U.S. Environmental Protection Agency
2017 International Emission Inventory Conference
"Applying Science and Streamlining Processes to Improve Inventories"

Training - August 14 - 15, 2017
Plenary - August 15, 2017
Technical Sessions - August 16 - 18, 2017

Hyatt Regency Baltimore on the Inner Harbor
300 Light Street
Baltimore, Maryland 21202

EPA

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

In Memoriam

Raymond Kevin Forde

(November 29, 1962 – July 28, 2017)

We mourn the passing of our dear friend Raymond Forde who died unexpectedly in July 2017. Raymond began his career in the emissions inventory field in 1989 with the EPA Region 3 Office in Philadelphia. After several years there he moved to the EPA Region 2 office in New York City where he was the key emissions inventory lead for most of his career, diligently supporting the program needs and concerns of the Region's states and territories. Raymond was more than just a colleague. He greeted everyone with a smile on his face and was a friend to all who knew him. Always a true gentleman, he treated everyone with respect, great kindness, and compassion. Raymond was a steady and long-standing member of the emissions inventory community and regularly attended the Emissions Inventory conferences. His many contributions to this community made him a well-respected and natural leader among his peers, and he will be greatly missed.

Welcome to the 2017 Emissions Inventory Conference

This year's conference will focus on improving the science and streamlining processes to build robust, sound and timely inventories. Topics include:

- How do key sectors in the U.S., including oil & gas, stationary sources, and other area sources affect local and regional air quality?
- What are the current scientific challenges in estimating emissions for key sectors? How can we improve emission estimates for these key sectors in inventories while making it a timely process?
- What are the challenges State, Local, and Tribal Air Agencies (S/L/T's) face in developing an emissions inventory? How do they prioritize the resources they have for inventory development?
- What are the key emissions inventory issues related to the National Ambient Air Quality Standards in the U.S.? What are key issues associated with the National Air Toxics Assessment (NATA) and air toxics? How do Eastern U.S. issues differ from Western U.S. issues?
- How does the Combined Air Emissions Reporting (CAER) project potentially impact Emissions Inventory planning and development?
- What are some of the advantages to using the Lean approach to improve different aspects of inventory development?
- How can EPA make the NEI process easier for the S/L/T's to quality assure, submit and review emission inventories, while ensuring high quality?
- How are inventories used for modeling (speciation, spatial and temporal allocation)? What do modeling and ambient data analysis tell us about gaps or potential improvements in emission inventories?
- What are some of the key international emissions inventory issues that affect air quality in other countries and the US?

Training will be offered all day Monday, August 14th and for half a day on Tuesday, August 15th. This year we will offer new training courses in addition those offered at previous conferences-including courses on using inventories for exceptional event demonstrations, developing future year inventories, and using the SPECIATE database for air quality modeling.

The plenary session overviewing key aspects of domestic and international inventories, science and streamlining inventory development will be held Tuesday afternoon. Concurrent technical sessions will run all day Wednesday and Thursday, and half day on Friday. We will be adding new special sessions this year on reconciling NOx emission inventories with ambient data, Combined Air Emissions Reporting, and research on life-cycle emissions impacts. We also have a very interesting lineup of poster presentations and the authors will be available to explain their work and answer your questions during breaks and on Thursday evening. The Conference will adjourn on Friday, August 18th at 12:00pm.

This is a great opportunity to keep abreast of developments in the world of emissions data and to network with other emission inventory professionals from federal/state/local and international regulatory agencies, tribal governments, industry and academia. We think you will also enjoy being in Baltimore and look forward to seeing you at the Conference.

US EPA Conference Organizers
Emission Inventory and Analysis Group
Office of Air Quality Planning & Standards

Schedule at a Glance

Date/Time	Session	Room
Mon Aug 14		
8:30 - 12:00	EI Prep for Air Quality Modeling	Constellation C
8:30 - 12:00	EIS and the Making of the NEI	Constellation D
8:30 - 12:00	EPA's Toxic Release Inventory	Constellation E
8:30 - 12:00	MOVES 2014a Training	Constellation F
12:00 - 1:30	**Lunch (On Your Own)**	
1:30 - 5:00	Projecting Emissions Inventory for Air Quality Modeling of Future Years	Constellation C
1:30 - 5:00	Nonpoint Inventory Tools for 2017 NEI	Constellation D
1:30 - 5:00	Use of Emissions Inventory data in Exceptional Event Demonstrations	Constellation E
1:30 - 5:00	MOVES 2014a Training (continues)	Constellation F
Tues Aug 15		
8:00 - 11:30	AVERT, COBRA, GHG Inventory & Green House Gas Reporting Program	Constellation C
8:00 - 11:30	Oil and Gas 101	Constellation D
8:00 - 11:30	SPECIATE's VOC and PM Emission Profiles and Their Use to Prepare AQM	Constellation E
8:00 - 11:30	MOVES 2014a Training (continues)	Constellation F
11:30 - 1:20	**Lunch (On Your Own)**	
1:20 - 5:20	**Plenary Session – Pending**	Constellation CDEF
1:20 - 1:25	US EPA/OAQPS – Tesh Rao	
1:25 - 1:35	US EPA/OAQPS – Chet Wayland	
1:35 - 1:55	MD Dept. of Environment – Roger Thunell	
1:55 - 2:15	MARAMA – Susan Wierman	
2:15 - 2:35	Region 8 US EPA – Cindy Beeler	
2:35 - 2:55	**BREAK**	**Exhibitor/Poster viewing**
2:55 - 3:15	US EPA/OAP US - Kong Chiu	
3:15 - 3:35	US EPA/OAQPS – Madeleine Strum	
3:35 – 3:55	European Environmental Agency – Martin Adams	
3:55 - 4:15	US EPA/OAQPS - Marc Houyoux	
4:15 - 4:30	**BREAK**	
4:30 – 5:15	Panel/Q&A – with audience	
	ADJOURNED FOR THE DAY	

