16th Annual International Emission Inventory Conference

Emission Inventories: "Integration, Analysis, and Communications"

Courses May 14, 2007
Conference May 15 - 17, 2007
Raleigh, NC – Sheraton Hotel

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 US Environmental Protection Agency (EPA) invites you to the 16th Annual Emission Inventory Conference "Emission Inventories: Integration, Analysis, and Communications," to be held May 15 – 17, 2007 at the Sheraton Hotel in Raleigh, NC. The conference is being organized by EPA's Emission Inventory and Analysis Group of the Office of Air Quality Planning and Standards (OAQPS).

This year the conference theme emphasizes new ideas for integrating emission inventory data across pollutants and source categories, analyzing emission inventory data to provide new insights and directions to air quality management, and communicating emissions inventory information in a clear and understandable manner to a broad range of stakeholders.

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).

This year, we will be following the format of the early years of the conference by starting the plenary session on Tuesday morning. We are very pleased to have three speakers who will address different aspects our conference theme regarding the integration, analysis and communication of emissions inventory data.

Steve Page, Director of the Office of Air Quality Planning and Standards, will start with a discussion of the Agency's efforts to reinvent emission inventories at EPA. Steve will discuss the importance of integrating emission inventories from the federal perspective and emphasize the need to leverage resources of our state and local agency partners. Nancie Imler, Chief Information Officer for the Pennsylvania Department of Environmental Protection will discuss advances in data sharing using the Environmental Data Exchange Network from a State perspective. Sharing data will be increasingly important as regional approaches to analyzing environmental issues become the norm rather than the exception. William Ross, Secretary of the NC Department of Environment and Natural Resources will complete the morning session by discussing his experiences on successfully using emissions and other air quality data in developing air quality policies and programs for NC.

On Tuesday evening, we will have a Poster Session and Exhibitor Reception from 6:00 – 8:00 pm with light refreshments. 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. We have a very interesting lineup of poster presentations and the authors will be available to explain their work and answer your questions. As we did last year, we intend to mix fun with work by offering attendees the opportunity to vote for the posters of their choice and award prizes to the winners so please stop by and participate.

The heart of the conference unfolds during the technical sessions that follow on Tuesday afternoon, Wednesday and Thursday morning. We have retained many technical sessions from earlier years that are the mainstay of the conference but have added a few new ones in response to changing program needs.

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.

It has been several years since we had the conference in the RTP, area and we are very pleased to be the host this year. Raleigh is well along in revitalizing its downtown and offers a variety of attractions that should help make your stay memorable. I look forward to seeing you at the conference.

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

Schedule at a Glance

Time	Session
Mon. May 14	
8:30 - 5:00	- Training Courses
Tue. May 15	
8:30-10:10 10:45-11:55	- Keynote Speakers - Steve Page, Director OAQPS, US EPA **Break** - Nancie L. Imler, Chief Information Officer, PA Department of Environmental Protection - William G. Ross, Jr., NC Department of Environment and Natural Resources
	Lunch (On Your Own)
1:30-3:10	- Session 1 - Emissions Modeling
	- Session 2 - Web-based Tools and Information Systems
	- Session 3 - Greenhouse Gases
3:10-3:40	**Break**
3:40-4:55	- Session 1 - Continues
	- Session 2 - Continues
	- Session 3 - Continues
6:00 – 8:00	- Poster Session and Exhibitors' Reception
Wed. May 16	
8:30-10:10	- Session 4 - Mobile Sources
	- Session 5 - Emission Factors
	- Session 6 - Air Toxics
10:10-10:45	**Break**
10:45-11:55	- Session 4 - Continues
	- Session 5 - Continues
	- Session 6 - Continues
	Lunch (On Your Own)
1:30-3:10	- Session 7 - Emissions Projections
	- Session 8 - Global/International Issues
	- Session 9 - GIS Assisted EI Development
3:10-3:40	**Break**
3:40-4:55	- Session 7 - Continues
	- Session 8 - Continues
	- Session 10 - Managed Burning & Wildfires
Thurs. May 17	
8:30 – 9:45	- Session 7 - Continues
	- Session 10 - Continues
	- Session 11 - Fugitive Dust
9:45-10:15	**Break**
10:15-12:20	- Session 10 - Continues
	- Session 12 - Stationary Sources
	- Session 13 - EI Validation and QA

Monday May 14, 2007

Training Schedule 8:30 – 5:00 pm

Introduction to Emission Inventories

Instructor: Anne Pope, US EPA
Monday, May 14 – All Day

This course will provide a broad overview of the emission inventory process. Participants will learn about each of the critical steps in designing and implementing the development of an emission inventory. The course will cover the following topics:

- Planning an emission inventory
- Developing an emission inventory work plan
- Estimating emissions
- Documenting an emission inventory
- Emission inventory quality assurance
- Emission inventory reporting
- Emission inventory maintenance

Quantifying Greenhouse Gas Emissions

Instructor: Andrea Denny, US EPA
Monday, May 14 – All Day

This course will provide hands-on training on several greenhouse gas quantification tools for state/local governments. Participants will learn which tools are appropriate for different situations, including: setting baselines, projecting future emissions, calculating project-based emissions reductions, quantifying state-wide emissions, quantifying emissions from government operations, estimating emissions from direct and indirect sources, working with schools, and communicating results. The tools discussed range from simple calculators designed to provide rough estimates to complex systems requiring extensive data to yield accurate results. Tools covered by this training will include: The State Greenhouse Gas Inventory and Projection Tool, The Clean Air Climate Protection Software (CACPS), Emissions and Generation Resource Integrated Database (e-Grid), Climate Change Emissions Calculator Kit (Climate CHECK), and the GHG Equivalency Calculator.

Introduction to the Emissions Modeling Framework

Instructor – Marc Houyoux, US EPA
Monday, May 14 – Morning

This course introduces participants to the main parts of the Emissions Modeling Framework (EMF) that are needed for running SMOKE, including a system overview that describes all functions of the EMF. Hands-on training will be provided that covers:

- Data Management for loading, viewing, documenting and revising SMOKE input data
- Quality Assurance for checking SMOKE inputs before they are used in SMOKE
- Case Management for setting up and running SMOKE jobs

Emissions Modeling Framework: The Control Strategy Tool (CoST) and Other Advanced Features

Instructor – Marc Houyoux, US EPA
Monday, May 14 – Afternoon

This course expands on "Introduction to the Emissions Modeling Framework", which is a prerequisite for this course. In this course, attendees will learn about using the Control Strategy Tool module of the Emissions Modeling Framework (EMF) to develop control strategies and convert these for input to SMOKE. Users will also learn about more advanced features of the EMF, such as defining Dataset Types and Sectors.

National Mobile Inventory Model (NMIM)

Instructor: Harvey Michaels, US EPA
Monday, May 14 – Morning

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. In addition to the basics, we plan to cover NMIM's diesel retrofit and fleet modeling capability. As time allows and participant interest indicates, we will also cover other topics, such as modifying the NMIM County Database using simple MySQL commands. 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 256 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. Please download and install the latest version of NMIM and the county database from http://www.epa.gov/otaq/nmim.htm.

Introduction to EPA's Motor Vehicle Emission Simulator (MOVES)

Instructor: David Brezinski, US EPA
Monday, May 14 – Afternoon

EPA's MOVES is an emissions modeling system that will eventually replace MOBILE6 and NONROAD as EPA's tool for estimating air pollution emissions from mobile sources. A draft model for estimating greenhouse gases and energy consumption from highway vehicles is available at this writing, and a demonstration version for criteria pollutants will be available prior to the class. Participants will learn how to use the highway vehicle demonstration version of MOVES on a Windows PC, including how to create a Run Specification, how to run the model, and how to work with model output. 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 256 Mb of RAM, and a minimum of five free gigabytes of hard drive space. Participants must have the demonstration version of MOVES pre-installed and running on their machines prior to the course. This version of the model will be available at http://www.epa.gov/otaq/ngm.htm.

Tuesday May 15, 2007

PLENARY SESSION

Steve Page, Director, Office of Air Quality Planning and Standards, US EPA

Steve Page is the director of the Office of Air Quality Planning and Standards (OAQPS) at the US Environmental Protection Agency, which is responsible for implementing the majority of the requirements of the Clean Air Act, including urban and rural air quality management, hazardous air pollution reduction programs, permitting programs and voluntary programs.

Prior to becoming Director, The Office of Air Quality Planning & Standards in 2002, Mr. Page was the director of EPA's Office of Radiation and Indoor Air. He also has served as Chief of Staff and Director of Communications for EPA's Air and Radiation Office serving under two assistant administrators. From 1986 to 1992, he held a variety of senior management positions in the Office of Radiation and Indoor Air, including Radon Division Director. As one of the principal architects of EPA's Radon Program, Mr. Page won an Emmy Award. He also received the prestigious Crain Award from the Advertising Council for the year's best public service advertising of the year.

Mr. Page has a Masters Degree in Public Administration from the University of Southern California and a Bachelors Degree from Marietta College. He has authored numerous articles on public health and environmental protection. Steve served on the Robert Woods Johnson Foundation National Advisory Board for the Allies Against Asthma project.

Nancie L. Imler, Chief Information Officer, Pennsylvania Department of Environmental Protection

Nancie L. Imler was named Chief Information Officer for the Pennsylvania Department of Environmental Protection in June 2003. Prior to that appointment she was Director of the Department's Bureau of Program Integration and Effectiveness.

Ms. Imler also served the Federal Government from 1980 to 1997 as an information technology system designer for the US Trident submarine program for the Navy Fleet Material Support Office.

Prior to her government service, Ms. Imler was a business education teacher at Elizabethtown High School in the 70s after graduating from Shippensburg University with a Bachelor of Science Degree in Business Education and a Master's Degree in Office Administration.

William G. Ross Jr., Secretary, NC Department of Environment and Natural Resources

William G. Ross Jr. is an attorney specializing in environmental law, and has broad civic and professional experience in a variety of land conservation and environmental protection efforts. Gov. Mike Easley appointed Mr. Ross as secretary of the N.C. Department of Environment and Natural Resources (DENR) on January 15, 2001.

From 1986 until his appointment as head of the state's lead environmental stewardship agency, Mr. Ross was a partner with the Greensboro and Raleigh law firm of Brooks, Pierce, McLendon, Humphrey & Leonard. From 1979 to 1984, Mr. Ross served as Director of the Office of Legal Affairs of the Department of Natural Resources and Community Development, which was later reorganized to become DENR.

Mr. Ross has been a member and leader of many committees and organizations including The Nature Conservancy, the Guilford County Parks and Recreation Committee, the Piedmont Land Conservancy, the Raleigh Greenway Commission, the NC Environmental Education Fund and N.C. Environmental Defense. Mr. Ross received a bachelor's degree in history from Davidson College in 1969 and his law degree from the University of Virginia in 1972.

Tuesday, May 15, 2007

Session 1. Emissions Modeling

Chairs: Marc Houyoux, US EPA
Mike Abraczinskas, NC DENR

1:30 "Emissions Modeling Framework: Status Update and EPA's Applications," M. Houyoux and M. Strum, US EPA; R. Mason, NOAA; A. Eyth, CEP.

EPA's Office of Air Quality Planning and Standards (OAQPS) have built an Emissions Modeling Framework (EMF) that supports preparation of criteria and toxics emissions data for use in air quality modeling. Emissions modelers in OAQPS are using the EMF to manage the many complex tasks associated with preparing air quality model emissions input data using the Sparse Matrix Operator Kernel Emissions (SMOKE) model. The EMF helps with the many steps of emissions data processing, include organizing and sharing input data for SMOKE, quality assurance of SMOKE input and output data, setting up SMOKE runs, and running SMOKE. This paper provides an update on development and availability of the EMF. The paper also describes the experiences and benefits of using the EMF to support OAQPS's 2002 air quality modeling applications.

1:55 "A New Tool for Integrated Emissions and Controls Strategies Analysis," D. Misenheimer, D. Weatherhead, M. Houyoux and L. Sorrels, U.S. EPA; A. Eyth, Q. He, and R. Partheepan, CEP.

EPA has been developing the Emissions Modeling Framework (EMF) to solve the many long-standing difficulties of complex emissions modeling. As part of the EMF, new software that provides a more integrated approach for the generation of controlled inventories is being created. The Control Strategy Tool (COST) will be part of the EMF, and will allow users to generate emission inventories with additional controls applied on top of a future-year base inventory. COST tracks information about control measures, their costs, and to which types of emissions sources they apply. It can also compute control strategies that match control measures to emission sources using algorithms such as "maximum emissions reduction" and "least cost". The result of a control strategy contains information that specifies the estimated cost and emissions reduction achieved for each control measure-source combination. The control strategy result can be exported to a CSV file as a table; viewed in a graphical table that supports sorting, filtering, and plotting; or it can exported to an emissions inventory file that can be input to SMOKE. By providing this new tool integrated within the EMF, it facilitates a level of collaboration between control strategy developers and emission inventory modeling that was not previously possible.

2:20 "Integrated Assessment Modeling in Spain," R. Borge, J. Lumbreras, and E. Rodriguez, Technical University of Madrid.

This paper shows the current state of the integrated modeling system being implemented in Spain. The system developed by the Technical University of Madrid (UPM) basically includes two major components; the emission projection system and the air quality modeling system. Emission information is one of the main sources of uncertainty in air quality modeling. This issue is also relevant to the analysis of the possible alternatives to improve air quality in a given region in future years as a result of the implementation of control strategies. Emission processing and generation of input files for the eulerian chemical-transport model is based on the Sparse Matrix Operator Kernel Emissions (SMOKE) modeling system. The adaptation of this software tool to Spain is briefly discussed and some examples are provided through a case study in the Iberian Peninsula. In addition, the utility and capabilities of the modeling framework are illustrated by showing some results regarding future-year ozone simulations in Spain.

2:45 "Development of an Interface for the Emissions and Dispersion Modeling System (EDMS) with the SMOKE Modeling System," B. H. Baek, S. Arunachalam and A. Hanna, Institute for the Environment, UNC at Chapel Hill; T. Thrasher, CSSI, Inc; R. Iovinelli and M. Gupta; Federal Aviation Administration.

The Federal Aviation Administration (FAA) Emissions and Dispersion Modeling System (EDMS) has been developed to assess the air quality impacts of aviation emissions sources, particularly airport sources, which consist of aircraft, auxiliary power units (APUs), ground support equipment (GSE), ground access vehicles, and stationary sources. EDMS utilizes EPA's NONROAD model for GSE emission factors, and EPA's MOBILE version 6.2 for on-road vehicle emission factors, and interfaces with the American Meteorological Society/EPA Regulatory Model (AERMOD) Version 04300 for air quality assessment. Research version of EDMS model will support hourly estimation of emissions inventory data for criteria air pollutants (CAPs) (e.g., volatile organic compounds (VOC), CO, NOx, SOx, particulate matter of size less than 2.5 microns ($PM_{2.5}$),) as well as hazardous air pollutants (HAPs) or "air toxics", from the ground level up to 10,000 feet.

Currently, airport/aircraft emissions are estimated at the county level as area sources, and represented only in the surface layer of air quality models. To provide realistic representations of all emissions from airport/aircraft sources, we developed an interface, called EDMS2Inv in the SMOKE modeling system to process AERMOD ready emissions inventory from EDMS to create emissions inputs to CMAQ. This new interface will allow enhanced representation of hourly emission inputs from the aviation sector in air quality models specifically in layers aloft to represent emissions from flights during takeoff and landing, and will help in designing new sensitivity/strategy scenarios to assess the impacts of airport-level emissions on local-to-regional air quality. We will present case studies of using the new interface with EDMS outputs for modeling commercial aircraft operations from three US airports.

3:10 **Break**

3:40 "A Revised Framework for Treating Primary Organic Aerosol Emissions in Inventories and Models," A. L. Robinson, A. P. Grieshop, M. K. Shrivastava, N. M. Donahue, T. E. Lane, and S. N. Pandis; Carnegie Mellon University.

This paper discusses a revised framework for treating primary organic aerosol emissions in inventories and models. Instead of using static aerosol emission factors, we represent the organic aerosol emissions using a volatility distribution. Conceptually, this distribution can be derived from speciated emissions data by lumping species with similar saturation vapor pressures. However, this is not possible in practice because less than 10% of the condensed and semivolatile mass has been speciated. We determine volatility distributions by fitting isothermal dilution data with absorptive partitioning theory, similar to well-established analyses of secondary organic aerosol. Representing emissions with a volatility distribution allows explicit treatment of both gas-particle partitioning and photochemical aging of primary emissions. We have implemented this approach using the chemical transport model PMCAMx, and present results from simulations conducted over the Eastern United States. The results show a dramatically altered picture of ambient organic aerosol.

4:05 "Preparation of the First National Emissions Inventory for Modeling at a National Level in Mexico," R. Iniestra, T. Lopez, D. Parra and V. Garibay-Bravo, Instituto Nacional de Ecología, México; Z. Adelman, UNC Chapel Hill.

The first Mexico's National Emissions Inventory (MNEI), was developed for base year 1999 and includes emission estimates for seven pollutants (VOC, CO, NOx, SO2, PM10, $PM_{2.5}$, and NH3) for point, area, on-road mobile, nonroad and natural sources. These emission estimates are available for each one of the 2,443 municipalities of Mexico.

The MNEI represents a significant effort of diverse public and private entities in México, U.S. and Canada. The data and report of the first national emissions inventory for México were published in September, 2006 and are now available for use in air quality modeling.

