin UAPCD.

The Dust Emissions Joint Forum (DEJF) of the Western Regional Air Partnership (WRAP) is engaged in gathering and improving data pertaining to the PM<sub>2.5</sub> and PM<sub>10</sub> components of fugitive dust emissions. Most of the PM<sub>2.5</sub> emission factors in EPA's AP-42 guidance for fugitive dust sources were determined by using high-volume samplers, each fitted with a cyclone precollector and cascade impactor. Beginning with the introduction of the cyclone/impactor method, it was realized particle bounce from the cascade impactor stages to the backup filter may have resulted in inflated PM<sub>2.5</sub> concentrations, even though steps were taken to minimize particle bounce.

This led DEJF to fund Midwest Research Institute (MRI) in conducting a controlled study of particle sizing in dust plumes. The objective of the study was to resolve the fine particle bias in the cyclone/impactor system, so that reliable PM<sub>2.5</sub>/PM<sub>10</sub> ratios could be developed for as many dust source categories as possible. For this purpose, an air exposure chamber connected to a recirculating supply air stream was used in conjunction with a fluidization system for generating dust plumes from a variety of western soils and road surface materials. R&P Model 2000 Partisol samplers were selected as the ground-truthing FRM samplers for PM<sub>10</sub> and PM<sub>2.5</sub>. The test results showed that PM<sub>2.5</sub> concentrations measured by the high-volume cyclone/impactor system used to develop AP-42 emission factors for fugitive dust sources have a positive bias by a factor of 2, as compared to the PM<sub>2.5</sub> concentration measurements from reference-method samplers. (The geometric mean bias is 2.01 and the arithmetic mean bias is 2.15.)

Based on the results of the WRAP/DEJF study and the prior EPA-funded field study, it is proposed that new PM<sub>2.5</sub>/PM<sub>10</sub> ratios be adopted for several categories of (uncontrolled) fugitive dust sources, as addressed in AP-42. This paper presents a listing of specific revisions to AP-42, for the purpose of incorporating the proposed PM<sub>2.5</sub>/PM<sub>10</sub> ratios. Five subsections of AP-42 Section 13.2, Fugitive Dust, are impacted by the proposed changes. Typically, AP-42 recommends that PM<sub>2.5</sub> emission factors for dust sources be calculated by using PM<sub>10</sub> emission factor equations along with specified PM<sub>2.5</sub>/PM<sub>10</sub> ratios. In most cases, the change in the PM<sub>2.5</sub>/PM<sub>10</sub> ratio is accomplished by changing the appropriate PM-2.5 particle size multiplier (k-factor) for the respective emission factor equation.

**Thursday, May 18, 2006**

**Session 14. Emission Factors**

Chairs: John Bosch, U.S. EPA  
Arthur Werner,  
MACTEC Federal Programs

4:00 pm "USAEC's Emission Factors from Munitions Use," B. E. Conway, U.S. Army Environmental Center; J. C. Bach  
Military Environmental Technology Demonstration Center.

The U.S. Army needs to characterize and quantify the emissions generated by the firing of weapons, detonation of explosives, and use of smoke and pyrotechnic devices. These emissions need to be characterized in terms of emission factors that definitively state the emission of specific products as a fraction of the total mass of a particular ordnance item. The US Army Environmental Center (USAEC) has embarked on a program to characterize the emissions generated by the functioning of U.S. Army ordnance. The program tactically fires munitions as they are used in training and analyzes the constituents. The sampling includes analysis for over 280 constituents.

The U.S. Environmental Protection Agency (EPA) has accepted the U.S. Army Environmental Center's (USAEC) emission factor data for munition items for publication in the EPA's Compilation of Air Pollutant Emission Factors, better known as AP-42. For the last several years, the U.S. Army has worked with the EPA to develop test programs producing scientifically defensible emission factor data for Firing Point (FP), Exploding Ordnance (EO), and Smoke/Pyrotechnics (SP) munition items used on Army training ranges. The EPA's acceptance of this data will add greater credibility of the U.S. Army Environmental Center's already scientifically defensible emission data.

Currently over 180 ordnance items have been tested by under this program. The results of this testing are being used in modeling efforts, health risk assessments and recently, 57 items are available in the U.S. Environmental Protection Agency's AP-42.

4:30 pm "DIAL Measurement of Fugitive Emissions from Natural Gas Plants and the Comparison with Emission Factor Estimates," A. Chambers and M. Stroscher, Alberta Research Council, Inc., Canada; T. Wootton, J. Moncrieff and P. McCready, Spectrasyne Ltd., UK.

Natural gas processing is a major industry in Alberta, Canada, and a significant source of fugitive emissions of both methane and volatile organic hydrocarbons (VOCs). This project investigated fugitive emissions at natural gas processing plants in Alberta using two complementary optical measurement methods. At five gas plants, the fugitive emissions of methane and volatile organic hydrocarbons were measured and quantified using Differential Absorption Lidar (DIAL). At two of the plants a gas leak imaging camera was also used to locate individual hydrocarbon leaks.

DIAL is a remote optical method that can measure hydrocarbon concentrations in the atmosphere at distances up to several hundred meters from the instrument. When combined with wind speed and direction, the DIAL concentrations measurements can be used to determine total emissions of hydrocarbons from an industrial site as well as proportioning the emissions to various parts of the plant.

For the five gas plants surveyed in Alberta with the DIAL method, measured methane fugitive losses ranged from 100 to 146 kg/hr and VOC losses ranged from 38 to 342 kg/hr. At one of the gas plants, over \$1 million of hydrocarbon product was lost per year due to equipment leaks. Compressors and condensate storage tanks were two significant emission sources at all of the gas plants. Process flares operating on pilot were typically responsible for 10 to 15% of the total methane emissions.

The DIAL measured emissions of methane, VOCs and benzene were compared with the values calculated with emission factor methods. Measured emissions of methane and VOCs were four to eight times higher than the emission factor estimates. The largest differences between measured values and estimates were for the flares and storage tanks.

DIAL was an effective method to quantify fugitive losses of hydrocarbons from the gas processing plants. The DIAL measured values gave a more realistic evaluation of revenue lost as fugitives than the industry accepted estimation methods, leading to an increased incentive to improve leak detection and repair.