Schedule at a Glance

Date/Time	Session	Room
Wed Aug 16		
8:00 – 8:25	Mobile Sources	Constellation D
	CAER	Constellation E
	Nonpoint and Point Sources	Constellation F
8:25 – 8:50	Mobile Sources	Constellation D
	CAER	Constellation E
	Nonpoint and Point Sources	Constellation F
8:50 – 9:15	Mobile Sources	Constellation D
	CAER	Constellation E
	Nonpoint and Point Sources	Constellation F
9:15 – 9:40	Mobile Sources	Constellation D
	CAER	Constellation E
	Nonpoint and Point Sources	Constellation F
9:40 – 10:10	**BREAK**	**Exhibitor/Poster viewing**
10:10 – 10:35	Mobile Sources	Constellation D
	CAER	Constellation E
	Nonpoint and Point Sources	Constellation F
10:35 – 11:00	Mobile Sources	Constellation D
	CAER	Constellation E
	Nonpoint and Point Sources	Constellation F
11:00 – 11:25	Mobile Sources	Constellation D
	CAER	Constellation E
	Nonpoint and Point Sources	Constellation F
11:25 – 11:50	Mobile Sources	Constellation D
	CAER	Constellation E
	Nonpoint and Point Sources	Constellation F
11:50 – 1:20	**LUNCH**	

Schedule at a Glance

Date/Time	Session	Room
Wed Aug 16		
1:20 – 1:45	International Emissions Inventories	Constellation D
	Lifecycle Emissions Impact	Constellation E
	Nonpoint and Point Sources	Constellation F
1:45 – 2:10	International Emissions Inventories	Constellation D
	Lifecycle Emissions Impact	Constellation E
	Nonpoint and Point Sources	Constellation F
2:10 – 2:35	International Emissions Inventories	Constellation D
	Lifecycle Emissions Impact	Constellation E
	Nonpoint and Point Sources	Constellation F
2:35 – 3:00	International Emissions Inventories	Constellation D
	Lifecycle Emissions Impact	Constellation E
	Nonpoint and Point Sources	Constellation F
3:00 – 3:30	**BREAK**	**Exhibitor Poster viewing**
3:30 – 3:55	International Emissions Inventories	Constellation D
	Lifecycle Emissions Impact	Constellation E
	Nonpoint and Point Sources	Constellation F
3:55 – 4:20	International Emissions Inventories	Constellation D
	Lifecycle Emissions Impact	Constellation E
	Nonpoint and Point Sources	Constellation F
4:20 – 4:45	International Emissions Inventories	Constellation D
	Lifecycle Emissions Impact	Constellation E
	Nonpoint and Point Sources	Constellation F
4:45 – 5:10	International Emissions Inventories	Constellation D
	Lifecycle Emissions Impact	Constellation E
	Nonpoint and Point Sources	Constellation F
	ADJOURNED FOR THE DAY	

Schedule at a Glance

Date/Time	Session	Room
Thurs Aug 17		
8:00 – 8:25	Oil and Gas	Constellation D
	EI Prep for Air Quality Modeling	Constellation E
	Tools and GIS	Constellation F
8:25 – 8:50	Oil and Gas	Constellation D
	EI Prep for Air Quality Modeling	Constellation E
	Tools and GIS	Constellation F
8:50 – 9:15	Oil and Gas	Constellation D
	EI Prep for Air Quality Modeling	Constellation E
	Tools and GIS	Constellation F
9:15 – 9:40	Oil and Gas	Constellation D
	EI Prep for Air Quality Modeling	Constellation E
	Tools and GIS	Constellation F
9:40 – 10:10	**BREAK**	**Exhibitor/Poster viewing**
10:10 – 10:35	Oil and Gas	Constellation D
	EI Prep for Air Quality Modeling	Constellation E
	Tools and GIS	Constellation F
10:35 – 11:00	Oil and Gas	Constellation D
	EI Prep for Air Quality Modeling	Constellation E
	Tools and GIS	Constellation F
11:00 – 11:25	Oil and Gas	Constellation D
	EI Prep for Air Quality Modeling	Constellation E
	Tools and GIS	Constellation F
11:25 – 11:50	Oil and Gas	Constellation D
	EI Prep for Air Quality Modeling	Constellation E
	Tools and GIS	Constellation F
11:50 – 1:20	**LUNCH**	

Schedule at a Glance

Date/Time	Session	Room
Thurs Apr 16		
1:20 – 1:45	Oil and Gas	Constellation D
	EI Prep for Air Quality Modeling	Constellation E
	Tools and GIS	Constellation F
1:45 – 2:10	Oil and Gas	Constellation D
	EI Prep for Air Quality Modeling	Constellation E
	Tools and GIS	Constellation F
2:10 – 2:35	Oil and Gas	Constellation D
	EI Prep for Air Quality Modeling	Constellation E
	Tools and GIS	Constellation F
2:35 – 3:00	Oil and Gas	Constellation D
	EI Prep for Air Quality Modeling	Constellation E
	Tools and GIS	Constellation F
3:00 – 3:30	**BREAK**	**Exhibitor/Poster viewing**
3:30 – 3:55	Oil and Gas	Constellation D
	EI Prep for Air Quality Modeling	Constellation E
	Tools and GIS	Constellation F
3:55 – 4:20	Oil and Gas	Constellation D
	EI Prep for Air Quality Modeling	Constellation E
	Tools and GIS	Constellation F
4:20 – 4:45	Oil and Gas	Constellation D
	EI Prep for Air Quality Modeling	Constellation E
	Tools and GIS	Constellation F
4:45 – 5:10	**Exhibitor/Poster viewing**	Atrium/Harborview/Foyer
	ADJOURNED FOR THE DAY	