This paper focuses on the progress to date in the development of the first MNEI for air quality modeling at a national level with the Comprehensive Air Quality Model with Extensions (CAMx) modeling system. The information of point, area, on-road mobile, nonroad and natural sources are temporally and spatially allocated with the Sparse Matrix Operator Kernel Emissions (SMOKE) modeling system for a modeling domain over the whole country with a grid cell resolution of 24 km. This paper emphasizes the main considerations, assumptions and limitations to develop the spatial emission allocation.

This work represents the first attempt to develop an emission inventory for modeling at national level in Mexico and its objective is to promote the use of the NEI for modeling at INE and in other institutions. Hence, there are several areas of opportunity to enhance the results, basically by improving the assumptions used in this work.

4:30 “The 2002 National Emissions Inventory Shakeout: The First Step in Development of EPA's 2002 Emissions and Air Quality Modeling Platform,” R. Mason, NOAA; M. Strum, M. Houyoux, and N. Possiel, US EPA; A. Beidler, Computer Sciences Corporation.

The Environmental Protection Agency (EPA)’s Office of Air Quality Planning and Standards (OAQPS) has performed a “shakeout” of version 1 of the 2002 National Emissions Inventory (NEI) as a first step in using the 2002 NEI for the 2002 Emissions and Air Quality Modeling Platform. The shakeout consisted of two major steps: (1) comparison of the emissions with those used from the latest version of the 2001 platform, and (2) air quality modeling for the purpose of comparing emissions-induced air quality changes from an existing year 2001 platform. The 2001 platform was used for many regulatory analyses, the most recent being the Final PM NAAQS standard. The Sparse Matrix Operator Kernel Emissions (SMOKE) processor was used to process the emissions for subsequent CMAQ 36km air quality modeling. We substituted a particular significant emissions inventory sector with emissions from Version 1 of the 2002 NEI and compared CMAQ results as a first step towards migrating to the 2002 NEI. Meteorology, CMAQ model version, and chemical mechanism were retained from the 2001 platform. The SMOKE input ancillary files were modified primarily to update cross references as was necessary to process emissions from new emissions source category codes. Each 2002 sector was processed separately through SMOKE and CMAQ creating a distinct “shakeout” run that was used to estimate the air quality changes resulting strictly from changes in the emissions for a particular sector.

This paper will discuss the methods the OAQPS emissions modeling team used to prepare the 2002 NEI for a 2002 platform, the quality assurance routines used throughout the emissions and air quality modeling process, and the CMAQ results for some inventory sector shakeouts and how those results were used to inform the NEI developers, ultimately leading to a more robust (Version 2) of the 2002 NEI.

Session 2. Web-based Tools and Information Systems

Chairs: Mark Van Soestbergen, ICBE
Jesse The’, Lakes IT Gp

1:30 “Integrating at the Place: What Role Will Emissions Play in Seeing the Big Picture?” P. Garvey, U.S. EPA.

The United States Environmental Protection Agency has talked about cross-media integration for years, if not decades. Attempts to gain traction among heavily centric media office in air, water, waste and toxics has been challenging. The proliferation and free use of web based tools, especially geographic information system mapping applications, have given the concepts of “integration” and “cross-media analysis” new life. Data collections, like the emissions inventory, and other release/discharge data sets have taken advantage of many of these web applications.

Google Earth ™ and Microsoft Visual Earth ™, to name a few, are powerful new mapping applications that are no longer just in the domain and use of power GIS experts. These web mapping applications are available at the desktop, free for the most part, allowing millions of new users easy access to vast amounts of environmental data. The easy access and robust geospatial tools could accelerate the use and analysis of emissions and other environmental data. EPA Programs are working together offering geospatial data to mapping application vendors, companies and interested parties. This data should be available to 100's of million desktops if these environmental channels take off as expected.

EPA's strategy offers a free downloadable data file to populate mapping applications with locational data on places of environmental regulation or of environmental interest. Air emissions data will be highly sought after and used in this new web service. EPA will include a "Profile Page" in the data download file which offers a central URL (Uniform Resource Locator) to offer further detailed environmental data on specific "facilities" and places of interest.

No longer will EPA be hearing: "Where is the data?", but the new question will be: "Do you see what this data shows happening in our communities?" This kind of question, asked by concerned citizens and local organizations interested in environmental issues will quickly change the political environmental landscape.

The paper "Integrating at the Place: What Role Will Emissions Data Play in Seeing the Big Picture?" will focus on the expanding role of geospatial mapping applications and the new ready access to locational data of emitters.

1:55 "The Air Emissions Inventory (AEI) Pilot: An update on a Universal Schema," S. Rasmussen, US Air Force; P. Garvey and S. Dombrowski, US EPA.

The Air Force's electronic emissions management system (APIMS) has saved them money in all areas except one, distribution of air emissions to state and local agencies. These agencies requiring the data want similar information but in various formats. A single file format, with agreed upon data elements, and could save the Air Force millions of dollars per year.

This paper will give an update on a project originally started as the "Air Force Project" and presented in the Poster Session last year. The universal schema has now been developed with the help of our pilot partners, Nebraska, NC, Texas, Utah and Washington. Discussion about the development of this schema and early testing will be covered as well as the future impact of a universal schema on industry.

2:20 "The Emissions Inventory Maintenance Application," J. E. Brandmeyer, A. Parks, S. Rao, and R. Zerbonia, RTI International.

The Air Quality Management Decision Support System (AQMDSS) is a comprehensive set of software tools that includes the complete data path from emission inventory development through emissions processing, air quality modeling, and data analysis. The AQMDSS uses the Multimedia Integrated Modeling System (MIMS) as the user interface for setting up and executing the Sparse Matrix Operator Kernel Emissions (SMOKE) processing system, the AMS/EPA Regulatory Model (AERMOD) and its AERMAP and AERMET preprocessors, the Models-3 Community Multiscal Air Quality (CMAQ), and other data preparation and analysis tools.

This paper is an update to one that was presented at the 14th Annual Emission Inventory Conference in Las Vegas, NV in 2005. At that time the design phase was complete and implementation had begun. The AQMDSS is now installed at the Beijing Municipal Environmental Protection Bureau (BMEPB) in Beijing, China.

First, this paper focuses on the Emissions Inventory Maintenance Application (EIMA) of the AQMDSS. Key features include:

- Relational database based on the National Emissions Inventory (NEI) Input Format (NIF) version 3 extended for multiple countries
- Menu-driven, multi-lingual user interface that supports data integrity
- Security that restricts user access to data files relevant for each type of user
- Data table access via Structured Query Language (SQL) to PostgreSQL, which strongly conforms to the ANSI-SQL 92/99 standards
- Open source in Java and may be implemented in Linux or Windows

Next, this paper describes how the EIMA was implemented at the BMEPB. We will report our experience with performing bulk data loads into the NIF 3.0 data format using SQL.

2:45 "An Integrated Emissions Calculation and Data Management Tool for Nonroad Mobile Sources in Texas," R. Baker and D. Preusse, Eastern Research Group, Inc.

An integrated emissions calculation and data management tool was developed for estimating emissions from nonroad mobile sources in Texas. EPA's NONROAD2005 emission factor model, Graphical User Interface (GUI) and Reporting Utility provide an effective means of generating emission estimates for these sources using default data. However, this system can become cumbersome for users attempting to estimate emission for multiple scenarios using combinations of default and site-specific equipment population and activity data. The new system described herein utilizes an enhanced GUI written in VB.NET, a modified version of NONROAD's Access-based reporting utility, and a MySQL database back end to provide greatly enhanced emissions modeling and reporting capabilities for nonroad sources. Data can be easily updated/revised to reflect local equipment populations, activity, growth, and temporal profiles at the Source Classification Code (SCC) and county-level, for multiple target years. Combinations of default and updated data are run through the NONROAD model in batch mode as a single scenario, rather than by performing individual runs for each equipment category featuring custom data. The system is designed to provide great precision estimating construction equipment emissions, allowing for characterization of up to 24 construction subsectors (e.g., highway, utility, residential, etc.) Equipment related data for NONROAD defaults as well as user-defined scenarios are maintained in a MySQL database. MySQL queries automatically generate NONROAD input files, which are then launched in batch mode, and associated output files are imported back into the database for further processing. Detailed adjustment factors are applied during post-processing to improve the accuracy of local emission estimates, including county-level engine activity adjustments for altitude, soil and ground cover conditions (for earthwork equipment), fuel parameters, as well as temperature and humidity corrections for exhaust NOx emissions. In addition, separate ammonia emission factors have been identified and incorporated for different fuel/technology type combinations. Due to the current uncertainty of ammonia emissions rates, the system is designed for users to easily change these factors. NONROAD's existing Access Reporting Utility was modified to output all emissions including ammonia in NIF3.0 format. Additional functionality was also added to allow reporting at the SCC/hp level of detail for multiple counties, or aggregates for county groups. The entire system can operate on a stand-alone PC or on a local server, and can be modified fairly easily for use in other states through updates of the MySQL data tables and fields.

3:10 **Break**

3:40 "A New Database Program for Creating Area Source Inventories," M. Noon, Ohio State University and T.Velalis, Ohio EPA.

The process of creating air pollution emission inventories can be both time consuming and expensive, imposing a trade-off between the quality and the quantity of an inventory. Preparers usually spend inordinate amounts of time managing rather then checking the accuracy of inventories that can easily exceed several tens of thousands of records. The Ohio Environmental Protection Agency (Ohio EPA) has developed a Microsoft Access Database program, called the Area Source Calculator, to help facilitate the creation of extensive and quality inventories.

The Area Source Calculator has three major functions; importing, calculating, and exporting. The import functionality allows the addition of activity, emission factor, and control data into the database. This information can then be used to calculate area source emissions for each pollutant by Source Classification Code (SCC) per county. These emissions can then be exported to the U.S. Environmental Protection Agency's (EPA) Nation Emission Inventory (NEI) Input Format (NIF) V3.0, Great Lakes Commission Regional Air Pollutant Inventory Development System (RAPIDS) V2.4.1 or Microsoft Excel.

Additional functionality has been included to help facilitate inventory accuracy and ease of use. Activity, Emission Factor, Control, and Emissions data can be copied between inventory years. Corrections can be made to the Area Source emissions based on known Point Source releases. The Area Source Calculator even includes basic quality assurance checks to help ensure the quality and integrity of the data.

The Area Source Calculator is designed to help Ohio EPA produce Area Source emission inventories in a minimal amount of time. Therefore, emphasis of creating emission inventories will be on establishing accurate data instead of managing information.

4:05 "Recent Improvements to the State Inventory Tool Land-Use Change and Forestry Module," A. Denny, S. Asam, A. Choate, L. Pederson, and V. Thompson, ICF International.

The State Inventory Tool (SIT) was developed under the EPA's state Emission Inventory Improvement Program (EIIP) to assist states in the inventory process. The SIT covers most major sources of GHG emissions and incorporates state-of-the-art accounting methods into a user-friendly, worksheet-style format that reduces the resource intensity of developing GHG estimates while increasing accuracy and consistency across states. Land-use change and forestry has historically beenone of the hardest categories of GHG emissions and sinks to quantify at the state level. This presentation will discuss major advances EPA has made to expand and improve upon earlier methods and tools.

The Land-Use Change and Forestry (LUCF) module of the SIT covers GHG sources and sinks related to land-use change and forestry activities. These sources and sinks include forest carbon flux, non-CO2 emissions from forest fires, carbon flux in urban trees, carbon emissions from liming of agricultural soils, carbon storage in landfilled yard trimmings and food scraps, and N2O emissions from settlement soils. This module has recently been updated to improve the accuracy of estimates and increase their consistency with the national Inventory of U.S. Greenhouse Gas Emissions and Sinks. Updates include the incorporation of new or revised default data and emission factors as well as the addition of a source previously not included (i.e., N2O emissions from settlement soils). Default data through 2005 was also added where possible for all sources/sinks.

4:30 "Web Service for Comparative Data Analysis of Emissions Inventories," S. Falke, Washington University in St Louis; G. Stella, Alpine Geophysics, LLC; T. Keating, US EPA.

This paper describes the development and application of web services for comparing US and global emission inventories. Web services and service oriented architectures are providing new ways to support emissions modelers and analysts as they provide a web browser based environment for accessing and analyzing emissions data and inventories. Traditional emissions data analyses that can be conducted using web applications reduce the effort associated with accessing data, formatting data, and running analyses. The web application presented here supports an "offline" analysis conducted by the authors for reconciling and comparing regional and global emissions inventories. The focus of the analysis was the reconciliation of global inventories developed using "top down" methods with regional inventories developed using localized "bottom up" methods for a domain covering the continental United States. Part of that analysis is reconstructed using web services, including the spatial allocation of point source US EPA NEI data to a 1x1 degree grid and calculation of differences and ratios between the gridded NEI and EDGAR inventories. The online application is made possible through dynamic internet access to emissions inventory data and web standards for connecting data access services with data analysis and map visualization services. The same analysis services can be quickly re-applied when emissions data are updated or applied to new comparisons with other inventories. The analysis web services are openly available online (www.neisgei.org) for other emissions or non-emissions applications.

Session 3. Greenhouse Gases

Chairs: Leif Hockstad, US EPA
Marion Van Pelt, ICF International

1:30 "Greenhouse Gas Emission Inventories and Forecasts for Nine Western States,"
S. M. Roe, R. P. Strait, H.Lindquist, E. H. Pechan; A. Bailie and A. Jamison, Pembina Institute; T. D. Peterson, Center for Climate Strategies.

This paper presents a summary of the greenhouse gas inventories and forecasts developed by the Center for Climate Strategies (CCS) in collaboration with the Western Regional Air Partnership (WRAP) for the following states: Alaska, Colorado, Idaho, Montana, Nevada, South Dakota, Utah, Washington, and Wyoming. These inventories and forecasts cover the period from 1990 to 2020. Emissions of each of the six gases recognized by the Intergovernmental Panel on Climate Change (IPCC) are included and presented in terms of their carbon dioxide equivalents (CO2e). In addition, emissions of black carbon, an aerosol species known to have positive climate forcing potential, were included. Both sources and sinks of carbon dioxide are included. Summaries of the state-level results for each of the source sectors are described. These source sectors are as follows: energy supply (electricity generation, fossil fuel industry); residential/ commercial/industrial (fossil fuel use, industrial processes), transportation, agriculture, forestry, and waste management. These inventories and forecasts are serving as the starting points in several state-level climate changes mitigation plan development projects.

1:55 "EPA's Climate Change Emission Calculator Kit (Climate CHECK): A Climate Change Education and Greenhouse Gas Emission Inventory Kit for High Schools,"
C. Steuer, ICF International.

In an effort to provide a climate-change-based educational resource for high school students, EPA's Office of Atmospheric Programs has recently released the Climate CHange Emission Calculator Kit (Climate CHECK). Climate CHECK is an Excel-based kit that educates high school students about climate change drivers and science by equipping them with the tools needed to understand, estimate, and mitigate their high school's greenhouse gas (GHG) emissions.

Climate CHECK is a technically precise emission inventory tool that is both educational and appealing to high school students. The kit combines standard emission inventory approaches with innovative content and structure that were developed according to stakeholder interviews with high school students, educators, and facilities staff. Climate CHECK consists of three sections that provide: (1) background information on GHGs, the greenhouse effect, and climate change; (2) calculators students can use to estimate and inventory their high school's GHG emissions; and (3) resources and planning devices that students can use to develop an action plan for reducing emissions.

Climate CHECK's emission inventory section helps students calculate GHG emissions from emission sources using their school's activity data (e.g., kilowatts of electricity purchased, tons of waste disposed). However, Climate CHECK differs from other emission inventory tools because it allows students to walk through calculations using appendices, a conversion-factor sheet, example calculations, and interactive explanations of selected terminology and concepts. This process helps students develop an understanding of emission sources so that they are equipped and empowered to reduce their school's GHG emissions.

To support the three sections, and the educators and students using them, Climate CHECK also provides information on how the kit meets national education standards, a quick inventory sheet for schools that are unable to produce a full inventory, a printable action plan sheet, and a feature that lets students send the results of their inventory to their school district for compiling and school-district-wide action.

2:20 "Best Practices for Including Carbon Sinks in Greenhouse Gas Inventories," A. Ravin and T. Raine, CDM.

There is growing interest and urgency in quantifying the storage capacity of carbon sinks for inclusion in greenhouse gas (GHG) emissions inventories because of the need to quantify and reduce an organization's carbon footprint. This is especially critical for entities with large areas of forested land, such as public agencies and land-based private companies, as the potentially significant amount of carbon dioxide removed from the atmosphere could be accounted for as a net reduction in an organization's annual GHG emissions. Although there are relatively few examples to draw from for incorporating forest carbon sinks in an organizational level GHG emissions inventory, this paper provides timely guidance and concrete examples in the following three areas: best practices for calculating carbon sinks, recent developments in carbon sink guidance and U.S.reporting programs, and recommendations for including carbon sinks in an organizational GHG emissions inventory.

Recent developments in U.S. GHG reporting programs are critical for considering if and how to include forest carbon sinks in an organizational level emissions inventory. This paper includes a review of the latest emissions inventory guidance in the IPCC *Good Practice Guidance for Land Use, Land UseChange and Forestry*, the GHG Protocol's *Land Use, Land-Use Change, and Forestry (LULUCF) Guidance for GHG Project Accounting*, ICLEI-Local Governments for Sustainability's *Urban Forestry Toolkit*, and the California Climate Action Registry and Chicago Climate Exchange requirements for emissions reduction forestry projects.

2:45 "Greenhouse Gas Emission: A Case Study of Development of Data Collection Tool and Calculation of Emissions," G. Shil, K. N. Blue, Trinity Consultants.

The absence of GHG regulations in the United States has not diminished the importance of businesses assessing their impact on global climate change. Growing concern among shareholder and investor groups has motivated many organizations to quantify their greenhouse (GHG) emissions and commit to GHG reductions. Accurate quantification and detailed documentation of GHG emissions data enables a company to demonstrate transparency and enhance the credibility of its corporate climate change strategy. Establishing a comprehensive corporate GHG inventory is an important first step in developing a climate change strategy. However, conducting a baseline corporate GHG inventory can be a challenging process, particularly with respect to data gathering and data validation.

This paper will present a case study in conducting a baseline GHG inventory using Environmental Management Information Systems (EMIS). The paper will present best practices in establishing the organizational and operational boundaries of a corporate GHG emissions inventory, conducting the data collection and data validation process using an EMIS, completing the calculation procedures, and establishing appropriate performance metrics. In addition, methods for improving data quality and integrating the GHG inventory with energy management systems will be presented. The best practices and guidelines presented in this paper will be based on the methodologies described in the reporting protocols and guidance published by California Climate Action Registry, World Business Council for Sustainable Development and the World Resources Institute, and U.S. EPA Climate Leaders program. Finally, the paper provides guidance on continuous improvement and maintenance of the baseline GHG inventory.

3:10 **Break**

3:40 "Estimating National Landfill Methane Emissions: Application of the 2006 IPCC Waste Model in Panama," M. Weitz, US EPA; J. B. Coburn, RTI Internacional; E. Salinas, Autoridad Nacional del Ambiente, (ANAM), Panama.

This paper estimates methane emissions from solid waste disposal sites in Panama for years 1990-2020 using both the 2006 IPCC Waste Model spreadsheet and the default emissions estimate approach presented in the 1996 IPCC Good Practice Guidelines. The IPCC Waste Model has the ability to calculate emissions from a variety of solid waste disposal site types, taking into account country- or region-specific waste composition and climate information, and can be used with a limited amount of data. Countries with detailed data can also run the model with country-specific values. The paper discusses methane emissions from solid waste disposal, explains the differences between the two methodologies in terms of data needs, assumptions and results, describes solid waste disposal circumstances in Panama, and presents the results of this analysis. It also demonstrates the Waste Model's ability to incorporate landfill gas recovery data and to make projections. The former default method methane emissions estimates are 25.0 Gg in 1994, and range from 23.1 Gg in 1990 to a projected 37.5 Gg in 2020. The Waste Model estimates are 26.7 Gg in 1994, ranging from 24.6 Gg in 1990 to 41.6 Gg in 2020. Emissions estimates for Panama produced by the new model were, on average, 8% higher than estimates produced by the former default methodology.

4:05 "Assessment of Potential Reduction in Greenhouse Gas (GHG) Emissions in Freight Transportation," H. C. Frey and P.-Y. Kuo, NC State University.

Freight transportation accounts for 9% of total greenhouse gas (GHG) emissions in the United States. The contributions of each of five freight transportation modes to total freight transportation GHG emissions are 60, 6, 5, 13, and 16 percent for truck, rail, air, water, and pipeline, respectively. There is growing interesting in reducing GHG emissions in freight transportation. Fifty-nine strategies are identified as potential best practices for these reductions. Total estimated GHG emissions reductions by 2025 for all practices is 4.6×108 tons CO2 eq., which is 42% of 2025 GHG emissions if no best practice is implemented. For the truck mode, 2025 GHG emissions could be reduced by 28 percent compared to 2003 levels. Of other four modes, 2025 GHG emissions could increase by 20, 8, 22, and 9 percent, respectively, compared to 2003 levels, which is smaller than the increase if no best practices are implemented. For thirteen practices for which costs were assessed quantitatively, ten practices may produce net cost savings concurrent with substantial reductions in GHG emissions. Based on current prices, switching from petroleum to biodiesel can reduce GHG emissions but increase total costs. Intermodal shifts could lead to potentially larger reductions. For example, a shift from truck to rail modes can reduce GHG emissions per ton-mile by 85 percent, even when truck transport at the start and end of the trip are considered. The results of the assessments are the basis for development of a guidebook that identifies and characterizes these best practices.

4:30 "Use of Black Carbon and Organic Carbon Inventories for Projections and Mitigation Analysis," K. Weitz, M. Bahner and A. Zapata, RTI International.

Black carbon (BC) and organic carbon (OC) aerosols have been identified as having potentially significant impacts on climate change, particularly at regional scales. However, the appropriate role for BC and OC emissions in any climate change mitigation strategy remains uncertain. We present emission inventories and projections for BC and OC in the United States circa 2000, and projections for the years 2015 and 2020. The projected U.S. emission inventories for 2015 and 2020 take into account recently promulgated regulations that target $PM_{2.5}$ (of which BC and OC are essentially sub-components), such as the Clean Air Highway Diesel Rule (or 2007 Highway Rule), the Clean Air Nonroad Diesel Rule, the Clean Air Interstate Rule, and others. BC emissions in the United States are projected to decline by 42 percent from 2001 to 2020, primarily as a result of diesel vehicle regulations. In contrast, OC emissions are projected to decline by only 9 percent, because open biomass burning emissions are assumed to be largely unaffected by these air quality regulations. We also briefly present the results of global assessments of 1996 and 2030 emissions of BC and OC, and contrast these results with the inventory results for the United States.

Poster Session and Exhibitors' Reception

Tuesday, May 15, 2007
6:00 – 8:00 pm

Chairs: Madonna Narvaez, US EPA
Regina Krystyn, US EPA

1. "Modeling Emissions Inventory Preparation for the Calgrid Photochemical Air Quality Model," D. Healy, New Hampshire Department of Environmental Services.

2. "Overview of Emissions Modeling in Canada," M. Sassi, V. Bouchet, and S. Menard, Environment Canada.

3. "Improving the Mobile Emissions Inventory for Air Quality Modeling in the Montreal Area," O. Gagnon, G. Morneau, and N. Pencheva, Environment Canada; Y. Noriega, Universite' de Montreal, Canada.

4. "Minerals Management Service Gulf of Mexico Emission Inventories," H. Ensz, Office of Leasing and Environment; D. Wilson and R. Billings, Eastern Research Group, Inc.

5. "New Uses for Emissions Inventories for the Next Decade," N. Mayer, US EPA.

6. "Impacts of Background Ozone Production on Houston and Dallas, TX Air Quality During the NOAA 2006 TEXAQS Field Mission," R. B. Pierce, J. Al-Saadi, C. Kittaka, K. Bowman, G. Osterman , C. Hostetler, D. Winker, and A. Soja, NASA Langely Research Center; T. Schaack, UW SSEC; W. McMillan, UMBC; Jim Szykman, US EPA.

7. "Seeing the Big Picture: Using Visualization Tools to Analyze Large Sets of Emission Data," W. Gerber, B. Jacoby, J. Veysey, and G. Kitzmiller, Eastern Research Group, Inc., J. Westphal, Texas Commission on Environmental Quality.

8. "Recent Updates to the SMOKE Modeling System," B. H. Baek, and A. Eyth, University of NC, Chapel Hill; M. Houyoux and M. Strum, US EPA.

9. "GIS Modeling of Agricultural Ammonia Emissions Air-Surface Exchange in NC Coastal Watersheds," J. T. Walker and S. Kimbrough, US EPA; R. Austin and W. Robarge, NC State University.

10. "Methodologies Estimating Mobile Source GHGs for Regional Inventories and Project Alternatives," J. Byun, Federal Highway Administration.

11. "Linking Traffic Analysis and Urban Emission Inventories; an Integrated Tool," A. Brignone, Citilabs; A. Poli and P. Di Giovandomenico, Environmental System Analysis S.r.l., Italy.

12. "Development of a Model Emissions Model for a Hybrid Electric Vehicle," H. Zhai, C. Frey, and N. M. Rouphail, NC State University.

13. “Demonstration of the New Consolidated Annual Criteria, Toxics and GHG Emissions Inventory System for Point and Nonpoint Sources,” N. Meskal and M. Meskal, Ecotek, MST Solutions, Inc; S. Summers, City of Albuquerque, Environmental Health Air Quality.

14. “Data for Environmental Modeling,” J. E. Brandmeyer, RTI International.

15. “Uncertainties in Prescribed Forest Fires Emission Inventories and Their Impact on Air Quality Modeling,” D. Tian and A. Russell, Georgia Institute of Technology; E. Reinhardt, USDA Forest Service; Y.Wang, Georgia Institute of Technology.

16. “Resolving NO_x Emissions Inventory Biases Using Discrete Kalman Filter Inversion, Direct Sensitivities and Satellite-based NO_2 Columns,” S. L. Napelenok, R. W. Pinder and A. Gilliland, US EPA.

17. “The Use of Emission Inventories for Mobile Source Air Toxics Project Analysis,” K. N. Black, Federal Highway Administration.

18. “Identifying Interesting Emissions Scenarios Using MARKAL, Monte Carlo and Data-Mining,” D. Loughlin, T. Johnson and C. Shay, US EPA.

19. “Australia’s National Pollutant Inventory,” P. Thorning and D. Lovejoy, Queensland Environmental Protection Agency, Australia.

20. “Toxic Overload: Modeling Ambient Mercury Air Pollution at a Trillionth of a Gram,” E. Cristoph and F. Hornsby, NC State University.

21. “An Exploratory Analysis of Public Databases to Identify the Next Major Lead Source Targeted for Reduction to Improve Blood Lead Levels in Children,” C. Harness and J.Drukenbrod, NC State University.

22. “Protecting Human Health: Forecasting PM Fine Levels for Air Quality Index Reporting,” M. Thelen, J. Brewer and M. Johnson, NC State University.

23. “Emissions Inventory of $PM_{2.5}$ Trace Elements across the US,” A. H. Reff, T. Pace, and D. Mobley, US EPA; P. V. Bhave and G. A. Pouliot, US EPA/NOAA .

24. “Can Meteorologically Adjusted Ozone Air Quality Trends Identify the Impact of the Nitrogen Oxides Utility Reductions,” A.Wootten, G. Antczak and J. Harris, NC State University.

25. “SPECIATE - EPA's Database of Speciated Emission Profiles,” D. Mobley, L. Beck and M. Houyoux, US EPA.

26. “US Metals Emissions Monitoring Update 2001-2005,” J. Heinze, Environmental Health Research Foundation.

27. “Estimation of Traffic Emissions for Megacity Delhi”, B.R. Gurjar, K. Sharma and M. Mohan, Indian Institute of Technology Roorkee, India.

28. “The Community Modeling and Analysis System”, Z. Adelman, A. Hanna, S.Arunachalam, U. Shankar, F. Binkowski, B.H. Baek, A. Eyth, A. Holland, and J. Wallace; University of North Carolina – Chapel Hill.

Wednesday May 16, 2007

Session 4. Mobile Sources

Chairs: Laurel Driver, US EPA
Joe Pedelty, US EPA

8:30 "Link-Level Mobile Source Emission Inventories in Regional Air Quality Modeling," A. K. Pollack, S. Shepard, and M. Jimenez, ENVIRON International Corporation; M. Janssen, Lake Michigan Air Directors Consortium. - **CANCELLED**

Highly resolved emission inventories for on-road mobile sources can be used in 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 application of the CONCEPT motor vehicle emissions model to develop hourly gridded link-level emission inventories for six states in the Upper Midwest using transportation modeling results from 15 metropolitan area and six statewide transportation networks. Key features of the CONCEPT model are the use of VMT mix temporal profiles to account for variation in VMT mix by hour of day, day of week, and month of year; temporal profiles for VMT by roadway type to disaggregate TDM daily or multi-hour group VMT into hourly VMT; and speed adjustments to account for congestion in peak periods.

TDM inputs and emission inventory results will be shown for the link-level emission inventory for the six-state region. The CONCEPT link-level emissions will be compared to emissions generated using EPA's NMIM model, which shows the important effects of accounting for temporal variation in VMT mix. Preliminary air quality modeling results using the link-level emissions will also be shown.

8:55 "Emissions and Air Quality Analysis of the California Low Emission Vehicle II (CA LEV-II) Standards in NC," M. Abraczinskas, P. Jones, V. Chandler, and P. Bello, NC Department of Environment and Natural Resources.

The NC Division of Air Quality (NCDAQ) conducted a technical emissions benefit analysis and air quality sensitivity study to quantify the differences between the California Low Emission Vehicle II standards (CA LEV-II) and the current Federal Tier 2 standards. The United States Environmental Protection Agency (USEPA) has adopted national motor vehicle and fuel standards which include the Tier 2 vehicle and gasoline standard (phase-in began in 2004), and the heavy-duty diesel vehicle and fuel standard (phase-in begins in 2006 with the release of the model year 2007 heavy-duty diesel vehicles and ultra low sulfur diesel fuel). Beyond the federal standards, NC has expanded its Inspection and Maintenance program, which covers 48 of the State's 100 counties, to ensure that vehicle emission controls are properly working.

The federal Clean Air Act (CAA) provides the framework for regulating emissions from on-road mobile sources. The CAA set the first federal vehicle emission standards. However, because California already had vehicle emission standards when this occurred, the CAA authorized California (and only California) to continue setting its own vehicle emission standards. Therefore all new vehicles sold in the United States are subject to emission standards set by either the federal government or the State of California. Other states have the option to adopt the California standards in lieu of the federal standards. This authority was granted under Section 177 of the CAA. Section 177 also guarantees the automakers that they will not have to meet more than two regulatory regimes by explicitly prohibiting any requirements that result in a "third vehicle".

The only on-road mobile emissions modeling tool available to NC is US EPA's MOBILE6.2. The emissions standard default for light-duty vehicles in MOBILE6.2 is the Tier 2 standard. Thus an approximation of the CA LEV-II program was used by NCDAQ to estimate the emissions benefits of adopting a CA LEV-II program in NC.

The purpose of this paper is to describe the potential emissions and air quality benefits of the CA LEV-II program in NC. The emissions estimation techniques will be discussed including the approximation of the CA LEV-II program in USEPA's MOBILE6.2.

Additionally, a comparison of the California and NC light duty fleet characteristics will be presented as part of a qualitative assessment of whether the fleet average enforcement of the CA LEV-II program would be needed in NC. Potential resource burdens on the State of NC are also explored. We will present an analysis of ozone sensitivity modeling to better understand the overall ambient air quality improvements associated with the estimated emissions reductions due to a CA LEV-II program.

9:20 "Implication of Measured In-Use Light Duty Gasoline Vehicle Emissions for Emission Inventory Development at High Spatial and Temporal Resolution," H. C. Frey and K. Zhang, NC State University.

The objective here is to evaluate the intra-and inter-vehicle variability in real-world light-duty gasoline vehicle emissions and assess implications for development of onroad vehicle emission inventories. A field study was conducted to characterize variability for selected vehicles for both total emissions and emission rates by routes, time of day, road grade, and among vehicles. Real-world data were collected using a portable emission measurement system (PEMS). The study area included two origin/destination pairs, each with three alternative routes. On an average trip basis, the total NO emissions differed by 24% when comparing alternative routes and increased by 19% when comparing congested versus less congested travel time periods. Positive road grades were associated with approximately a 20 percent increase in localized emissions rates, while negative road grades were associated with a similar relative decrease. The average NO vehicle-specific power based modal emission rates differed by more than 2 orders of magnitude when comparing different vehicles. The results demonstrate that alternative routing can significantly impact trip emissions. Road grade should be taken into account for localized emissions estimation. Furthermore, there are locations on the roadway network where one or more vehicles may have high proportions of its total trip emissions. The magnitude and location of these emissions hotspots can vary by vehicle, pollutant, and time of day. Micro-scale modeling may be needed to capture episodic emissions such as for near-road short-term human exposure assessment. Implications for emission inventory development are discussed.

9:45 "Analysis of Heavy Duty Diesel Truck Activity and Emissions Data," T. Huai, S. D. Shah, J. W. Miller, and T.Younglove, University of California; D.J. Chernich, and A. Ayala, California Air Resources Board.

Despite their relatively small population, heavy-duty diesel vehicles (HDDVs) are (in 2005) disproportionate contributors to the emissions inventory for oxides of nitrogen (NO_x) and particulate matter (PM) due to their high individual vehicle emissions rates, lack of engine aftertreatment, and high vehicle miles traveled. Beginning in the early 1990's, heavy-duty engine manufacturers began equipping their engines with electronic sensors and controls and on-board electronic computer modules (ECMs) to manage these systems. These ECMs can collect and store both periodic and lifetime engine operation data for a variety of engine and vehicle parameters including engine speed and load, time at idle, average vehicle speed, etc. The University of California, Riverside (UCR), under a contract with the California Air Resources Board (CARB), performed data analysis of 270 ECM data sets obtained from the CARB. The results from this analysis have provided insights into engine/vehicle operation that have not been obtained from previous on-board datalogger studies since those previous studies focused on vehicle operation and did not collect engine operating data.

Results indicate that HDDVs spend a considerable amount of time at high-speed cruise and at idle and that a smaller percentage of time is spent under transient engine/vehicle operation. These results are consistent with other HDDV activity studies, and provide further proof of the validity of assumptions in CARB's EMFAC2002 model. An additional important contribution of this paper is that the evaluation of vehicle ECM data provides several advantages over traditional GPS and data logger studies: 1) ECM data is significantly cheaper than the traditional method ($50/record vs. ~$2,000/record); 2) ECM data covers vehicle operation over the entire life of the vehicle, whereas traditional surveys cover only short periods of surveillance (days, weeks or months). It is worthwhile to note that this work was not intended to compare the various methods of data collection but to provide additional empirical support for the EMFAC2002 model and to explore the utility of this unique low-cost form of data collection and analysis.

10:10 **Break**

10:40 "Methodology for Activity, Fuel Use and Emissions Data Collection and Analysis for Nonroad Construction Equipment," H. C. Frey, W. J. Rasdorf, S-H. Pang, K. Kim, and P. Lewis; NC State University.