Schedule at a Glance

Date/Time	Session	Room
Fri Aug 18		
8:00 – 8:25	Biomass Burning	Constellation D
	PM and VOC Speciation	Constellation E
	Reconciling NOx Emission w/Ambient	Constellation F
8:25 – 8:50	Biomass Burning	Constellation D
	PM and VOC Speciation	Constellation E
	Reconciling NOx Emission w/Ambient	Constellation F
8:50 – 9:15	Biomass Burning	Constellation D
	PM and VOC Speciation	Constellation E
	Reconciling NOx Emission w/Ambient	Constellation F
9:15 – 9:40	Biomass Burning	Constellation D
	PM and VOC Speciation	Constellation E
	Reconciling NOx Emission w/Ambient	Constellation F
9:40 – 10:10	**BREAK**	
10:10 – 10:35	Biomass Burning	Constellation D
	PM and VOC Speciation	Constellation E
	Reconciling NOx Emission w/Ambient	Constellation F
10:35 – 11:00	Biomass Burning	Constellation D
	PM and VOC Speciation	Constellation E
	Reconciling NOx Emission w/Ambient	Constellation F
11:00 – 11:25	Biomass Burning	Constellation D
	PM and VOC Speciation	Constellation E
	Reconciling NOx Emission w/Ambient	Constellation F
11:25 – 11:50	Biomass Burning	Constellation D
	PM and VOC Speciation	Constellation E
	Reconciling NOx Emission w/Ambient	Constellation F
	CONFERENCE CONCLUDED	

TRAINING - Monday – August 14, 2017

Course Title: Emissions Inventory Preparation for Air Quality Modeling (Base year)
Instructors: Alison Eyth and Jeff Vukovich, US EPA

Time: 8:30am - 12:00pm
Place: Constellation C

Course Description
The Emissions Inventory Preparation for Air Quality Modeling (Base Year) training will describe how the emissions inventories used for modeling relate to the National Emissions Inventory (NEI) and how they are processed into formats that are used by air quality models. Speciation, temporal allocation, and spatial allocation will be discussed along with quality assurance techniques.

Course Title: Emission Inventory System (EIS) and the Making of the NEI
Instructors: Rich Mason, Sally Dombrowski, Madeleine Strum and Jennifer Snyder, US EPA

Time: 8:30am -12:00pm
Place: Constellation D

Course Description:
EPA will cover new features to the Emissions Inventory System (EIS) and walk through the NEI development process in this two-part course. For the EIS component, we'll showcase the new reports structure, data tagging, quality assurance checks, functionality improvements, dataset and selection viewing at various levels, and streamlined nonpoint survey. We will provide live EIS demonstrations and walk through viewing outputs from EIS.

For the NEI component, we will cover a wide range of information, including an introduction to how we communicate updates and share data on SharePoint, and how to view NEI data and documentation on public websites. We will provide a walk-through of a nascent 2017 NEI Plan, highlighting proposed new business rules for data submittals, including QA and selection hierarchy of data from multiple sources. We will also dive deeper into details on HAP augmentation and chromium speciation procedures, PM augmentation with supplemental PM2.5 modeling species, and other augmentation datasets.

Course Title: Toxic Release Inventory (TRI) Training Course – The Quality Behind the Numbers and Helping You Get to the Numbers
Instructors: Steve Witkin, Velu Senthil and Kara Koehrn, US EPA

Time: 8:30am - 12:00pm
Place: Constellation E

Course Description:
The TRI data is a valuable dataset for including in emissions inventories. In the first half of this course you will learn what is available in this Public Right-to-Know Registry. We will start with a brief overview of the TRI program then dive into the data quality processes and documentation supporting the program. You will hear how the TRI data fits into the Combined Air Emissions Reporting (CAER) then we will address specific questions presented by the attendees. The second half of this course will cover how to get to the TRI data which best matches your specific needs, what on-line tools are available, pros and cons of the various tools and demonstrations of some live data pulls.

TRAINING - Monday – August 14, 2017 (continues)

Course Title: MOVES2014a Training
Instructors: Gary Dolce and Kathryn Dotzel, US EPA

Time: 8:30am - 5:00pm
Place: Constellation F

Course Description:
This 1.5-day course will cover almost all of the material included in EPA's basic 2-day course, with some material abbreviated to fit into the shorter format. No prior knowledge of MOVES is required. Attendees will need to bring laptop computers with the latest version of MOVES2014a already installed and tested and with the course materials loaded. Please allow enough time ahead of the course for installation and testing, as we will not be able to resolve installation problems the day of the course. The latest version of MOVES2014a is available here: www.epa.gov/moves/moves2014a-latest-version-motor-vehicle-emission-simulator-moves.

The MOVES training materials are available here: https://www.epa.gov/moves/moves-training-sessions#training.

Course attendance will be limited to 40.

Course Title: Projecting Emissions Inventories for Air Quality Modeling of Future Years
Instructors: Alison Eyth and Jeff Vukovich, US EPA

Time: 1:30pm - 5:00pm
Place: Constellation C

Course Description:
The Projecting Emissions Inventories for Air Quality Modeling of Future Years training will describe how emissions inventories representing future years are prepared for air quality modeling. The techniques used to prepare future year inventories for air quality modeling for electric generating units, other stationary point and nonpoint sources, commercial marine vessels, and onroad and nonroad mobile sources will be discussed.

Course Title: Nonpoint Inventory Tools for the 2017 NEI
Instructors: Rich Mason and Jennifer Snyder, US EPA; David Cooley and Jonathan Dorn, Abt Associates

Time: 1:30pm - 5:00pm
Place: Constellation D

Course Description:
EPA, along with Abt Associates, is in the process of overhauling most of the tools used in the nonpoint data category for the 2017 NEI. We will discuss how each of these tools fit into one of three categories for method improvements and the State/Local/Tribe inventory submitter review process. The tool category types determine the timeframe for draft tool release, submitter review, and finalization. We will provide an overview of the new Nonpoint Emissions Methodology and Operator Instructions (NEMO) documents, as well as a walk through the Nonpoint Method Advisory (NOMAD) component of the NEI SharePoint site that serves as a repository for all nonpoint tools, documentation, analyses and other information useful to data submitters.

The training will also walk through three of the more intricate nonpoint tools (outside of oil and gas which as its own training on Tuesday, August 15th): residential wood combustion, fuel combustion at industrial and commercial/institutional facilities, and solvent use. We will provide an overview of the tools, discussing the procedures and assumptions as well as user options available for running the tools and creating EIS-ready emission estimates. We will discuss areas for further development for the 2017 NEI and there will also be an interactive demonstration of each tool using sample datasets.

Participants are encouraged to bring their laptops to run the tools during the training session. The tools and sample datasets are will be available for download a week prior to the conference. (**Note that MS Access must be installed on the laptop.)**

Course Title: Use of Emissions Inventory Data in Exceptional Event Demonstrations
Instructor: Ben Gibson and E. Wortman, US EPA

Time: 1:30pm - 5:00pm
Place: Constellation E

Course Description:
Exceptional events are unusual or naturally occurring events that can affect air quality but are not reasonably controllable using techniques that Tribal, State or Local air agencies may implement in order to attain and maintain the National Ambient Air Quality Standards. Examples of exceptional events may include wildfires, prescribed fires, high-wind dust storms, stratospheric ozone intrusions, and volcanic and seismic activities. In September 2016, the Environmental Protection Agency (EPA) finalized revisions to the Exceptional Events Rule (EER) to establish criteria and procedures for use in determining if air quality monitoring data has been influenced by exceptional events.

This course will provide an overview of the EER and which elements of an exceptional events demonstration can leverage emissions data from the NEI for supporting analyses. Building off of the introductory EER context, we will walk through examples to review general applications for NEI data and more specific fire-related event applications. We will also discuss other data resources for fire-related events that can be used to supplement NEI data in certain exceptional events demonstrations. Although this course will cover some technical aspects of NEI functionality related to exceptional events, it will more broadly aim to help participants better understand how and why certain emissions data can be used in exceptional events demonstrations.
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Training - Tuesday – August 15, 2017

Course Title: AVERT, COBRA, GHG Inventory & Green House Gas Reporting Program Training
Instructors: Robyn DeYoung, Denise Mulholland, Mausami Desai and Adam Eisele, US EPA

Time: 8:00am -11:30am
Place: Constellation C

Course Description:
EPA will provide an overview on how to use two free EPA tools AVERT (AVoided Emissions and geneRation Tool) and COBRA (Co-Benefits Risk Assessment) Health Impact Screening and Mapping Tool. Attendees will get a summary of each tool and an in-depth hands-on training for how to use each tool individually and link them together to 1) evaluate the impacts of energy efficiency and renewable energy on emissions of NOx, SO2, CO2 and PM 2.5 using AVERT and 2) estimate the health impacts and related economic value of those impacts due to emission reductions in the EGU and other emission inventory source categories using COBRA.

The AVERT training will teach participants how to use AVERT to analyze different types of EE programs, wind, geothermal and solar technologies within AVERT's main module. Participants will learn how to interpret the various output display tables and work with SMOKE-ready outputs for use in air quality models. The AVERT training will also walk through the steps participants would need to take to modify base year data with specified retirements, additions and emission rate changes and re-run the baseline data through AVERT's Statistical Module to create a new future-year for analysis in the Main Module.

The COBRA training will teach participants how COBRA translates emissions impacts into changes in ambient air quality (specifically particulate matter), converts those changes into localized health impacts (e.g. reductions in asthma, respiratory illnesses, etc), and then quantifies the economic value of those impacts. Participants will learn how to: select counties, states or regions for an analysis; review the emissions baseline built into COBRA; enter changes in emissions (e.g. PM2.5, SO2, NOx, NH3, VOCs) - in absolute or percentage terms - under the appropriate source categories depending on the scenario; and explore the resulting localized health impacts and their monetized values using COBRA's output maps and tables. The training will show users how they can use COBRA specifically for energy efficiency and renewable energy scenarios but will also show users how to quantify health impacts from emission changes in other sectors, such as transportation.

GHG Inventory & Green House Gas Reporting Program Training

EPA tracks U.S. greenhouse gas emissions and their sources through two complementary programs: The Inventory of U.S. Greenhouse Gas Emissions and Sinks (the Inventory), and the Greenhouse Gas Reporting Program (GHGRP). While the two programs cover emissions from many of the same sources, they are not identical in their coverage, categorization, or methodologies. In this session you will learn more about the differences and similarities in these data sets and what tools are available to access the data (FLIGHT, GHG Inventory Data Explorer, EnviroFacts, etc.).

Training - Tuesday – August 15, 2017 – (continues)

Course Title: Oil and Gas 101: An Overview of Oil and Gas Upstream Activities and Using EPA's Nonpoint Oil and Gas Emission Estimation Tool for the 2017 NEI
Instructors: Jennifer Snyder, US EPA; Regi Oommen and Mike Pring, Eastern Research Group

Time: 8:00am -11:30am
Place: Constellation D

Course Description:
Nonpoint source emissions from the oil and gas exploration and production sector have gained interest in recent years in the United States, as drilling technology has allowed development of unconventional oil and gas plays (such as shale or tight sands) in areas where there was previously no activity, or where activity had subsided after depletion of the conventional reserves. While the major emissions sources associated with oil and gas collection, processing, and distribution have traditionally been included in the National Emissions Inventory (NEI) as point sources (e.g. gas processing plants, pipeline compressor stations, and refineries), the activities occurring "upstream" of these types of facilities have not been as well characterized. EPA developed the Nonpoint Oil and Gas Emission Estimation Tool to assist state and local agencies with estimating emissions from these upstream sources.

This course is for stakeholders interested in learning about the types of sources and emissions that may occur at upstream oil and gas exploration and production sites and for those interested in using the Nonpoint Oil and Gas Emission Estimation Tool to compile an emissions inventory for this important source category. The course is divide into three parts. The first part will provide a general overview of upstream oil and gas exploration and production processes, emissions sources covered by the tool, and where data may be available to assist in estimating emissions for these upstream sources (including gathering data that could be used as inputs from permit data or E&P TANKS or GlyCALC runs from your state's existing data sources). The second part includes a discussion of EPA's plans for the 2017 NEI pertaining to oil and gas. The third part will cover use of the tool to compile emissions estimates and prepare them for submittal to EPA and the 2017 NEI.

Participants must bring their own laptop computers with the latest version of the Nonpoint Oil and Gas Emission Tool already installed prior to the beginning of the course.

Intended audience – Federal/State/Local/Tribal Agencies and Contractors.