Nonroad construction equipment is a significant source of nonroad mobile source air pollutant emissions. Emissions from nonroad construction equipment are typically quantified based on steadystate modal engine dynamometer tests. However, such tests do not represent real-world activity, herefore, there is a need to quantify energy use and emissions from construction equipment based on in-use measurement methods. The purpose of this paper is to develop standard procedures for field data collection and analysis for nonroad construction equipment. The methodology is based on second-bysecond measurement of in-use activity and emissions using a portable emissions measurement system (PEMS). The procedure for field data collection includes development of a study design, installation of the PEMS, field measurements, data quality assurance, and analysis of the data. Installation of the PEMS must take into account the configuration of the vehicle and the amount of time required to install the PEMS. After field data collection, the raw data undergo a quality assurance procedure to check and correct synchronization between engine and emission data; identify missing data, and remove incorrect data. The screened data are analyzed in terms of the effect of engine activity on fuel use and emissions, and in terms of the effect of real world activity. One of the most significant challenges to data collection is vibration of the vehicle that is transmitted to the instrument, which may cause internal damage to the PEMS. Recommendations are made regarding preferred data collection, quality assurance, and analysis procedures in order to obtain valid energy use and emissions data for nonroad construction equipment.

11:05 "Refining Commercial Lawn and Garden Equipment Population and Emissions Estimates," S. Smeltzer, Alamo Area Council of Governments, Texas.

In the past, San Antonio region off-road emission inventories of commercial lawn and garden equipment contained inaccuracies in equipment counts and usage rates. A wide variety of businesses and agencies use lawn and garden equipment, causing the NONROAD model default values for emissions calculations to be inappropriate in some cases. The accuracy of lawn and garden equipment counts and usage rates increases with the use of local data acquired through surveys. Additionally, the accuracy of emissions calculations for this category also increased with the subdivision of the category into user types, such as commercial business, golf courses, or public schools. User types were then surveyed to determine local lawn and garden usage rates and equipment population in the San Antonio region for the year 2005.

Through analysis of the surveyed data, usage rates were found to differ significantly from usage rates provided through NONROAD model defaults. Survey results from some categories, such as Turf and Tiller equipment, reflected usage rates less than 10% of those of the NONROAD model defaults; whereas, categories such as Rear Mowers and Front Mowers, surveyed equipment usage was 200% more than that of the NONROAD model defaults. Thus, adjustments were made to the equipment populations in the NONROAD 2004 model based on the percent difference between the survey results and the NONROAD model defaults. Emissions were then geocoded by user type locations.

11:30 "Estimating the Monthly Variation in California's Nonroad Equipment Emissions for the 2002 Emissions and Air Quality Modeling Plateform," M. Strum; US EPA.

The Environmental Protection Agency (EPA)'s Office of Air Quality Planning and Standards (OAQPS) is developing a 2002 Emissions and Air Quality Modeling Platform using the 2002 National Emissions Inventory (NEI) Version 3.0. In the 2002 modeling platform (also called Version 3.0), monthly emission data consistent with the 2002 NEI are input into the Sparse Matrix Operator Kernel Emissions (SMOKE) processor for onroad and nonroad categories to generate air quality model inputs for these categories. With the exception of California, these data are generated using the National Mobile Inventory Model (NMIM). The NMIM model accounts for the monthly variation in activity, temperature, and fuels in estimating emissions. In addition, NMIM outputs provide emission mode information (e.g., exhaust and evaporative) in addition to the source category information. Because California uses different models to estimate onroad and nonroad emissions than NMIM, NMIM-generated California emissions are replaced by California-submitted emissions. The California nonroad data from the 2002 NEI are annual emissions and do not include the emission mode. A different approach than for the rest of the country was thus needed to process the California nonroad data to generate air quality model inputs. This paper discusses two options, focusing on the temporal aspects of the emissions processing. We compare the use of monthly temporal profiles based solely on equipment-based activity data to the computation of NMIM-like monthly emissions. This paper will discuss these two methods of disaggregating the annual emissions and describe the differences in the resultant monthly emissions.

Session 5. Emission Factors

Chairs: Art Werner, MACTEC
John Bosch, US EPA

8:30 "Use of Recent Source Test Data to Develop Emissions Factors for WebFIRE," W. Hodan, L. Cress, S. Kersteter and A.Werner, MACTEC Federal Program; R. Myers, US EPA.

MACTEC has been tasked by EPA's Measurement Policy Group, (MPG), to develop emissions factors data from source test reports. The effort includes working with state agencies to obtain copies of source test reports that have been reviewed and accepted by the agency within the past five years. This effort is targeting MACT area source categories and non-utility coal fired source categories where condensable particulate matter emissions were quantified. MACTEC is evaluating the availability and quality of information in these source test reports and extracting information necessary to calculate emissions factors. The emissions factors and associated information from the source test is then being entered into an electronic format for uploading to the WebFIRE data base. As the information is added to the data base, WebFIRE will be able to automatically calculate a new emissions factor, and users will be able to use search criteria to find emissions factors for pollutant emissions from similar sources or processes. In addition to the traditional characterization of emissions factors by Source Classification Code (SCC), pollutant, and associated controls, the user will be able to review and group by multiple process parameters such as throughput and process design capacities, specific control parameters, equipment manufacturer, etc. Available information is being included in searchable format as well as descriptive narrative within each emissions factor record. In a parallel effort, information from EPA background documents used to develop AP-42 is being transferred to the more detailed format. Detailed, high quality source test data in a format that can easily be searched, sorted, and examined will make it possible for EPA, state and local air quality agencies, and industry to estimate emissions for individual processes.

8:55 "Ammonia Emissions from Open Lot Beef Cattle Feed Yards on the Southern High Plains," R.W. Todd, N. A. Cole and R. N. Clark, USDA-ARS.

Concentrated animal feeding operations (CAFO) are major sources of ammonia emitted to the atmosphere. There is a considerable literature on ammonia emissions from poultry and swine CAFO, but few comprehensive studies have investigated large, open lot beef cattle feedyards. During a series of field campaigns from 2002 to 2007 at three feedyards on the Texas High Plains, we used a variety of independent methods to quantify ammonia emissions: nitrogen mass balance; change in N.P ratio from feed to manure; the micrometeorological flux-gradient method; and a backward Lagrangian stochastic dispersion model. Atmospheric ammonia concentration was measured using gas washing, passive samplers, chemiluminiscence, and open path lasers. Summer ammonia emissions ranged from 30 to 60% of fed nitrogen. Winter emission rates were about half those of summer. Annualized emission rates of ammonia-N from the various methods converged on a range of from 35-45% of fed N. Emission factors based on total annual production ranged from 10 to 15 kg NH3-N (head produced)-1 yr-1. Annual ammonia-N emission for a median size feedyard in the region (30,000 head) would range from 700 to 1000 Mg NH3-N yr-1.

9:20 "Outdoor Wood Boilers - New Emissions Test Data and Future Trends," P. Guldberg, C.C.M.

Concerns have been in by NESCAUM and NYS DEC about the emissions from Outdoor Wood Boilers (OWB). These residential furnaces are designed to heat an entire home and in many cases replace multiple indoor wood stoves, which are typically sized to heat a single room. To properly compare OWB and woodstove emissions, the measure is emissions per unit of fuel burned (g/kg-dry) or heat input (lb/MMBtu). To meet an emissions goal on a g/kg or lb/MMBtu basis requires the furnace to have good combustion efficiency and low emissions. By contrast, use of a mass-per-time measure (g/hr) does not impose these requirements because firing rate can simply be limited, an approach taken by some wood stove manufacturers in gaining EPA certification. Particulate Matter (PM) emissions from six current-model OWB were measured with EPA Method 5G in 48 tests done in 2005/2006. The results reveal PM emission rates do not vary over a wide range of burn rates (1.3 to 13 kg-dry/hour) and operation of an OWB with larger firebox than a stove at a reduced firing rate, when heat demand is low, does not produce high emissions. The average of the test results are within 10 percent of the results from EPA tests on a Central Boiler OWB done in 1995. A comparison of the OWB test data to EPA tests of certified woodstoves as actually used by residential owners show that: 1) current OWB PM emissions are in the same range as certified woodstove emissions on a g/kg basis and average 25 percent higher, and 2) cycling of the OWB fire by the thermostat in a home does not produce high emissions. A comparison of polycyclic aromatic hydrocarbon (PAH) data reveals OWB emissions are similar to, and lower than PAH emissions from certified woodstoves. Mass emissions from the OWB tests were analyzed in a dispersion modeling analysis to produce contour maps of maximum 24-hour $PM_{2.5}$ concentrations under different stack height conditions. The results demonstrate that a properly installed OWB can operate year-round next to a residence and fully comply with the new $PM_{2.5}$ air quality standards. OWB manufacturers have worked with EPA to develop a voluntary Outdoor Wood-fired Heater

(OWH) Program with a Phase 1 emissions target of 0.6 lb/MMBtu, representing a 30 to 80 percent reduction in PM emissions from existing OWB. The Program uses EPA Draft Standard Test Method 28 OWHH that incorporates EPA Method 5G. The Phase 1 emissions goal is more stringent than the current NSPS for wood stoves. Manufacturers will be bringing OWH Phase 1 Qualified Models to market starting in 2007, and those units will have lower emissions on a g/kg basis than certified woodstoves now in use.

9:45 "Greenhouse Gas Emissions from Freight Trucks," J. Davies, US EPA.

The transportation sector accounted for almost 28 percent of total U.S. greenhouse gas (GHG) emissions in 2004, according to the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2004*. Over the period 1990 to 2004, GHG emissions from the transportation sector increased at the fastest rate of any end-use economic sector in the U.S. and accounted for the largest absolute increase of any of these sectors. The increase in light-duty GHG emissions alone (224 TG CO2 Eq.) was greater than non-transportation economic sectors except for residential (229.9 Tg CO2 Eq.). Perhaps surprisingly, the share of transportation GHG from light-duty vehicles actually declined from 64 percent 1990 to 61 percent in 2004, reflecting the rapid growth in GHGs from freight trucks; while passenger vehicle GHGs grew by 23 percent, freight truck GHGs increased by 62 percent. This paper will examine the factors affecting the growth in freight truck GHGs, including the growth in overall freight movement; the growing share of freight goods carried by truck; changes in distribution and logistics; and the stagnation of truck fuel economy.

10:10 **Break**

10:40 "VOC Emissions and Reduction Potential in Solvent Utilization," Y. Sunwoo, Y.-Il Ma, Y. J. Kim, J. Y. Yoo, H. M. Kim, S. H. Kim, J. S. Nam, J. H. Kim, H. K. Sung, Konkuk University; D.G. Kim and J. H. Hong, National Institute of Environmental Research, Kyungseo-dong, Seo-gu, Incheon, Korea.

The Korean government established the "Framework for Special Act on Seoul Metropolitan Air Quality Improvement"as part of the "Special Measures for Metropolitan Air Quality Improvement" in 2005. General reduction measures of VOCs were included in the "Framework" for air quality improvement. For successful reductions of VOCs emissions, VOCs emission estimating methods for specific sources and source-specific reduction programs must be developed. In this study, emission factors for dry cleaning, metal degreasing and printing facilities, were developed and their VOCs emissions estimated. VOCs emissions were estimated to be 27,482 tons from these sources in Seoul Metropolitan Area in 2001. And 12,851 ~ 15,451 tons of VOCs are estimated to be reduced in SMA by 2014.

11:05 "Development of Factors to Estimate 4-digit SIC Employment from 6-digit NAICS Employment Data for Selected Nonpoint Emission Inventory Categories with Example VOC Emission Calculations," R. E. Wooten, NC Division of Air Quality.

For a number of nonpoint source (previously area source) categories, emission estimates of VOC can be made by multiplying a factor times employment in certain SIC categories. Employment is no longer reported by SIC categories (since 1997). This paper describes development of a conversion crosswalk to use the appropriate portions of 6-digit NAICS based employment data to construct estimates of the various 4-digit SIC employment values needed to calculate selected nonpoint source emissions. Example emission calculations are shown. Access database files and an Excel file demonstrating crosswalk development, use of the crosswalk, and processing of employment data are offered.

11:30 "Quantification of Uncertainty in Emission Factors and Inventories," H. C. Frey, NC State University.

For both scientific and policy reasons, there is increasing demand for quantification of variability and uncertainty in emission factors and inventories. Variability refers to inherent differences in emissions among different sources or for a given source over time. Uncertainty refers to lack of knowledge regarding the true value of emissions at a given location and time period. Scientific advisory organizations such as the National Academy of Sciences and EPA's Science Advisory Board often call for increased quantification of variability and uncertainty, either directly with respect to emissions or in integrated assessments of which emissions characterization is a component (e.g., human health risk assessment). The Office of Management and Budget has required quantification of uncertainty as part of regulatory impact assessment. EPA's Office of the Inspector General recently released a report specifically calling for quantification of uncertainty in emission factors. Thus, it appears not to be a question of if uncertainty analysis should be done, but rather, how? This paper will provide an overview of methods for and examples of quantification of variability and uncertainty in emissions factors, and quantification of uncertainty in emission inventories, based on an accumulated body of research over a number of years and spanning a variety of emission source categories and pollutants. Furthermore, the implications of several key guidance and advisory documents, such as the Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Emission Inventories and the NARSTO Emission Inventory Assessment, will be briefly summarized. Key findings, conclusions, and recommendations will be offered regarding practical strategies for moving forward in the effort to quantify uncertainties in emissions.

Session 6. Air Toxics

Chairs: Anne Pope, US EPA
Rich Mason, US EPA

8:30 "Toxicity-Weighting: A Prioritization Tool for Quality Assurance of Air Toxic Inventories," D. Wright, Maine Department of Environmental Protection.

With 187 Hazardous Air Pollutants (HAPs) being emitted from hundreds of source categories, determining where to begin a quality assurance (QA) review of a HAP inventory is daunting. The potential health risk posed by a given HAP is related to both the amount emitted and the toxicity of the compound. Toxicity varies ten orders of magnitude between HAPs. Thus, QA prioritization based on just tons of HAPs emitted can waste resources on HAPs emitted in high amounts but with low toxicity, while neglecting HAPs emitted in low amounts with high toxicity. By toxicity-weighting a preliminary HAP inventory, quality assurance reviews are focused on those HAPs that "drive the risk"; saving agency resources while ensuring that subsequent modeling and policy decisions are based on sound science.

In 2005, a Maine stakeholder group, the Air Toxics Advisory Committee (ATAC), successfully used Toxicity-Weighting to reach agreement on an Air Toxics Priority List. To weight its preliminary inventory, the ATAC used the toxicity-factors from EPA's Risk Screening Environmental Indicators (RSEI) Model. In 2007, the ATAC developed new toxicity-factors to better align with the risk endpoints used in Maine's Ambient Air Guidelines and the National Air Toxics Assessment (NATA). By toxicity-weighting the inventory, the ATAC focused its limited resources to find pollutant and SCC coding errors that had resulted in several significant, erroneously high risks for Maine in the 1996 NATA. Conversely, the QA review also found missing HAPs from important source categories, which had resulted in significant, erroneously low risks for several other areas of Maine. This information was used to develop a corrected HAP inventory, identify Emission Factor needs, and better describe inventory uncertainty. The inventory corrections also resulted in a more accurate 1999 NATA for the state, and an Air Toxics Priority List that accurately reflected the HAPs of greatest concern.

Additionally, the "apples-to-apples" comparison afforded by toxicity-weighting simplifies communication. After weighting, tens of thousands of records in the HAP inventory can be simplified into a few charts and graphs. This data communication was crucial for the diverse members of the ATAC to reach agreement on inventory changes, which pollutants to place on Maine's Air Toxics Priority List, and the order of those pollutants.

8:55 "An Assessment of Beno(a)pyrene Air Emissions in the Great Lakes Region,"
J. Dettling, Great Lakes Commission; C. Y. Wu, Minnesota Pollution Control Agency; O. Cabrera-Rivera, Wisconsin Dept. of Natural Resources; D. Asselmeir, Illinois EPA; D.McGreen, A. Ostrander and J. Lax, Michigan Department of Environmental Quality; C. Mancilla, New York Department of Environmental Conservation; T. Velalis, Ohio EPA; J. Bates, Indiana Department of Environmental Management; P.Wong and C. Doan, Ontario Ministry of the Environment.

Benzo(a)pyrene is a persistent toxic substance whose presence in the environment is of concern due to impacts on wildlife and human health. In 1997, it was listed as one of twelve "Level I Compounds" under the U.S.-Canada Binational Toxics Strategy. The two nations have committed to pursuing benzo(a)pyrene emission reduction strategies and tracking the progress of these efforts. Emissions inventories are valuable ways of identifying high-emitting sectors, determining the relative benefit of various emission reduction strategies, and for tracking trends. The eight U.S Great Lakes states and the Canadian province of Ontario have been collaborating on a regional toxic air emissions inventory for the past 15 years. Following the publication of the 2002 inventory, these states and province conducted a specific assessment of the benzo(a)pyrene emissions inventory, including its coverage, estimation methods, available emission factors, errors and inconsistencies. Updates were made to the data to produce a regional inventory with greater accuracy, consistency and comprehensiveness.

This paper details the emissions inventory assessment process, presents the revisions to he 2002 regional benzo(a)pyrene inventory, offers recommendations for correcting gaps in estimation tools for a variety of emission sources. The paper also discusses implications for both benzo(a)pyrene control strategies and future emission inventory work for this and other pollutants.

9:20 "The Use of the 2002 NEI in the Risk and Technology Review (RTR)," A. Pope, P. Hirtz, and T. Palma, US EPA; S. Finn, Eastern Research Group, Inc.

The Risk and Technology Review (RTR) is a combined effort to evaluate both risk and technology as required by the Clean Air Act (CAA) after the application of maximum achievable control technology (MACT) standards. Section 112 (f) of the CAA requires EPA to evaluate the risks remaining after the application of MACT standards. Section 112(f) (2) directs EPA to conduct risk assessments on each source category subject to MACT standards, and to determine if additional standards are needed to reduce residual risks. EPA streamlined the residual risk standard development process in the RTR by combining the 33 MACT source categories requiring residual risk and technology reviews into one group. The RTR process including the compilation and use of the NEI is undergoing peer review by EPA's Scientific Advisory Board (SAB).

The 2002 NEI is the starting point for the RTR. The 2002 NEI data for the RTR categories were modeled using EPA's Human Exposure Model (HEM). The HEM results will be used to determine if residual risk standards are needed to reduce risk for the RTR categories. The HEM results indicate that critical data elements in the NEI directly influence risk results for facilities modeled as part of the RTR categories. In order for the NEI to be used in future regulatory applications and local modeling applications, it is important the NEI data partners improve the data quality for these critical fields in future NEI submittals.

9:45 "1990 - 2002 NEI HAP Trends: Success of CAA Air Toxic Programs in Reducing HAP Emissions and Risk," A. Pope and M. Strum, US EPA.

Requirements of the Clean Air Act (CAA) and Government Performance Results Act (GPRA) have established the need for a more comprehensive hazardous air pollutant (HAP) emissions inventory effort that can be used to track progress by the Environmental Protection Agency (EPA) over time in reducing HAPs in ambient air. In response to these needs, the EPA has developed the National Air Toxics Assessment (NATA) to estimate the magnitude of HAP emissions reductions and demonstrate reduced public risk from HAP emissions attributable to CAA toxics programs. EPA has also developed toxicity weighted emissions data trends to track progress in reducing risk of HAPS to Americans. To estimate risk and HAP emission reductions, EPA compiles the National Emissions Inventory (NEI).

This paper briefly discusses the compilation of the 2002 NEI for HAPs, highlights data sources and quality, and describes methodology used to toxicity weight NEI HAP emissions. This paper focuses on 2002 emissions data summaries and trends in HAP emissions and toxicity weighted emissions trends from 1990 to 2002. The toxicity weighted emission trends shows the success of CAA air toxic programs in reducing HAP emissions and risk.

10:10 **Break**

10:40 "A Closer Look at Air Pollution in Houston: Identifying Priority Health Risks," H. L. Bethel, US EPA; K. Sexton, S. Linder, G. Delclos, and T. Stock, The University of Texas, S. Abramson, Baylor College of Medicine, M. Bondy, The University of Texas; M. Fraser, Rice University; J. Ward, The University of Texas.

Air pollution levels in the City of Houston are considered to be unacceptable by knowledgeable experts and the general public and are likely to cause air-pollution related health effects for Houston residents. Pollutant levels are driven by many sources including: tailpipe emissions from cars, trucks and buses; toxic pollutants emitted into the air by more than 400 chemical manufacturing facilities, including 2 of the 4 largest refineries in the U.S.; the petrochemical complex along the Houston Ship Channel and the Port of Houston; and many small operations spread geographically across Greater Houston, such as surface coating processes, dry cleaners, gas stations, printing processes, restaurants, charcoal barbecues, and gasoline-fueled lawn maintenance equipment.

Mayor Bill White's Task Force on the Health Effects of Air Pollution was formed to identify priority pollutants for the City of Houston. The Task Force considered information on health effects (California EPA & OEHHA, 2002; California OEHHA, 2005; U.S. EPA, 2005, 2006d, 2006e, ATSDR) and both modeled (U.S. EPA, 2006a) and measured ambient pollutant concentrations (U.S. EPA, 2006b, 2006c) to assign 179 air pollutants (hazardous air pollutants [HAPs] and criteria pollutants) to 1 of 5 risk categories: definite, probable, possible, unlikely and uncertain. A dozen of these substances were judged to pose a definite risk to human health. Finally, the distribution of these risks was found to be far from equal. The substances identified as definite risks were found in greater numbers in several East Houston neighborhoods adjacent to the Houston Ship Channel. Full results of the Task Force work can be found in their Report to the Mayor (Sexton, et al., 2006).

11:05 "Evaluation of Air Toxic Concentrations and Emissions for the San Juan, Puerto Rico, MSA," R. Oommen, J. Hauser, D. Dayton, and J. Swift, Eastern Research Group, Inc.

Air toxics pollution continues to be a pervasive problem in many cities around the U.S. Acute and chronic exposure to certain pollutants can lead to cancer and/or noncancer effects. Over the last several years, efforts have been made by federal, state, local, and tribal agencies to reduce air toxics emissions and concentrations, thereby reducing associated risk. Understanding the relationship between emissions and concentrations, and integrating meteorological data can be useful in developing strategies for reducing air toxic pollution. An evaluation of air toxics emissions and concentrations was conducted for two monitoring sites in the San Juan, Puerto Rico (PR) Metropolitan Statistical Areas (MSA) that participated in the 2005 Urban Air Toxics Monitoring Program (UATMP). The U.S. Environmental Protection Agency (EPA) sponsors the UATMP to obtain air toxics measurements data to characterize the composition and magnitude of pollution across the United States. Air toxics monitoring data from the same sampling day were reviewed at these two sites to determine if there is a significant difference in concentrations from the upwind and downwind locations. Air toxics pollutants analyzed include volatile organic compounds (VOCs) and carbonyls. An evaluation of emission sources from the 2002 National Emissions Inventory (NEI) potentially affecting downwind concentrations is also presented. The NEI is also managed by U.S. EPA, and contains emissions information from stationary (point and area nonpoint) and mobile (onroad and nonroad) sources. Data from the National

Weather Service (NWS) and the National Oceanic and Atmospheric Administration (NOAA) are used to identify predominant daily wind flow and for the construction of back trajectories.

11:30 "Quantifying Community Use of Pollutant Inventories," P. Thorning, Queensland Environmental Protection Agency; M. Howes, Griffith University, Australia.

In Australia, the National Pollutant Inventory (NPI) commenced in 1998 and the first reports were published on the Internet (www.npi.gov.au) in 2000. Eight years of annual emission data on 90 substances from 4000 of the most significant pollutant emitters in Australia has been collected and published. Reporting to the NPI is mandatory if a facility exceeds certain thresholds relating to substance usage, fuel or waste burning or emissions to the environment. Like many other Pollutant Release and Transfer Registers (PRTRs), the NPI was established with Community Right to Know (CRTK) cited as one of the drivers. It therefore follows that the success of the NPI, and other PRTRs, is at least partly dependant on community knowledge and use of the information in the PRTR. Despite this, apart from the numerous case studies reported by the Working Group on Community Right-to-Know, there is little evidence in the literature of comprehensive analysis of the level of knowledge and use of PRTRs by members of the community. The question about the level of knowledge and use of PRTRs is particularly relevant in Australia as there is anecdotal evidence suggesting that the NPI has been embraced less enthusiastically by environment groups than has been the case with some overseas inventories. This paper will present the findings of a survey of members of pro-environment community groups in Australia concerning the NPI. The survey sought information on the organizations awareness of the NPI and whether it had used information from the NPI to plan or conduct actions against reporting facilities. The paper will also outline further research that is currently being conducted on barriers to community knowledge and use of the NPI.

Session 7. Emission Projections

Chairs: Linda Chappell, US EPA
Dan Loughlin, US EPA

1:30 "Understanding Historical Emission Trends," J. Warren and W. Hunt, NC State University; L. Chappell, US EPA.

Air pollution is harmful to people and the environment. In order to better understand the nature of the environmental problem, emission inventories are developed for all sources in an area. They are based upon engineering estimates. They represent both gases and particles of air pollution that are emitted into the air by a variety of sources.

Emission inventories (EI) change over time and may be reduced as a result of emission control programs. The U. S. Environmental Protection Agency, (EPA) Office of Air Quality Planning and Standards (OAQPS) is responsible for the National Emissions Inventory (NEI). Emissions data are collected by state, local, and tribal and the federal governments. The EI includes a number of different sources: (1) Point sources – stationary locations of pollution include factories, pulp and paper mills, petroleum refineries, electric power plants, etc.; (2) Mobile Sources - cars and trucks, airplanes, etc.; (3) Biogenic sources – natural sources of emissions – trees, animals, etc.; (4) Area Sources – small stationary sources of emissions such as dry cleaners and degreasing operations.

Future emissions are critically important when trying to determine the impact of air quality standard regulations that are protective of human health and the environment. How will regulations impact sources in the future making changes needed to reduce emissions to achieve the air quality standards? Emissions inventories are projected for future years to conduct analyses for our rulemakings. The methods for forecasting emissions into the future are complex. The objective of this project is to improve upon the existing method to forecast future emissions. Two sectors will be examined to forecast future emissions – petroleum refineries and chemical manufacturing. The pollutant that will be examined is nitrogen oxides. We will try and take technological change into account using gross domestic product and other variables. The Presidents Energy Plan to reduce oil consumption by 20 percent in 10 years will be used to forecast future emissions. Different alternatives will be examined in the paper.

1:55 "Using Historical Information to Improve Emission Projections (or How to Avoid Being Doomed to Repeat History)," A. D. Bollman and J. H. Wilson, Jr., E.H. Pechan, Inc; M. Janssen, Lake Michigan Air Directors Consortium.

The poet and philosopher, George Santayana is often quoted as having said that "those who cannot learn from history are doomed to repeat it." While he certainly did not have emissions forecasting in mind when identifying this conceit, it does have application to air pollutant emission projection practitioners. Under contract to the Lake Michigan Air Directors Consortium (LADCO), E.H. Pechan & Associates, Inc. is performing a study to analyze whether recent historical evidence suggests that EPA's emission projection guidance and tools may overstate future emission levels. The purpose of this study, which focuses on a set of Midwest region priority stationary source categories, will be two-fold: (1) compare default EPA emission activity growth rates with recent historical emission activity growth rates; and (2) analyze whether past trends indicate that significant stationary source emission reductions may be expected to occur beyond those forecast by EPA's projections methodology. It is anticipated that this paper will discuss recommendations for near-term improvements to emission projection methods, along with topic areas for future research.

2:20 "Emission Projections for the EPA Section 812 Second Prospective Clean Air Act Cost Benefits Analysis," J. H. Wilson, Jr, M. A. Mullen, A. D. Bollman, K. Thesing and M. Salhortra, E. H. Pechan; J. Neumann and J. Price, Industrial Economics Inc; J. DeMocker, US EPA.

Section 812 of the Clean Air Act Amendments of 1990 requires the US EPA to perform periodic, comprehensive analyses of the total costs and total benefits of programs implemented pursuant to the CAA. The first prospective analysis was completed in 1999. The second prospective analysis was initiated during 2005. The first step in the second prospective analysis was the development of base and projection year emission estimates, which will be used to generate benefit estimates of CAAA programs. This paper describes the analysis methods and results of the recently completed emission projections. There are several unique features of this analysis. One is the use of consistent economic assumptions from the Department of Energy's "Annual Energy Outlook 2005" projections as the basis for estimating 2010 and 2020 emissions for all sectors. Another is the analysis of the different emissions paths for both with and without CAAA scenarios. Other features of this analysis include being the first EPA analysis that uses the 2002 National Emission Inventory files as the basis for making 48 state emission projections, incorporating control factor files from the regional planning organizations that had completed emission projections at the time the analysis was performed, and modeling the emission benefits of the expected adoption of measures to meet the 8 hour ozone NAAQS, the Clean Air Visibility Rule, and the PM-2.5 NAAQS. The results of this study have been reviewed by EPA's Science Advisory Board.

2:45 "Activity Trends for Key Emission Sources in California's San Joaquin Valley, 1970-2030," S. B. Reid, D. C. Sullivan, B. M. Penfold, S. M. Raffuse and T. H. Funk, Sonoma Technology Inc.

Growth surrogates and growth activity data are key components of emission forecasting tools such as the US Environmental Protection Agency's (EPA's) Economic Growth Analysis System (EGAS) and the California Air Resources Board's (CARB's) Emission Forecasting System (CEFS). While these tools may provide reasonable projections of emissions-related activities at a national or state level, it is desirable to gather local growth activity data for regional emission inventory development purposes.

In a study sponsored by the San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD), Sonoma Technology, Inc. (STI) developed growth surrogates and growth activity data for several key emission sources in the San Joaquin Valley (Valley), including civilian aircraft, locomotives, petroleum refineries, foam manufacturing plants, cogeneration operations, and wineries. Activity data were collected for the years 1970 through 2030 and compared with activity data incorporated into CEFS, which backcasts and forecasts emission levels from a base year to some historical or future year.

The results of this project showed that, in general, the updated activity data collected by STI resulted in lower emission forecasts for 2030 than forecasts produced by the data currently incorporated into CEFS. For example, CEFS predicted a 65% growth in foam manufacturing activities in the Valley from 2002 to 2030, while the activity data collected by STI showed only a 16% growth in foam manufacturing over that same period. This paper will highlight methods and data sources utilized in this project and demonstrate how activity data collection efforts can improve estimates of historical and future trends in emissions.

3:10 **Break**

3:40 "Issues in the Use of Planning Models for Inventory Development," D. Long, America Electric Power Service Corporation; M. Koerber and M. Janssen, Lake Michigan Air Directors Consortium. - **CANCELLED**

In recent years, the inventories developed for use in large regional modeling exercises have begun to use planning models in an effort to better capture the issues involved in future growth of the electric generating sector. One area where debate has focused recently is the accuracy of the control decisions made by the Integrated Planning Model (IPM) as used in Clean Air Interstate Rule photochemical modeling scenarios vs the actual deployment of controls by the utility industry. In this paper we examine several different IPM simulations covering the Clean Air Interstate Rule and several other derivative simulations to determine how well these various simulations have captured the currently announced and underway control technology installations in the midwest, consider the implications of these findings on regulatory policy decisions being made by state and local air pollution control agencies, and offer suggestions on how to improve the predictions in the future.

4:05 “Using Emission Inventories for an Integrated Energy and Environmental Decision Making,” V. Bhatt and J. Lee, Brookhaven National Laboratory; E.Linky, US EPA; T. O. Carroll, State University of New York. - **CANCELLED**

Over the past several years, the US Environmental Protection Agency (EPA) has been leading the development of the National Emissions Inventory. This paper highlights the approach of using emission inventories for attainment of demonstration challenges for the next generation of air quality management programs. It uses an integrated energy-emissions-economic decision making methodology of the MARKAL model, which is a well established state-of-the-art tool for energy systems analysis, developed at BNL in the 1970s. The flexible nature of the modeling framework allows comprehensive modeling of highly interconnected energy sub-systems, including energy resources, central and distributed electricity generation technologies, transmission and distribution technologies, end-use consumption technologies, all sectoral demands, related energy emissions and any constraints or policy assumptions that may be applied to the energy system. MARKAL analysis can be done for a short-, medium- or a long-term planning horizon.

MARKAL concept was applied at an urban level with the New York City project, supported by a recent US EPA Region 2 grant, to address policies related to energy efficiency, green buildings, electricity peak-load reduction, urban heat island (UHI) and pollution prevention. US EPA’s Emissions & Generation Resource Integrated Database (EGRID) was used to model each electricity plant in New York City. Important parameters like resource mix, heat-rate, peak-load contribution, operational efficiency and emissions and other were used to model power plants with the installed capacity of 20 MW or more. Smaller generating units were aggregated on the basis of their fuel mix.

A case-study of the Lower Manhattan substation was selected to analyze the impacts of alternative end-use demand reduction strategies based on energy efficiency and UHI mitigation. Substation based electricity load patterns were supplied by the utility – Consolidated Edison. This study used the EnergyPlus model, developed by the US Department of Energy to quantify the heating and cooling electricity load characteristics and energy use of buildings, to analyze the impacts of building upgrades and differences in surface temperatures. EnergyPlus simulations were made for typical buildings in the case-study area and the resultant end-use demands were aggregated using the building inventory comprised of older construction and modern glass structures within the case-study area, and then linked to MARKAL for analyzing the substation based peak electricity load, citywide energy impacts and emission reductions.

This case-study highlights a “validation of concept” for an integrated framework. This framework provides a promising approach to stakeholders from electricity generation, transmission and distribution, urban and state energy planners, and users. Further “proof of concept” can be provided by implementing this framework at other case studies in New York City or at a regional or state level for attainment of demonstration challenges for the next generation of air quality management programs.

4:30 "Developing the WRAP Point and Area Source Emissions Projections for the 2018 Base Case," P. Fields and M. Wolf, Eastern Research Group, Inc; A. Pollack, ENVIRON International Corporation; T. Moore, Western Regional Air Partnership.

The Western Regional Air Partnership (WRAP) is assessing impacts and evaluating control strategies pertaining to regional haze within its geographic domain: States of Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming, and the Native American reservations located within these states. To assist the WRAP with this assessment, and to provide valuable inputs into the visibility models used by the WRAP's Regional Modeling Center, the WRAP and its contractors developed a base case emissions inventory of point and area sources for the year 2018. (Other inventories for other source types, such as mobile sources and fire, were addressed by other contractor teams and are not covered in this paper.)

This paper discusses the methods used to develop the WRAP 2018 base case inventory, including projections of area-wide oil and gas sources based on a new inventory developed for these sources especially for the WRAP analysis. Other parts of the methodology included (1) data collection from each state, local and tribal agency related to post-2002 "on-the-books" controls resulting from implementation or enforcement of consent decrees, new permit limits, new rules/regulations, and Early Action Compacts; and (2) determination of adjustments needed to reflect post-2002 conditions such as new facilities that had come on line and facilities that had retired or gone out of business. Growth factors were developed using information from DOE/EIA and the US EPA's EGAS (Version 5.0) model.