Course Title: SPECIATE's VOC and PM Speciation Profiles and Their Use to Prepare for Air Quality Modeling
Instructors: Madeleine Strum, Mike Kosusko, US EPA; Tejas Shah, Ramboll Environ

Time: 8:00am -11:30am
Place: Constellation E

Course Description:
This training provides general concepts on chemical speciation, the SPECIATE database and browser, and how to use the Speciation Tool to create model ready speciation inputs for a photochemical air quality model. We will focus on speciation of VOC and PM2.5 for air quality modeling.

Training - Tuesday – August 15, 2017 (continues)

Course Title: MOVES2014a Training (Continues)
Instructors: Gary Dolce and Kathryn Dotzel, US EPA

Time: 8:00am -11:30am
Place: Constellation F

Course Description:
This 1.5-day course will cover almost all of the material included in EPA's basic 2-day course, with some material abbreviated to fit into the shorter format. No prior knowledge of MOVES is required. Attendees will need to bring laptop computers with the latest version of MOVES2014a already installed and tested and with the course materials loaded. Please allow enough time ahead of the course for installation and testing, as we will not be able to resolve installation problems the day of the course. The latest version of MOVES2014a is available here: www.epa.gov/moves/moves2014a-latest-version-motor-vehicle-emission-simulator-moves.

The MOVES training materials are available here: https://www.epa.gov/moves/moves-training-sessions#training.

Course attendance will be limited to 40.

Poster Presentations

1. ***"Improved Temporalization of Small Non-CAMD EGUs",*** H. Ashenafi and E. Bull, Maryland Department of the Environment.

2. ***"Sound Data Leads to Sound Analysis: EPA's RTR Program",*** E. Goehl and T. Palma, US EPA; S. Enoch and D. Wilson, Eastern Research Group.

3. ***"BOEM's Year 2014 Emissions Inventory for the Gulf of Mexico Outer Continental Shelf"***, H. Ensz, Bureau of Ocean Energy Management; and D. Wilson, B. Do, S. Enoch, and R. Billings, Eastern Research Group.

4. ***"An Evaluation of NOx and VOCs Emissions in the National Emission Inventory by Source Apportionment Technology",*** J. Lin, and E. Zalewsky, NYSDEC.

5. ***"Atmospheric Implications of Light Alkane Emissions from the Oil and Natural Gas Sector",*** Z. A. Tzompa-Sosa, Colorado State University; B. Henderson, US EPA; K. Travis, Harvard University; and E. V. Fischer, Colorado State University.

6. ***"Impact of Using a Projected 2017 U.S. Inventory on Recent Canadian AQ Forecasts",*** Q. Zheng, J. Zhang, M. D. Moran, R. Pavlovic, and M. Sassi, Environment and Climate Change Canada.

7. ***"Developments in Emission Measurements Using Lightweight Sensors and Samplers",*** J. Aurell, University of Dayton Research Institute; A. Holder, W. Mitchell, US EPA; B. Seay, Duke University; V. Chirayath, NASA; and B, Gullett, US EPA.

8. ***"A Comparison Between Model and Literature-Based Emission Factors for Wildland Fires",*** A. Seagram and S. Huang, Sonoma Technology; and V. Rao, US EPA.

9. ***"Comparison of Three Marine Black Carbon Measurement Methods",*** J. Yang, K. Johnson, J. W. Miller, T. D. Durbin, Y. Jiang, G. Karavalakis, and D. R. Cocker, University of California—Riverside.

10. ***"Canadian Emissions Inventory Package for Base Year and Future Projection"***, M. Sassi, R. Mashayekhi, J. Miville, S. Cousineau, A. Duhamel, C. Bolduc, P. Lucas-Picher, J. Racine, and C. Zaganescu, Environment and Climate Change Canada.

11. ***"Sensitivity of NOx Emissions for On-Road Mobile Gasoline Vehicles Estimated by MOVES2014a to Fuel Sulfur Content in Gasoline",*** G. Grodzinsky, D. Tian, J. Boylan, Georgia Department of Natural Resources.

12. ***"Grassland Smoke Emission Measurement Supporting Multi-Modeling Framework Simulation of Rangeland Burning Practices for the Kansas Flint Hills Fire Experiment",*** J. Wilkins, M. Landis, K. Baker; US EPA, J. Aurell, University of Dayton Research Institute; and B. Gullett, US EPA.

13. ***"Sensitivity of MOVES Inputs on Emission Rates When Comparing MOVES to Real-World Measurements",*** D. Sonntag and D. Choi, US EPA.

Poster Presentations – (continues)

14. ***"Enhanced EIS Data Retrieval Features for 2017",*** J. Christie and M. Brooks, US EPA.

15. ***"Assessing Small Fire Activity Using New Satellite Products",*** S. Raffuse, UC Davis; N. K. Larkin, US Forest Service.

16. ***"Evaluation of Revised Emissions Factors for Emissions Prediction and Smoke Management",*** S. Prichard, University of Washington; S. O'Neill, S. Urbanski, and N. K. Larkin, US Forest Service.

17. ***"Estimating Point Source Condensable PM (CPM) Emissions in Inventories",*** R. Merrill, B. Parker, M. Hays and V. Rao, US EPA.

18. ***"Development of Spatio-Temporal Black Carbon Emissions Inventory of Pakistan",*** I. Shahid, Institute of Space Technology, Islamabad, Pakistan.

19. ***"Accuracy, Communication, and Transparency: Expanding the Scope of Accountability and Collaboration in Emissions Reporting",*** H. Sadeghi, and E. Manitou, ERA Environmental Management Solutions.

20 ***"E-Enterprise: Combined Air Emissions Reporting",*** US EPA, The Environmental Council of States, Alaska, Arizona, Connecticut, Georgia, Massachusetts, Michigan, Minnesota, Mississippi, North Carolina, Oklahoma, Oregon, South Carolina, Southwest Clean Air Agency, Texas, Vermont, Virginia and Wyoming.