The results of the 2018 point and area source base case inventory were provided in several formats, including Excel pivot tables (i.e., for analysis of results at the state, county, facility, or SCC level), National Emissions Inventory Format (NIF) 3.0, and Sparse Matrix Operator Kernel Emission (SMOKE)/Inventory Data Analyzer (IDA) format.

The initial WRAP 2018 base case inventory for point and area sources was used by the WRAP RMC to model the planning target for the first regional haze planning milestone year. Then, the 2018 base case inventory was revised to correct omissions/errors in the original data set and to update some facility emissions, growth factors, and control factors. Details on the methods, data, assumptions, and results of the work to revise the WRAP 2018 base case emissions inventory for point and area sources will also be discussed in the paper.

Session 8. Global/International Issues

Chairs: Rebecca Tooly, US EPA
Marc Deslauriers, Environment Canada

1:30 "Reconciliation and Comparison of Regional and Global Emission Inventories," G. Stella, Alpine Geophysics, LLC; T. Keating, US EPA.

Once thought of as a local issue, air pollution is now recognized as a complex problem subject to local, regional, hemispheric, and global influences. Observations from surface sites and satellites, combined with predictions from global atmospheric models, suggest that air pollution transported between distant countries on an intercontinental scale can significantly affect the ability to achieve air quality objectives.

One obstacle that scientists face in assessing intercontinental flows of air pollution is the lack of high quality and officially-recognized emissions estimates for many parts of the world. Since 1990, the Global Emissions Inventory Activity (GEIA) has attempted to make accessible global gridded emissions estimates to support atmospheric modeling studies. Until recently, GEIA has only included a few data sets. For ozone and aerosols, almost all global air quality modeling efforts have relied on a single emissions data base, the Emissions Database for Global Atmospheric Research (EDGAR).

The purpose of this analysis is to compare emission estimates contained among various regional and international emission inventories, centering on emissions in the continental United States and to reconcile differences based on the alternate methods of emission inventory preparation.

1:55 "India PM10 Emission Inventory Training and Capacity Building Programs: EPA Efforts for Developing a Sustainable Foundation," P.Gaffney and M. Benjamin, California Air Resources Board; T. MacDonald, US EPA; J.Core, Core Environmental Consulting; A. Ojha, Air Quality Management Cell, Pune, India.

Between 2003 and 2006, the US EPA's Office of International Affairs organized, sponsored, and deployed four unique emission inventory training and capacity building projects in India. These projects were developed and planned through a Memorandum of Understanding between the EPA and the Indian Ministry of Environment and Forests. They are part of an ongoing partnership between the US and India to enhance in-country capabilities to better understands and improves air quality in India. In addition to emission inventory projects, the overall EPA/India air quality program includes projects related to air quality monitoring, modeling, and control strategy development, and is supported by multiple sponsors and collaborators.

This paper focuses on the four emission inventory capacity building projects designed to provide a foundation for developing sustainable emission inventory programs within India's cities, states, and ultimately, nationally. Each project was completely distinct, ranging from traditional classroom sessions, to highly interactive, hands-on intensives to develop actual emission estimates. We will discuss the objectives of each project, the ways in which they succeeded, where they fell short, and the benefits of the entire program to date. Our hope is that this work and the lessons learned will assist other countries that are in the early stages of developing their emission inventory programs.

2:20 "Completion of the 1999 Mexico National Emissions Inventory - Lessons Learned," P.G. Fields, and M. E. Wolf, Eastern Research Group, Inc; V. G. Bravo and L. Rojas-Bracho, Instituto Nacional de Ecologia, Mexico; R. Halvey, Western Governor's Association.

The 1999 Mexico National Emissions Inventory was recently completed. This inventory includes annual estimates for seven pollutants (NO_x, SO2, VOC, CO, PM_{10}, $PM_{2.5}$, and NH3) for point, area, on-road motor vehicle, nonroad mobile and biogenic sources. The inventory includes emissions for each of the Mexican states, including the Federal District, plus each of Mexico's 2,443 municipalities. The project was sponsored by the US EPA, Western Governors' Association, North American Commission for Environmental Cooperation, and Mexico's Secretariat of the Environmental and Natural Resources) and the National Institute of Ecology.

This paper provides an overview of the objectives and scope of the 1999 Mexico NEI, building upon previous papers written on the process and progress in the past. Results are presented by pollutant, source type and source category, and by state or geographical area. Also, the process used to develop the emissions modeling files is described, including quality assurance and gap-filling techniques used to provide all of the information required for the NIF and SMOKE/IDA formats and subsequent air quality modeling. (Note that another paper by Iniestra, et. al. describes the details of the SMOKE/IDA processing and air quality modeling of the 1999 Mexico NEI emissions using CAMx.)

The project team shares its perspective on "lessons learned" during planning, data collection and dissemination, and reporting of the Mexico NEI, with the objective of providing a basis for improving the quality of available information, and generating information that is currently not available for inventory purposes. For example, certain source categories were not included in the 1999 Mexico NEI such as paved and unpaved road dust; reasons for this will be explained and suggestions will be made for including these sources in future versions of the inventory. Perspectives related to the human and material resources that are needed to successfully complete such an extensive effort will be provided, along with plans for the future such as developing emission projections to future years.

2:45 "Emissions Inventorying as an Integrated Part of the State-of-the-Art Air Quality Management System, AirQUIS," C. Guerreiro, H. Laupsa and R. Odegard, Norwegian Institute for Air Research.

AirQUIS, developed by the Norwegian Institute for Air Research (NILU), is a GIS based integrated management system that includes a user interface, comprehensive measurement and emission inventory databases, and a suite of models for use in simulating ambient air concentrations and exposure.

This paper presents the AirQUIS module for emission inventorying, and its use for assessment, modelling and management of air quality on urban/agglomeration scale. This tool contains the necessary forms and functionalities for producing a complete, detailed bottom up atmospheric emissions inventory for any region, typically a city. Excel based templates have been developed for source information and data collection. These templates can easily be imported into the AirQUIS emission module. The emission information collected in the system is accessed directly by the emission model, which generates the necessary spatial and temporal emission data for use in the dispersion-modelling module of the system.

The emission inventory tool organizes the emission data by three types of source: point, area and line. The emission inventory for point sources includes facility identification, position, release characteristics, as well as technical stack parameters. Sources treated in the tool as area sources are typically smaller or more diffuse sources of pollution (e.g. space heating, open air burning, gas stations, etc) provided either in the form of administrative districts or as regular gridded data. Vehicle emissions from road transport are treated in the line sources section. Data required are: position and physical characteristics, e.g. slope, number of lanes, etc., as well as link-specific dynamic traffic data for each road link in the road network, such as annual daily traffic, vehicle type distributions, traffic speed and traffic emission factors. Emissions data are distributed temporally using time variation factors on the average annual emissions.

The emission inventory tool is used to assess and aggregate the contributions from individual sources, source categories and geographical areas. The GIS platform is used for the visualization, presentation, update and management of the emission data. Functionalities for studying the impact of emission abatement measures on air quality are also included as part of the air quality management system.

3:10 **Break**

3:40 "Harmonization of National Inventory and Projections of Multi-Pollutant Emission Scenarios," T. Pignatelli, G.Vialetto and I.D. Elia, Italian Agency for New Technology, Energy and the Environment; R. DeLauretis, M. Contaldi, and D. Romano, Italian Agency for Environmental Protection and Technical Service, Italy.

In the development of environmental policies, within both the context of the 27 Member States of the European Community and the larger context of the UN-ECE Convention on Long Range Transboundary Air Pollution, there is the need of accurate assessment of the national emission inventories and projection of air pollutant emissions. This task is carried out at EU27/Convention level, as well as at national level, by Member States and Parties. Especially at EU level, where the mandatory directives on air quality are driven by emissions & projections data, the consequences of unrealistic emission objectives, deriving from low quality in inventories and projections can dramatically affect the economic life of the Countries. Therefore, for a number of years, Italy has put great efforts in establishing appropriate methodologies to achieve the best quality, as possible, in the inventory and emission projection assessment. This paper describes the adopted methodology, as well as the results, in terms of harmonization between inventory and emission projections and in terms of compliance with the targets and emission ceilings established for Italy by the EU Directives and the Gothenburg Protocol of the Convention, for the concerned air pollutants. The latest inventories and emission scenarios developed for the purposes of the review process (still in progress) of the EU Directive on Emission Ceilings, through a proper Integrated Assessment Model (RAINS_Italy), are reported.

4:05 “New Insight into the Role of Wood Combustion as Key PM Source in Italy and in Lombardy Region,” S. Caserini, A. Fraccaroli, A. M. Monguzzi, M. Moretti, and E. Angelino, ARPA Lombardia, A. Leonardi, R. De Lauretis, APAT (National Environmental Protection Agency); V. Zanella, C.R.A. Customized Research & Analysis, S. Marengo, Stazione Sperimentale, Donato Milanese, Italy.

The work provides new evidence of the importance of wood combustion as a key source for $PM_{2.5}$ and toxic emissions (i.e. PAH) both at national (Italy) and at local (Lombardy Region) level. A specific survey, based on CATI (Computer Assisted Telephone Interviewing) and TELEPANEL techniques, has been undertaken. Data were statistically analyzed in order to allow an estimate of wood consumption in different Italian regions. The research confirms and updates previous assessments of the entity and patterns of the use of wood for domestic heating in Italy and in Lombardy, highlighting its large use, in particular in the sub-Alpine and Apennine area. Details on used types of combustion installations and temporal split of wood use are provided.

Collected data allow a better estimation of wood combustion emissions from old residential equipments that represent an important share of primary PM_{10} emissions in Italy and in Lombardy Region. Domestic appliances for wood combustion are responsible for up to 90% of the primary emitted fine particulate from non-industrial combustion in Italy. This share increases when natural gas, characterized by very low primary PM emissions, represents the only alternative fuel used.

Although the large variability of PM emission factors for wood combustion (depending on type of wood, combustion devices, etc.) is an important source of uncertainty for PM emissions, this work stresses the importance of technological improvements as well as new policy for emission reduction in this sector.

Session 9. GIS Assisted EI Development

Chairs: Wayne Boulton, RWDI
Sally Dombrowski, US EPA

1:30 “A Detailed Urban Road Traffic Emissions Inventory Model Using Aerial Photography and GPS Survey,” V. Gois and H. Maciel, InventAr, P. Torres, S. Mesquita and F. Ferreira, Comissão de Coordenação e Desenvolvimento Regional de Lisboa, C. Almeida and L. Nogueira, Departamento de Ciências e Engenharia do Ambiente, Portugal.

The European Union (EU) legislation defines specific “zones” according to population density that require air quality to be assessed with greater detail. Such is the case of the “Greater Lisbon Zone” which is surveyed by a network of 24 monitoring stations and occasional extensive monitoring procedures using passive sampling or low-volume samplers. Given the relevance of road traffic air emissions in this urban area, results from the monitoring network had to be complemented with a detailed inventory of air emissions and air quality models. An alternative methodology was developed and tested to estimate traffic flows and air emissions at a very detailed level (road by road) while circumventing the high cost of implementing a more extensive monitoring system for road traffic. This new methodology is a bottom-up approach based in car counting from aerial photographs associated to GPS data to assess average speed of traffic flows, also for each road link. The inventory is adjusted to the total fuel consumption within the region (top-down approach).

Since 2004 the methodology is being tested in the air emission inventory of the Lisbon region and already six municipal areas are covered. In order to test the methodology the estimates of traffic flow have been compared with car counting. Air emissions were also compared, with good results, to measurements of air quality with passive samplers using multivariate statistical models.

This alternative methodology has the advantage of being sustained in real field data. The analysis demonstrates that it is particularly suitable for dense urban areas where road traffic is a prevalent factor in air quality, allowing better resource management and cost saving.

1:55 "Pollutant Emission Register in the Netherlands", B. Leekstra and G. J. Stolwijk, Environmental Assessment Agency, the Netherlands.

In the Netherlands, the first steps for the establishment of an integrated Pollutant Release and Transfer Register (PRTR) were made in 1974. Since then, following the development of ICT, several updates of the database application have been performed including a close integration with GIS. In the last eighteen months, a new update of the application and database has been carried out. The objective was to develop an integrated web-based tool allowing:

- the emission inventory experts to annually update their emission calculations on-line;
- the database management group to calculate emission totals at the national level in order to comply with international formats for reporting to the EU and UN, like CRF and NFR, but also the regional and local level (provinces, water boards, municipalities, 5*5 km);
- to show emissions to the public, as an implementation of the Aarhus requirements;
- to allow the professional "data-user" (policy-advisors, modeling experts) to extract data from the database.

The new database comprises emission data on air, water as well as on soil. Furthermore, the database integrates emission data of large point sources and diffuse sources. Emissions form large point sources are derived from the Annual Environmental Reports (AER). The electronic application of this AER is linked to the national PRTR database. Emissions from diffuse sources at the national level are calculated by emission experts, on the basis of activity data and emission factors. After approval of these data by the involved institutes, these data are regionalized geographically Emissions of large point sources are located at the location of the site; diffuse sources on the basis of GIS and a number of general parameters (like population density, animal density, traffic intensity).

The emission data from this database are used to evaluate environmental policy at the (inter)national as well as the regional level.

2:20 “GIS Assisted Emission Inventory Development for Variable Grid Emission Database for Mississippi Region,” J. Indracanti, V. S. Challa, R. L. Hughes, J. M. Baham, C. Patrick, M. Rabarison, J. Young, and Y. Anjaneyulu, Trent Lott Geospatial and Visualization Centre; S. Swanier, Jackson State University.

The present paper discusses methodology and highlights the results of the model for preparing variable grid emission inventory database using existing macro level emission database for inputting into pollution/chemistry – climate models. The fundamental goal behind the work is to prepare variable grid air pollution seasonal emission database for using in Community Multiscale Air Quality Model (CMAQ) system and development of microscale / mesoscale coupling of air pollution dispersion for Mississippi Gulfport area. A Geographical Information System (GIS) based methodology for distributing the emissions from macro scale inventory to finely gridded emission values (microscale), considering local micro¬level details, emission sources, activity data and season of the year using relational data structure is described. For the model description, model performance a case study of Mississippi region is presented.

The US EPA AP-42 emission factors database is taken as the source for the development of emission inventory in conjunction with GIS database for landuse / land cover, point data sources. Various stochastic geo¬statistical interpolation techniques were tested for spatial mapping under GIS environment. The model is to used compute non-biogenic emissions at non¬sampled location and it is anticipated that in the future the model will incorporate the satellite derived vegetation indices and leaf area index database for development of comprehensive emission inventory for both biogenic and non-biogenic emissions.

2:45 “Application of an Emission Inventory GIS-Based Tool across the Michigan/Ontario Border,” M. V. Altena, J. W. Boulton, S. Pellatt, and M. Lepage, RWDI AIR, Inc, Ontario Canada.

This paper presents the application of an Emission Inventory GIS-based software system called EIGIS across a geographic area covering Detroit, Michigan and south-western Ontario. The common goal behind these two related projects was to examine how EIGIS could be used to improve the current emission inventories for transboundary modelling applications.

The EIGIS software system is based on 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 EIGIS tool can also be used to analyze emissions data, generate reports and prepare model input files from the computed emissions inventories. Both projects involved a detailed examination of how emissions for specific sectors were being computed, and how they could be improved by adopting a bottom-up approach using EIGIS. GIS-based activity data were obtained and imported into EIGIS, which was then used to compute the emissions at the geographic feature level.

Session 10. Managed Burning & Wildfires

Chairs: Scott Goodrick, USFS
Amber Soja, NASA

3:40 "EPA's Perspective on Fire Emission Inventories - Past, Present, and Future," T. G. Pace, US EPA.

This presentation will outline the ongoing progress to improve fire emissions estimates in the National Emissions Inventory (NEI). Each year, the US Environmental Protection Agency estimates the emissions from all important sources of air pollutants and makes this information available to the public in the NEI. The NEI is often used as the basis for air quality modeling to estimate the pollutant concentrations found in the air due to various sources, including fires. Modelers need hourly emissions from each fire and its location. Also, an estimate of the heat release from the fire is needed so the initial plume rise can be estimated. This type of information is challenging to gather for stationary sources that operate in a single location all year with a relatively stable and predictable process. Fires present an even greater challenge owing to their transitory nature and the wide range of fuel types, fuel conditions, and terrain, meteorology and suppression efforts encountered.

The development of a fire inventory has evolved over time from relatively crude "rules of thumb" for emissions from fires in different parts of the US into a more sophisticated process where fire events are compiled into electronic databases and input to emission models to estimate fuel consumption, emissions and heat release. The future holds promise for even better databases and emissions models by exploiting satellites to detect fires (as a supplement and quality enhancement to ground-based fire data records). Satellites can also be used to track plume movement and to characterize fuels and fuel characteristics in near-real time.

4:05 "Development and Demonstration of Smoke Plume, Fire Emissions, and Pre-and Post-Prescribed Fire Fuel Models on NC Coastal Plain Forest Ecosystems," R. Mickler, C. Geron, M.Rorig, and A. Bailey, Alion Science and Technology.

Prescribed fire research on the coastal plain of NC is providing fire management tools to land managers that integrate fuel loading, fire emissions, and smoke plume measurements and modeling. The ongoing study includes activities which (1) Inventory, map, and model live and down woody debris/fuels biomass utilizing USDA Forest Service Forest Inventory and Analysis P2 and P3 field plot protocols, develop fuel loading formulas for fire behavior models in the Alligator River National Wildlife Refuge and the Air Force Dare County Bombing Range in the NC Coastal Plain, and incorporate data from Coastal Plain forest types into the fuel characteristic classification (FCC) system and the FARSITE fire behavior model; (2) Validate the USDA Forest Service PB-Coastal Plain smoke model, the BlueSky smoke prediction system, and the BlueSky Rapid Access Information System (BlueSkyRAINS) for the near-coastal land-water interface, including differences in vegetative land use; (3) Characterize photochemically active and radiatively important trace gases as well as PM emissions from prescribed burns in Coastal Plain forest types and histosol soils, and (4) Deliver personal computer and web-based decision support tools for estimating inputs of live biomass and down woody debris/fuels into a fire behavior model, real-time smoke plume models, and an emissions model for prescribed burns for use by federal and state land managers in NC specifically, and other users throughout the Coastal Plain of the southeastern US. Fuel loading, emissions, and smoke dispersion model output have been developed for prescribed burns at several locations for burns ranging in size up to 2,000 acres.

4:30 "Carbon, Trace Gas, and Particulate Emissions from Wildfires in the Boreal Regions of North America," N.H.F. French, Michigan Technological University; E.S. Kasischke, College Park; M. R. Turetsky, Michigan State University; W. de Groot, Northern Foresty Centre, Canada; R. Honrath, Michigan Technological University; R. Ottmar, Pacific Northwest Research Station, USDA.

Large wildfires in the boreal region of Canada and Alaska are prevalent and have an impact on the atmospheric concentrations of CO_2, CO, O_3, NO_x, and CH4 across North America. In addition, new evidence indicates wildfires in the boreal forest regions generate substantial amounts of mercury emissions. Due to recent climate change, the average burned area in the NA boreal region has more than doubled, and the deep organic layers are more vulnerable to burning because of warming of permafrost and drying of peatlands. As a result, large regional fire events over short time periods produce very high rates of emissions. The cool, wet conditions that have promoted the build up of organic carbon in deep duff and peat layers also have facilitated mercury accumulation in organic soil layers for millennia. Since boreal fires combust dead surface organic matter in forests and peatlands, carbon and mercury releases can be as high as 4 to 8 kg C-m-2 and 2 to 7 mg Hg-m-2 per fire event. These emissions significantly affect concentrations far downwind. For example, during summer 2004 there were times when CO from the Alaska/Canada fires exceeded anthropogenic CO over US cities.

With funding from NASA, the Joint Fire Science Program, NSF, and the Canadian Government, US and Canadian researchers have been developing a consistent methodology to estimate carbon, trace gas, and particulate emissions from wildfire. Models to estimate the consumption of the forest floor and peatlands in boreal North American are being developed to study terrestrial carbon cycling and estimate trace gas emissions. Measurements of atmospheric CO, O_3, nitrogen oxides, and equivalent black carbon show boreal fires to be of great importance to levels of these gas and aerosol species on the continental to hemispheric scale. The work we present examines how fuel consumption varies in the deep surface organic layers found in many boreal forests and peatlands, and how factors controlling the variations in fuel consumption influence inter-annual to decadal variations in the North American terrestrial carbon budget and the emissions of CO, mercury, and ozone precursors.

Thursday May 17, 2007

Session 7. Emission Projections

Chairs: Linda Chappell, US EPA
Dan Loughlin, US EPA

8:30 "EMPAX-CGE: Application Capabilities as an Economic Driver for Emissions Projections," A. Rios, US EPA.

EGAS 5.0 is EPA's tool for calculating emissions growth factors. It currently utilizes economic activity data from the Department of Energy and REMI 5.5 and 6.0 to drive emissions on a state level. Although REMI 6.0 provides the economic data used for the majority of EPA's non-EGU emissions projections, it lacks the specifications needed to consistently project economic growth in the energy-intensive sectors that generate the highest quantities of non-EGU emissions. REMI does not incorporate EPA's current and future rules, regulations, and standards as well as the control strategies required to comply with these regulations and standards. As a result, REMI's economic growth path driving EGAS 5.0 is not set up to adjust to output changes in the affected sectors caused by EPA regulation and tends to over estimate future emissions growth projections. EMPAX-CGE is a computable general equilibrium model of the US manufacturing sectors developed by EPA for the purpose capturing changes in the economy and its growth path resulting from compliance with EPA regulations. It interlinks the energy intensive sectors into regional economies that allow for cross regional trading and movement within sectors. EMPAX-CGE's dynamic component permits market clearing over multiple time horizons and generates an economic growth path in five year intervals (2005 to 2050). This paper details the merger of EMPAX-CGE with EGAS 5.0 which may create a system that more accurately and consistently projects emissions for the sectors considered significant to the emissions inventory. As EMPAX-CGE is further developed into a state level model, it can replace REMI as the main economic driver for the energy-intensive sectors in EGAS.

8:55 "Projecting Future-Year Pollutant Emissions: Emerging Methods and Tools from the EPA ORD Global Change Air Quality Assessment," D. Loughlin, B. Bierwagen, A. Grambsch, B. Hemming, T. Johnson, and C. Shay, US EPA; B. Benjey and A.Gilliland, NOAA.

Many areas of the US currently are not meeting air quality standards for tropospheric ozone and fine particulate matter. Expected future economic expansion, population growth and migration, and climate changes have the potential to exacerbate air pollution further. In contrast, factors such as energy efficiency improvements, smart growth approaches, and various federal, state, and local actions may yield decreasing emissions rates. It is important that decision-makers have the information necessary to identify future risks associated with air quality and to act proactively and effectively to moderate or adapt to those risks.

To this end, the Office of Research and Development of the US Environmental Protection Agency is carrying out a Global Change Air Quality Assessment in which we are exploring the effect of various factors on future year air quality out to 2050. A number of methods being used within the air quality assessment have the potential to benefit Federal, state, regional, and local emissions and air quality modeling applications. For example, we are modeling future-year climate changes to evaluate potential impacts on heating and cooling demands. We are also exploring approaches for projecting future-year county-level populations and land use changes. These forecasts, in turn, feed the US EPA MARKet ALlocation model to explicitly model technology change and its impacts on fuel use and pollutant emissions.

The goal of this presentation will be to convey the methodological developments from the ORD Global Change Air Quality Assessment and to discuss their potential relevancy to other emissions and air quality modeling applications.

9:20 "Accounting for Land us**e** Changes in Projecting Future-Year Emissions Scenarios," A.Eyth, L. Ran, and Z. Adelman, UNC at Chapel Hill; D. Theobold, Colorado State University.

Air quality modeling is performed for several future year time periods in support of regulatory analyses to assess the likelihood that areas will be in attainment after the application of proposed emissions controls. Typical years that are modeled include 2009, 2014, 2020, and 2030. Currently, changes in land use are not considered when the emissions for these future year scenarios are generated. These changes could be important to include for more realistic modeling results, especially in areas in which rapid development is underway. In this paper we will explore potential methods for incorporating land use changes into the regulatory air quality modeling process for future years. We will investigate using outputs from the Integrated Climate and Land Use Change Scenarios (ICLUS) project to inform the spatial allocation of future year emissions, such as data output from the Spatially Explicit Regional Growth Model (SERGoM). We will also examine the likely impact on emissions model results, air quality model results, and on regulatory decisions if a methodology for projecting future land use were to be incorporated into the regulatory modeling process.

Session 10. Managed Burning & Wildfires

Chairs: Scott Goodrick, USF
Amber Soja, NASA

8:30 Incorporation of Federal Land Manager Estimates of Prescribed Burning into Emission Projections Developed for the VISTAS Regional Planning Organization," W. R. Barnard, MACTEC, Inc; P. Brewer, VISTAS; G. Stella, Alpine Geophysics.

In recent years the importance of wild and prescribed fires to visibility improvement has been widely recognized by air quality regulators and scientists. One of the primary items that air quality regulators and scientists have been working to try and understand is how to balance the usage of prescribed fire as a tool of Federal Land Managers (FLMs) to assist in restoration of habitats and control of wildfires. One of the primary issues related to prescribed burning is how to incorporate projected increases in the number of acres burned with the Clean Air Act Amendments visibility projection goals. This paper discusses the approach used by the Visibility Improvement State and Tribal Association of the Southeast (VISTAS) Regional Planning Organization (RPO) to incorporate projected increases in prescribed fire acres burned by the US Fish and Wildlife Service and the USDA Forest Service. Due to the nature of the data available, slightly different approaches were used in incorporating the data from each agency into the 2009 and 2018 emission projections prepared for VISTAS. Both methods are discussed in this paper.

8:55 "Developing a Near Real-Time Regional System for Modeling Air Quality Impacts of Prescribed Fire Emissions-Linking State Fire Activity Information with Regional Scale Air Quality Models," S. Goodrick, G. Achtemeir, and Y.Liu, U.S Forest Service; J. Brenner, Florida Division of Forestry.

Emissions from wildland fires are becoming of increasing importance with recent changes to air quality regulations regarding $PM_{2.5}$ concentrations and regional haze. Wildfire reporting is fairly well handled, especially when compared with the reporting of prescribed fire activities. Information on prescribed fire emissions ranges from good to nonexistent. With states developing/implementing Smoke Management Plans, the status of prescribed fire emissions information will begin to improve; however differences between states on the information captured in their prescribed fire reporting systems will likely lead to some difficulties in working with the data. The Southern High Resolution Modeling Consortium, as a potential user of this data, has begun work on a flexible database system designed to bring data from the various states together in a consistent format for use by the air quality community. The basic operations of the modeling system and fire activity database will be demonstrated using prescribed fire activity data from the state of Florida.

9:20 "Global Near Real Time Estimates of Biomass Burning Emissions using Satellite Active Fire Detections,"J. Al-Saadi and B. Pierce, NASA Langley Research Center; A. Soja, National Institute of Aerospace/NASA; C. Kittaka, SSAI; L. Emmonds, NCAR; S. Kondragunta and X. Zhang, NOAA NESDIS; Todd Schaak, Space Science and Engineering Center; J.Szykman, US EPA.

We present a new technique for generating daily global estimates of biomass burning emissions suitable for use in models forecasting atmospheric chemical composition and air quality. We combine ecosystem-dependent carbon fuel databases, fire weather severity estimates, and near-real-time satellite fire detections from the MODIS instruments to estimate the amount of carbon released from active fires. Emissions of CO, NO_x, and hydrocarbons are then estimated using ecosystem-dependent emission ratios. These emissions estimates have been used to provide global chemical and regional aerosol forecasts for much of 2006 using the NASA/University of Wisconsin Realtime Air Quality Modeling System (RAQMS). The largest overall uncertainty in this approach lies in inferring area burned from instantaneous active fire detections. Here we evaluate emissions for spring and summer of 2006 by intercomparing our emissions estimates with three other approaches using satellite fire detections over regional to global domains: 1) NOAA GOES fire detections over the continental US, 2) MODIS fire and landcover products over North and Central America, and 3) 8-day composite MODIS detections applied to global GFEDv2 emissions. Overall we find there are large differences in area-burned estimates, particularly for small fires. We compare RAQMS global CO redictions with observations from the MOPITT and TES instruments over regions where biomass burning is significant. CO emission estimates from burning are consistent with satellite observations over the US but we find large discrepancy in three out of four regions of large tropical burning.

9:45 **Break**

10:15 "Use of Environmental Satellite Imagery for Smoke Depiction and Transport Model Initialization," M. Ruminski and S. Kondragunta, and R. Draxler, NOAA.

The National Oceanic and Atmospheric Administration (NOAA) produce a daily satellite based smoke and fire analysis for the US. The capability to specify smoke concentration levels and to identify the start time, duration and areal extent of a particular fire which is producing smoke emissions has recently been added.

Smoke concentration values are obtained from visual inspection of animated Geostationary Operational Environmental Satellite (GOES) visible band imagery in conjunction with output from the automated GOES Aerosol and Smoke Product (GASP). There are three categories of smoke concentration utilized: 5, 16 and 27 μg/m3, which correspond to light, medium, and dense smoke respectively. The smoke concentration values are available for air quality managers and other users to download and/or view as GIS shapefiles.

The initial time and duration of smoke emissions are also obtained through inspection of animated GOES visible imagery by an analyst. This information is incorporated into the Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model which produces a 48 hour forecast of smoke dispersion and transport. In addition to approximating smoke emissions and the diurnal variations observed in wildfires the specification of emission duration allows for the representation of short duration agricultural and prescribed burns as well.

A number of examples depicting various smoke concentrations, including fires of different size and duration, will be shown. HYSPLIT performance in depicting the observed smoke will also is presented.

10:40 "A Methodology for Estimating Area Burned Using Satellite-Based Data in Near Real Time," A. Soja, National Institute of Aerospace; J. Al-Sasdi, B. Pierce, C. Kittaka, and J. Szykman, NASA Langley Research Center; L. Giglio, Science Systems and Applications, Inc; S. Raffuse, Sonoma Technology; D. Roy, D. J. Williams, T. Pace, and J. Kordzi, US EPA; D. Randall, Air Sciences Inc; T. Moore, Colorado State University.

Biomass burning is significant to emission estimates because: (1) it is a major contributor of particulate matter and other pollutants to the atmosphere; (2) it is one of the most poorly documented of all sources; and (3) it can adversely affect human health. Additionally, biomass burning can be a significant contributor to a regions inability to achieve the National Ambient Air Quality Standards for $PM_{2.5}$ and ozone, particularly on the top 20% worst air quality days.

The United States does not have a standard methodology to track fire occurrence or area burned, which are essential components to estimating fire emissions. However, satellite imagery is available almost instantaneously and has great potential to enhance emissions estimates and their timeliness. Over the last years, we have worked to statistically define the amount of area burned that could be defined by satellite-derived data in Near-Real-Time. Without this background information, potential error could not be assigned to area burned estimates and confidence in satellite-based emissions estimates was limited.

The goals of this investigation are: (1) to demonstrate the ability of satellite-derived fire products to quantify ground-based estimates of area burned; and (2) to suggest a methodology to improve area burned estimates in an effort to enhance existing emissions estimates to the large-scale National Emissions Inventory. First, we will briefly show a statistical analyses comparing 2002 ground-based area burned data to satellite-based data [MODIS (Terra and Aqua) thermal anomaly and GOES]. This analysis demonstrates that MODIS data captures most of the area burned by wildfires, and GOES shows an enhanced ability to capture agricultural fires. We estimate that by combining these satellite-based data products, satellite data are able to capture 93 to 110% of the total area burned by wildfire, prescribed, agricultural and rangeland burning.

11:05 "Sensitivity of CMAQ Simulations to Prescribed Burn Emissions under Varied Plume Core Numbers," Y. Liu, G. L. Achtemeier, and S. L. Goodrick, USDA Forest Service.

Recent studies with Daysmoke indicate the importance of plume-core number for smoke transport and dispersion processes. Since Daysmoke is a tool used to estimate plume rise and vertical distribution of smoke particles for our CMAQ simulations of prescribed burns, it is expected that the CMAQ simulations would be sensitive to plume-core number. This study seeks to understand this sensitivity. An experiment is first conducted using the Fourier amplitude sensitivity test (FAST) to identify the most important parameters in the calculation of plume rise with Daysmoke. This technique determines the relative contribution of individual model input parameters to the variance of the model output. A set of 13 parameters is examined with a range of values for each parameter specified based on measurements of prescribed burning or empirical estimates. The result indicates that plume-core number is among the most important parameters for the estimation of plume rise. CMAQ simulations of a prescribed burn are then conducted with different plume-core numbers. The burn was implemented at the Brush Creek unit of the Cherokee National Forest near the Tennessee-NC border on March 18, 2006 with about 1656 acres burned. Fire emissions are estimated using a forest fuel and fire modeling scheme. The atmospheric conditions are obtained from an MM5 simulation. It is shown that the simulations are significantly dependent on the plume-core number. The simulated ground PM concentrations are remarkably larger for multiple-core smoke updraft than single-core one.

11:30 "Synthesis of Multiple Observations Using a Regional Aerosol Assimilation/Forecast Model (RAQMS) and Assessment of Biomass Burning Emission Estimates," C. Kittaka, SSAI, NASA Langley Research Center; B. Pierce, J. Al-Saadi, D. Winker, C. Hostetler, NASA Langley Research Center, Hampton VA; T. Schaack, University of Wisconsin; A. Soja, National Institute of Aerospace; Greg Tripoli, University of Wisconsin; A. da Silva, NASA Goddard Space Flight Center; J. Szykman, US EPA; T. Baynard and R. Spackman, NOAA; B. Lambeth, Texas Commission on Environmental Quality.

This study presents the synthesis of multiple observations using a regional aerosol model (RAQMS) to evaluate biomass burning emission estimates and assess consequent impacts on air quality. During the NOAA 2006 TexAQS II field study observations from different platforms, such as the MODIS and CALIPSO satellites, aircraft and ground, are available. These combined resources provide an opportunity for detailed interpretation of factors influencing local air quality. However, their utilization is not straightforward due to difficulties in incorporating data that are at different temporal and spatial resolutions.

A 3D aerosol assimilation/forecast model can be an effective tool for linking multiple observations. To demonstrate this we investigate aerosol loading due to wildfire emissions during Aug - Sept, 2006, and discuss biases in wildfire emission estimates. We assimilate MODIS aerosol optical depth (AOD) using RAQMS. RAQMS-MODIS AOD analysis increments are used to quantify errors in biomass burning emission estimates. CALIPSO observations are used to evaluate the altitudes of aerosol transport. The NASA Langley High Spectral Resolution Lidar (HSRL) and in-situ measurements obtained during the 2006 TexAQS/GoMACCS field experiments are used to evaluate the model performance and to assess the impact of wildfires on local air quality. This study shows an impact of biomass burning emissions over the Pacific Northwest on air quality over eastern TX in early Sept, 2006. Furthermore, this study suggests a possible bias in the biomass emission estimates.