21. ***"Rice Cultivation and Greenhouse Gas Emissions: A Review and Conceptual Framework with Reference to Ghana",*** K. K. Boateng, Kwame Nkrumah University of Science and Technology and Ghana, G. Y. Obeng, Kwame Nkrumah University of Science and Technology, Ghana and Arizona State University; and E. Mensah, Kwame Nkrumah University of Science and Technology, Ghana.

22. ***"SLEIS – The Next Generation"***, S. Hanks, Utah Department of Environmental Quality and B. Smith, Windsor Solutions, Inc

23. ***"Aviation Emissions Inventory Development and Research",*** R. N. Gross, M. A. Kenney, and L. C. Fowler, KB Environmental Sciences

Exhibitors Presentation

Abt Associates, Inc is a mission-driven, global leader in research, evaluation and program implementation in the fields of health, social and environmental policy and Internation development. Known for its rigorous approach to solving complex challenges, Abt Associates is regularly ranked as one of the top 20 global research firms and one of the top 40 international development innovators. The company has multiple offices in the US and program offices in more than 40 countries.

Eastern Research Group – Eastern Research Group, Inc. (ERG) offers clients the full spectrum of technical services required to achieve successful air quality management. Our staff of over 400 consists of engineers, environmental scientists, information technology experts, and communication specialists with over 30 years of experience addressing air quality needs at all project scales for stationary and mobile sources. The bulk of our experience rests with public agencies in the Federal, State, Local, and Tribal government sectors. ERG performs nationally recognized research in areas such as greenhouse gas emissions and controls, air permitting, air toxics, emissions assessments, emissions projections, air regulation development, inventory management, and ambient air quality monitoring. We can assist you with defining and quantifying problems, and determining the most technically effective and cost-beneficial solutions for all stakeholders. Our conference exhibit booth will have materials available documenting the breadth of this experience, and key staff from these programs will be on hand to meet with you and provide more detailed information and insight on how our capabilities can address your needs (www.erg.com).

E-Enterprise for the Environment is a new model for collaborative leadership among environmental co-regulators. Through projects in multiple program areas, the US EPA, States, Locals and Tribes are working together to modernize business processes and enhance services to users to improve the implementation of environmental programs.

KB Environmental Sciences – KBE provides professional air quality consulting services within the highly specialized transportation sector. This includes airports and aviation, surface transportation and mass transit, construction activities, military installations, and marine ports. KBE's staff purposely comprises a unique blend of relevant expertise and practical experience that together provide all the necessary skills and tools for conducting air quality assessments. These attributes include superior capabilities in air quality monitoring and modeling; advanced knowledge of atmospheric science, meteorology and climatology; as well as demonstrated success with data and information management techniques considered necessary for this type of specialized work.

Lake Environmental Software is internationally recognized for its technologically advanced environment modeling software and data products. We remain dedicated to providing industry and the regulatory community with exceptional service and cost effective environmental IT solutions. Our products increase productivity, reduce errors and provide unique solutions in an ever-increasing regulatory constrained world.

Exhibitors Presentations – (continues)

US EPA - Emission Inventory & Analysis Group (EIAG) – The Emission Inventory and Analysis Group is responsible for developing the National Emissions Inventory (NEI), a national database of air emissions information. NEI is a compilation of data comprising of input from numerous State and Local air agencies, Tribal nations, industry, and other Federal databases. The NEI database contains information on stationary and mobile sources that emit criteria air pollutants and precursors, as well as hazardous air pollutants. NEI data are used for air quality modeling; tracking emission trends and developing risk assessments, regulations and regional pollution control strategies. Staff will be available to answer your questions on the Emission Inventory System (EIS), the Emissions Modeling Framework (EMF), mobile models, the Risk Technology Rule, the Air Emissions Reporting Rule (AERR) and analysis of the National Emission Inventory data.

Windsor Solutions, Inc. is an information systems consulting firm headquartered in Portland, Oregon. Windsor was founded in 1998 and specializes in the provision of environmental information systems to federal, state, local, and tribal government organizations. Windsor has an exceptional national reputation for the delivery of high quality environmental information system solutions.

The State and Local Emissions Inventory System (SLEIS) developed by Windsor allows permitted facilities to submit point source emissions inventory data and related meta-data to State and Local agencies via a Web-based, CROMERR-compliant reporting system. SLEIS positions organizations to better manage and review collected data, including the quality assurance of emissions inventory data submitted by regulated entities. SLEIS also includes an Exchange Network interface to manage the generation and submission of XML files to EPA's Emissions Inventory System (EIS).

SLEIS enables the regulated community to meet reporting obligations by providing a secure, intuitive, and streamlined interface for the submission of facility inventory and emissions data and meta-data. SLEIS also brings much greater efficiency to the collection, processing, analysis, and quality assurance of emissions inventories and provides the ability to configure the system to meet each agency's unique needs.

Zephyr Environmental Corporation is a privately held full-service environmental health and safety (EHS) firm offering consulting, training and data systems services to clients worldwide. Zephyr was founded in Austin, Texas in 1994 and now has approximately 80 staff members in offices. Austin, San Antonio and Houston, Texas; in Columbia, Maryland and in York, Pennsylvania. Zephyr works with multiple industries in a number of regulatory arenas, including air and water quality, waste management and cleanup issues, incident management, natural resources and workplace and community safety.

Wednesday Morning - August 16, 2017

Session 1: Mobile Sources

Chairs: Gary Dolce, US EPA
Laurel Driver, US EPA
John Koupal, ERG

8:00 ***"The USEPA MOVES Model – A Midcourse Review",*** J. Heiken, Oak Leaf Environmental, Inc.