11:55 "On the Multiple-Core Updraft Smoke Plume Problem: Is the Genie Out of the Bottle?"
G. L. Achtemeier, S. L. Goodrick, and Y. Liu, USDA.

The Daysmoke plume model is designed to simulate smoke emissions and dispersion from prescribed burns in the manner in which the burns are conducted by land managers. Recent results with Daysmoke regarding multiple-core updrafts have confirmed our suspicions that the dynamics of smoke plumes from prescribed burns are more complex than the dynamics of plumes from point sources such as industrial stacks. Therefore, simple plume rise algorithms and models designed to simulate plume rise from point sources cannot be expected to correctly place smoke vertically in the atmosphere – a critical factor for the accurate prediction of downwind smoke concentrations at ground level.

Although Daysmoke has identified the multiple-core updraft smoke plume as a significant contributor to uncertainty in predictions of smoke concentrations at the ground, the model has not offered any pathways to solve the problem. To date we cannot offer substantive explanations of why some burns develop single-core updrafts while other burns develop multiple-core updrafts. Furthermore, updraft core numbers may vary during the lifetime of some burns thus increasing the complexity of the problem.

The experimental rule-driven fire spread model (Rabbit Rules) shows promise for identifying updraft core numbers. Rabbit Rules can simulate complex fire behavior including some phenomena associated with coupled fire-atmosphere interactions. Rabbit Rules may provide updraft core data in three ways – the number of discrete low pressure centers generated by heat released from the fire on the scale of 10's to 100's of meters, the number of independent ground-level wind circulations generated by heat released from the fire on the scale of 10's to 100's of meters, and the number of heat centers contained by the burn on the scale of 1's to 10's of meters.

Session 11. Fugitive Dust

Chairs: Illias Kavouras, DAS, NV
Rodney Langston, Clark County

8:30 - 9:45 This session will consist of a panel discussion focusing on the results of a multi-component study conducted in Clark County, Nevada. This study is titled "The Preferred Alternative Method for Measuring Paved Road Dust Emissions for Emissions Inventories: "Mobile Technologies vs The Traditional AP-41 Methodology" and the authors are R. Langston, R. S. Merle Jr, and D. Hart, Clark County Department of Air Quality and Environmental Management; V. Etyemezian, H. Kuhns, and J. Giles, Desert Research Institute; D. Fitz and K. Bumiller, Center for Environmental Research and Technology, University of California; D. James, Department of Civil and Environmental Engineering, University of Nevada. Several of the authors will participate on the panel discussion.

This paper discusses Clark County Nevada's experiment completed in September of 2006, which used two vehicle-based technologies to estimate paved road dust emissions, TRAKER (Testing Re-entrained Aerosol Kinetic Emissions from Roads), developed by the Desert Research Institute (DRI), and SCAMPER, (System of Continuous Aerosol Measurements of Particulate Emissions from Roadways) developed by the University of California in Riverside (CE-CERT).

Motor vehicles produce a significant fraction of the PM_{10} emissions in the western United States. AP-42 (USEPA, 2006) measurements are time-consuming, require lane closure to collect samples, and don't consider vehicle speed, frontal area, drag coefficient or silt reservoir depletion.

The experiment was designed to:

1. Examine and quantify relationships between vehicle-based technologies and AP-42 silt loading measurements.
2. Evaluate paved road dust emissions absent of replenishing sources.
3. Determine and quantify the relationships of emissions measured using PM_{10} horizontal flux tower techniques, mobile measurement systems, and AP-42 methods.

Representative soil was evenly applied to an 800-meter section of road surface. SCAMPER and TRAKER made repeated test runs while an instrumented tower measured upwind-downwind horizontal PM_{10} flux measurement. AP-42 methods were used to collect samples and calculate PM_{10} emission factors. Both silt loadings and vehicle speeds were varied during the experiment.

Both TRAKER and SCAMPER measured rapid decay of the PM_{10} emission rate. Monitoring of a fluorescent silt surrogate, tower flux and AP-42 silt loading measurements were consistent with the mobile methods. Decaying particle suspension rates suggest emission rates may be a function of vehicle speed and silt loading.

Session 12. Stationary Source

Chairs: Lynn Barnes, SC DHEC
Bob Betterton, W VA DEP

10:15 "Development of a County Level Portable Fuel Container (PFC) Emission Inventory for VISTAS Based on the US EPA National PFC Inventory," W. R. Barnard, MACTEC, Inc; P. Brewer, VISTAS; G. Stella, Alpine Geophysics, LLC.

This paper discusses the approach used by the Visibility Improvement State and Tribal Association of the Southeast (VISTAS) Regional Planning Organization (RPO) to develop a county level portable fuel containers emission inventory based on the State level estimates provided in the "Estimating Emissions Associated with Portable Fuel Containers (PFCs), Draft Report, Office of Transportation and Air Quality, United States Environmental Protection Agency, Report #EPA420-D-06-003, February 2006". PFC emissions were felt to be an important component of VOC emissions that had not previously been included in earlier versions of the VISTAS base year or projection year inventories. The paper discusses how the State level emissions presented in the report were allocated to the county level and projected to the years 2009 and 2018. Fuel usage values derived from NONROAD 2005 runs completed for VISTAS for the years 2002, 2009 and 2018 were used in conjunction with the "spillage" data file to develop allocation factors used to assign emissions to each county. The allocation scheme is based on using the "spillage" file that is part of the US EPA's NONROAD model along with estimated fuel usage in each year.

10:40 "An Updated Emissions Inventory of Oil and Gas Area Sources in the Western Region," A. Bar-Ilan, R. Friesen, A. Pollack, and A. Hoats, ENVIRON International Corporation.

The Western Regional Air Partnership (WRAP) is sponsoring the development of an emissions inventory of area sources deriving from oil and gas (O&G) exploration and production in the western states region, which has seen substantial growth in this sector in the last 10 years. In 2005, ENVIRON developed for WRAP an emissions inventory of these area sources for 2002, as well as projecting emissions to 2018 for regional haze modeling.

ENVIRON has continued to develop this emissions inventory of O&G point sources in an improved inventory effort for the second phase of this project. The previous inventory focused mainly on emissions of nitrogen oxides (NO_x) from O&G area sources. The revised inventory incorporates particulate matter (PM) emissions as well as volatile organic compounds (VOC) emissions. A new emissions inventory methodology has been developed to determine emissions in the geological basins where significant O&G activity is occurring. The new inventory develops basin-wide average emissions for each basin based on equipment data and activity specific to that basin. This new approach is able to better capture the differences in activity among different basins. The focuses of this inventory are drilling rigs and wellhead compression, which are the two largest source categories of NOx and PM emissions. More detailed information on O&G equipment and emissions by basin of activity is accessible for this inventory as compared to previous inventories.

In addition to the 2002 inventory, a 2005 inventory is being developed, as well as revised emissions projections for 2018. Resource management plans and production forecasts are incorporated as well as direct producer information on production trends and equipment needs to better estimate 2018 emissions. The 2018 projections include a detailed assessment of potential control technologies for reducing emissions primarily from drill rig and compressor engines, including an analysis of the impact of these controls in each state on the emissions inventory in the region.

11:05 "Evaluation of Point Source Sensitivity Runs for the State of NC," M. Xie and J. Godfrey NC Department of Environment and Natural Resources.

The existing ozone (O3) standard is an 8-hour standard set to protect public health from short-term and prolonged exposures to O_3. The design value for ozone is defined as: a 3-year average of the annual 4th highest daily maximum 8-hour average. If a monitored design value is > 0.084 ppm (84 ppb), that monitor is violating the standard.

In the NC Metrolina (Mecklenburg, Union, Gaston, Rowan, Iredell, Lincoln, and Cabarrus Counties) nonattainment area, three monitors were violating the 8-hour ozone standard at the end of the 2006 ozone season. There are eight monitors in the Metrolina area with design values (for the 2004-2006 3-year period) ranging from 0.076ppm to 0.088 ppm for 2006 ozone season.

The NC Division of Air Quality (NCDAQ) is required to submit an attainment demonstration plan (State Implementation Plan) to the U S Environmental Protection Agency (US EPA) in June 2007 for the Metrolina nonattainment area that details the State's plan to bring the area into attainment of the Federal standard. This analysis must estimate whether selected emissions reductions will result in ambient concentrations meeting the National Ambient Air Quality Standards (NAAQS) for ozone. It must identify a set of control measures that will result in the required emissions reductions.

Considering the controls that are planned for the major utilities, the NCDAQ conducted a series of sensitivity runs for their power plant point sources to show how additional reductions would impact future design values. The results show that the model was relatively stiff considering large emission changes.

11:30 "Integration of GHG Point Source Emissions into the Routine Air Emission Inventory Process," J. H. Southerland and H. Hawkins, NC Department of Environment and Natural Resources.

Climate change and related greenhouse gas (GHG) emissions have come to the forefront in recent months and years. Man made emissions of carbon dioxide and other "equivalent" pollutants are believed to be making a substantial contribution and exacerbating the problem through increases in atmospheric levels of these heat-trapping pollutants. Up to this point, many concerns and related activities have been focused on, by and through special governmental groups that existed primarily for and because of the problem. A trend seems to have developed in government to suggest that the focus and responsibility in the future for inventories may be the responsibility of the air quality and air emission inventory agencies and community. This is particularly the case because such emissions are generated largely by large fuel combustion sources and manufacturing facilities in the point source sector, they frequently require an air permit and they are already reporting regularly to the bureaucracy regarding other criteria and hazardous pollutants.

This paper is planned to report on how a typical agency such as the NC Division of Air Quality (DAQ) has become involved in such concepts and the prospects of implementing the results. The DAQ will begin an inventory effort for CY 2008 to implement a GHG inventory for point sources holding a Title V air permit as a first step in the process. This paper will discuss some of the mechanics of this, the legal authorities, the details of pollutants and other aspects that must be considered before such an effort is begun. The DAQ's AERO/ED data system(s) and the impacts this will have on them will be discussed. The manner of implementing an inventory and likely a future registry and considerations related to reporting to "some" a national registry and the implications and issues related to using these as a basis for a cap and trade process will be outlined and issues and deliberations brought home to the typical state inventory process and the potential impacts. These will be put into a practical and real world account of activities that are unfolding all across the country and with which many agencies will have to deal with.

11:55 "Using Tunable Diode Lasers to Measure Emissions from Animal Waste Lagoons," D. B. Harris, US EPA.

Open-path optical spectroscopy has been applied to several fugitive sources by ORD's National Risk Management Research Laboratory (NRMRL) scientists for more than a decade. Open-path Fourier transform infrared (OPFTIR) has been used during the initial research phase because of the ability to detect multiple compounds simultaneously. Recent improvements is solid state, near infrared (NIR) tunable diode laser (TDL) has led to their development as a measurement system when a single species is of interest. Emissions from agricultural husbandry facilities have become of interest as both a particulate precursor (ammonia) and a greenhouse (methane) source. The OPFTIR was used in the initial studies to monitor both gases and TDL has been deployed lately to focus on ammonia. The TDL has developed into a reliable instrument for collecting long term data at animal waste treatment facilities and is a major component of testing being conducted by the agricultural industry to develop sector specific emission factors.

Session 13. EI Validation and QA

Chairs: Tom Ballou, VA DEQ
Rhonda Thompson, US EPA

10:15 "Using Google Earth to Access and Display Emissions Data," D. Mintz, UD EPA.

If you have used Google Earth to look at your neighbor's backyard or fly though the Grand Canyon, then you're ready for this paper. The EPA's Emissions Inventory and Analysis Group are building linkages to emissions data. If you can navigate Google Earth, you will soon be able to access and display emissions data quite easily. This paper provides some background regarding Google Earth's KML (Keyhole Markup Language). It also describes how SAS is used to access and display data within the Google Earth application.

10:40 "ISO 14064, International Standard for GHG Emissions Inventories and Verification," J. Wintergreen and T. Delaney, First Environment Inc.

In March 2006, the international organization for standardization (ISO) completed its four-year development of ISO 14064, a three-part international standard for GHG management activities, including the development of entity emission inventories. The development process included the involvement of over 175 experts representing 45 countries. The standards include minimum requirements for GHG inventories which provide a basic structure against which credible and consistent independent auditing can be performed. The ISO 14064 standard offers policy makers a ready foundation of best practices upon which to build a GHG reduction program. ISO 14064 offers organizational users opportunities for improved consistency, increased flexibility and decreased effort associated with voluntary GHG inventories.

This presentation will provide an overview of Part 1 of the standard and how it is used to conduct a GHG inventory. A comparison of the Part 1 against the WBCSD/WRI GHG Protocol will demonstrate how Part 1 is compatible with the GHG Protocol. It will also show the additional value that can be obtained from using these approaches together.

Part 3 of ISO14064 also provides, for the first time, a standardized process for conducting a verification of a GHG inventory or a reduction process. The presentation will include an overview of the verification process for inventories under Part 3 of the standard.

11:05 "Emission Inventory Validation and Improvement: A Central California Case Study," S. B. Reid, L. R. Chinkin, B. M. Penfold, and E. K. Gilliland, Sonoma Technology Inc.

The methodologies and data used to develop emission inventories are continually refined and improved. New emission factors, activity data sets, and mobile source emission models have resulted in revised emission estimates that need to be evaluated for accuracy and usefulness for photochemical grid modeling and other applications. Sonoma Technology, Inc. (STI) used a variety of techniques to perform an emission inventory validation on an updated base-year inventory recently developed by the California Air Resources Board (CARB). Inventory improvements made by CARB include changes to CARB's EMFAC and OFFROAD mobile source emission models and have impacted both the magnitude and spatial distribution of emissions.

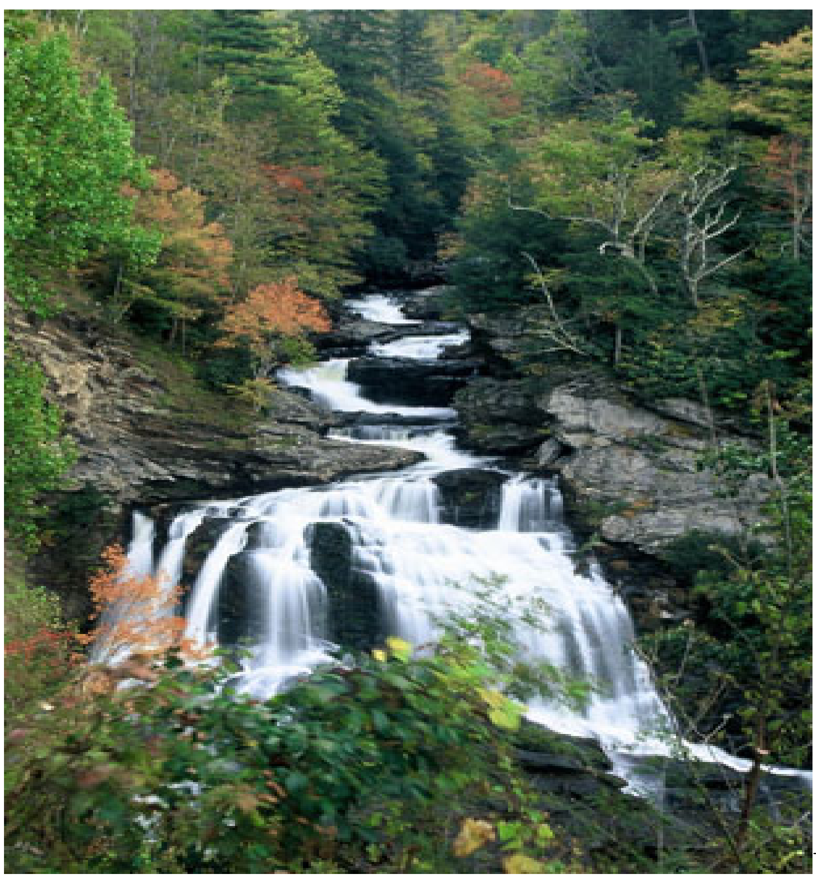
STI's review was performed on a gridded, temporalized version of the CARB inventory that was prepared for an ozone modeling application in central California. STI compared the CARB emission inventory with ambient measurements collected in central California during summer 2000. Measurements of speciated volatile organic compounds (VOC), nitrogen oxides ($NO_{x)}$, and carbon monoxide (CO) from over a dozen monitoring sites were compared with emissions data by calculating pollutant ratios and weight fractions. Comparisons were also made by day of week and by wind quadrant.

The results of these analyses showed that the latest CARB emission inventory, in general, shows better agreement with ambient data than previous emission inventories in California. However, this study also identified specific areas for which further improvements are needed to the magnitude, temporal allocation, and/or spatial allocation of CARB emission estimates. This paper will demonstrate how emission validation techniques can be used to assess the accuracy of emission estimates for areas outside California.

11:30 "Comparison of 2002 NEI and RPO Emisson Inventories," G. Stella, Alpine Geophysics; R. Ryan, and D. Solomon, US EPA.

EPA's Emission Inventory and Analysis Group (EIAG) prepare a detailed emission inventory of the US every three years. This inventory is called the National Emission Inventory (NEI). This inventory is used to support EPA's photochemical modeling, as well as a variety of other types of air quality studies and analyses performed by EPA and others. EIAG completed a version of the 2002 NEI in February of 2006. The Regional Planning Organizations (RPOs) are also conducting photochemical modeling to support their mission. Due to differences in schedules and inventory development methodologies the RPOs each developed their own 2002 inventories.

This paper will compare the criteria pollutant emission estimates and related data contained within these two emission inventories. This paper will highlight major differences in the two inventories and will provide insights into why major differences occurred.



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