MOVES represents a new paradigm for on-road emissions inventory modeling. The innovative methods that define this model relative to the predecessor (MOBILE) also require wholly distinct input, and the accuracy of MOVES depends on the quality of underlying, supporting data record. This paper serves as an independent evaluation of the current state of the model over the 10-year period from the first, draft model release through the second, major revision, MOVES2014. Informing this review are projects of the CRC (E-101-& E-116), regulatory model development for Canada and other evaluation efforts. First, the wholesale revision to the on-road inventory method is a monumental achievement. Many of the goals of the original concept are realized, and additional achievements, not initially envisioned, are incorporated. While MOVES represents the most accurate tool for estimating US on-road emissions in the current regulatory context, there remain areas of uncertainty and gaps in the underlying method including: (1) a fragmented light-duty exhaust test record, (2) temporal/spatial variability in the SCR control effectiveness and (3) variability observed in evaporative emission rates for the tank vapor vented process. MOVES2014 results show that the implementation of national regulatory policies dominates the short-term trends, and that local control programs have relatively less impact. For 3 locations selected to represent the broadest range of possible conditions, the average declines in THC, NOx, PM2.5, and CO emissions from 2011 to 2022 are 55%, 71%, 73% and 43% respectively. How the model methods interface with these inventory results are in described in further details.

8:25 ***"Improvements to Default Data for the On-Road Sector of the 2014 NEI",*** A. DenBlyker, J. Koupal, D. Jackson, M. Weatherby, C. Palacios, and R. Billings, Eastern Research Group; D. Brzezinski, H. Michaels, A. Eyth, and L. Driver, US EPA.

The 2014 NEI relies on EPA's Motor Vehicle Emission Simulator (MOVES) model to estimate on-road emissions for states outside of California and the SMOKE-MOVES framework to produce the gridded emissions needed for air quality modeling. State/local/tribal air agencies were encouraged to submit local inputs for MOVES, resulting in vehicle fleet and activity data submissions for over 1,800 counties, the largest compilation of local MOVES data to date. To facilitate this, EPA developed a standardized framework for agencies to submit MOVES input data, taking advantage of MOVES features to streamline the input of local data. EPA and Eastern Research Group, Inc. (ERG) compiled the state-submitted data and populated other areas with default information. ERG identified national datasets of vehicle registrations and telematics data that could be used to improve default on-road inputs at the local level for both MOVES and SMOKE. With EPA sponsorship, ERG purchased July 2014 vehicle registration data from IHS Market for the entire country and used it to prepare local estimates of vehicle populations, age distributions, and gas/diesel splits for all MOVES source types. Under CRC (project A-100) sponsorship, ERG purchased vehicle telematics data from Street Light Data, Inc. and prepared local speed and vehicle-miles traveled (VMT) distributions separately for three types of vehicle classes. An emissions impact analysis in CRC A-100 shows that using the telematics-based inputs can affect modeled daily on-road emissions between -2 and 9 percent for VOC, 1 and 5 percent for NOX, and -9 to 14 percent for PM2.5.

Wednesday Morning - August 16, 2017

(Session 1 continues)

8:50 ***"Using Vehicle Telematics for MOVES Activity Input",*** D. Brzezinski, and C. Fulper and A. Verma, US EPA.

Vehicle activity, along with emission rates and vehicle populations, is a critical part of the information needed to accurately estimate the impact of vehicles on air quality inventories. Vehicle telematics data (detailed vehicle information collected remotely), is now being gathered for many purposes, such as vehicle insurance, and provides a new and important source of vehicle activity data. This new data includes detailed information about vehicle activity, distributed both temporally and spatially, for very large samples of in-use vehicles. Using recently purchased trip-based summaries from telematics data, we will explore how this data can be used to provide up-to-date estimates of vehicle miles traveled, idle fractions, average speeds, engine starts and soak periods for use in the EPA MOVES highway vehicle emission model. This paper will also explore the importance of temporal and regional differences in activity.

9:15 ***"The Impact on Air Quality and AQ Decision Making of Actual Versus Modeled Fuel Sulfur Concentrations",*** J. McDill, MARAMA.

Analysis of historical (2011-2017) gas and diesel fuel actual sulfur concentration data collected in Maryland and New York. The outcome of a MOVES sensitivity runs is used to understand the impact of widespread use of MOVES sulfur content defaults on modeled outcomes and conclusions. The availability and impact of the banked credits on future mobile emissions is considered.

9:40 BREAK

10:10 ***"MOVES Emission Inventory Quality Assurance Tool",*** L. D. White and M. Venugopal, Texas A&M Transportation Institute.

The quality of any model outputs depends on its inputs. The Environmental Protection Agency (EPA) first released MOVES in December 2009. The latest version, MOVES2014a, was released in 2015. Over its seven-year history, several features and improvements have been added, and the tool has been extensively used by planners and modelers to develop emission inventories for state implementation plans and transportation conformities. Although users have appreciated MOVES' flexibility of data inputs, modeling options, and detailed outputs, an area of increasing importance to users is the quality and integrity of user inputs. Currently, MOVES does not perform a detailed quality assurance (QA) check on user inputs to verify appropriate values for specific modeling scenarios. This paper presents the key features of MOVES QA—a utility tool funded by the Texas Commission on Environmental Quality (TCEQ). The QA utility tool is a graphical user interface (GUI) that allows more efficient input and output processing. The utility provides a robust review of the MOVES model input and output data, allowing reviewers to assure databases and tables are in the correct format. The utility also quality assures output data and identifies errors including, but not limited to, vehicle miles of travel (VMT) conversion errors. If input or output errors are found, they are flagged, and included in a summary report.

10:35 ***"The Evolution of Geospatial Data Elements for Commercial Marine Vessels in the EPA's National Emission Inventory",*** H. Perez and R. Billings, Eastern Research Group; L. Driver, US EPA

The National Emission Inventory (NEI) is a large and complex data system that includes detailed information on emissions from point, area, and mobile sources, including port and underway operations for commercial marine vessels (CMV). In the mid-1990's, the CMV component of the NEI was developed in support of section 112(c)(6) and 112(k) of the Clean Air Act. These emission estimates were based on 1992 State Implementation Plan inventory guidance which apportioned underway and port vessel emissions to counties with navigable waterways. As Geographic Information Systems (GIS) data became increasingly available, emissions could be assigned to individual ports and shipping lanes based on relative activity.

These ports and shipping lanes datasets evolved into GIS shapefiles, initially focusing on coastal ports that service large vessels equipped with Category 3 marine diesel engines. As smaller vessels equipped with Category 1 and 2 engines were added, the network of shipping lanes was expanded to include inland waterways as well as increasing the number of smaller ports that these vessels visit. Currently the EPA is reviewing the port shapefiles and making refinements to ensure that vessel emission estimates are spatially apportioned to areas that accurately represent hoteling and maneuvering operations within ports. These new port shapes include a number of customizations to make them suitable for both the NEI and for use in exposure assessments. This paper will summarize the evolution of the NEI's CMV geospatial elements over time and will include suggestions of possible future developments.

11:00 ***"Simulating Emissions from Commercial Marine Vessels in the Great Lakes: An Approach for Using Transponder Data in Emission Modeling",*** Z. Adelman, B.H. Baek and B. Naess, UNC Institute for the Environment; M. Janssen, LADCO.

Automatic Identification Systems (AIS) are safety devices that communicate real-time marine vessel information, including the vessel's identity, type, position, course, speed, navigational status and other safety-related information automatically to appropriately equipped shore stations, other ships, and aircraft. Required on all commercial vessels operating on U.S. navigable waters, AIS data provide high resolution measurements of commercial marine vessel (CMV) activity. The Lake Michigan Air Directors Consortium (LADCO) developed an AIS based emissions inventory for year 2014 CMV in the Great Lakes. This presentation demonstrates a method to convert the sub-hourly, link-based LADCO inventory of CMV emissions for cruising, maneuvering, and hoteling operating modes to three-dimensional, hourly emissions estimates. We developed a new software tool, Linkproc, to process the CMV data for input to gridded air quality modeling systems. The tool includes capabilities to correct erroneous land-bound tracts and to produce tabulated emissions reports. While this presentation demonstrates an application of Linkproc to a CMV inventory, we will discuss the potential for other link-based emissions source applications, such as on-road mobile and rail.

11:25 ***"Marine Scrubber Efficiency and NOx Emission from Large Ocean Going Vessels",*** J. Yang, K. Johnson, J. W. Miller, T. D. Durbn, Y. Jiang, G. Karavalakis, and D. R. Cocker, University of California—Riverside.

Ship transportation plays a major role in the global economy and international trade by contributing to 80% of global trade by volume and over 70% of global trade by value. Utilizing a scrubber to reduce the sulfur emissions to an equivalent low sulfur fuel level is a strategy that has been generally accepted both by governmental agencies and ship owners due to its high sulfur emissions reduction and also the long term cost benefit of operation compared to the use low sulfur fuel. Also, marine NOx is more of a concern since the NOx emissions has been reduced significantly by the application of SCR system for on road heavy duty diesel trucks and large off road equipment. Under the IMO low sulfur regulation and the upcoming NOx technical code, as well as the 'saving fuel' of the marine shipping, advanced engine technologies (electronic controlled fuel and lube oil injection, exhaust gas recirculation, turbocharger cutoff operation) and advance after-treatment technologies (scrubber, SCR, DPF) has been start commercializing. Little studies have been done on these areas to understand the NOx performance of these advanced engine and after-treatment technologies and the scrubber efficiency of removing the sulfur emissions. This study disclosed that the scrubber system shows an over 95% reduction in SOx, but very limited reductions on sulfur from the particle phase. Also, this study provides significant information of engine technologies (electronic controlled fuel and lube oil injection and turbocharger cutoff operation) and scrubber impact on NOx emissions from large ocean going vessels.

11:50 LUNCH

Wednesday Morning - August 16, 2017

Session 2: Combined Air Emissions Reporting (CAER)

Chairs: Joe Mangino, US EPA
Michael Burton, AZ DEQ

8:00 ***"E-Enterprise Combined Air Emissions Reporting (CAER) Overview",*** J. Mangino, US EPA; M. Burton, Arizona Department of Environmental Quality, M. Wert, Massachusetts Department of Environmental Protection; S. Dombrowski and M. Houyoux, US EPA; and Dr. B. W. Shaw, Texas Commission on Environmental Quality.

The Combined Air Emissions Reporting (CAER) project seeks to streamline multiple emissions reporting processes. Currently, air emissions information is collected by the EPA and state, local or tribal air agencies through numerous separate regulations, in a variety of formats, according to different reporting schedules, and using multiple routes of data transfer. In the proposed future state, the CAER project is expected to reduce the cost to industry and government for providing and managing important environmental data and to improve decision-making capacity through more timely availability of data. This paper will provide an overview of the CAER project and accomplishments to date. The goals of this project are as follows:

- Reduce industry burden for point source reporting.
- Improve timeliness and transparency of data.
- Create consistent information across air emissions programs.
- Improve data quality.
- Improve accessibility and usability of data.
- Support more timely decision-making

8:25 ***"Combined Air Emissions Reporting (CAER): A Research and Development Project on State/Local/Tribal, National Emission Inventory (NEI) and the Toxic Release Inventory (TRI) Comparison",*** K. Koehrn, US EPA; C. Y. Wu, Minnesota Pollution Control Agency; C. Wilbanks, South Carolina Department of Health and Environmental Control; J. Parra, M. Strum, and J. Drukenbrod, US EPA.

This presentation will review the results of the CAER R&D project involving State/Local/Tribal, NEI, and TRI program data comparison. This team researched pollutants and terminologies used in the NEI and TRI and proposed resolutions to harmonize the differences. The following results will be covered:

1. Issues on harmonizing pollutant codes between NEI and TRI
2. Resolution for how to handle/share emissions data for the pollutants identified.
3. Issues and solutions related to terminologies used to define reporting requirements
4. Issues involving different coverage for the same facility and possible ways to resolve.

8:50 ***"Combined Air Emissions Reporting (CAER): A Research and Development Project on GHG Needs Towards a Combined Reporting System",*** J. Gamas, K. Chiu, B. Cook, US EPA; E. Elbel, S. Summers, Oregon Department of Environmental Quality; A. Kovacevic, Minnesota Pollution Control Agency; J. Garfinkle, Massachusetts Department of Environmental Protection.

This presentation will describe the results of the CAER R&D project to map emission data in the EPA's National Greenhouse Gas Reporting Program (GHGRP) to state GHGRP programs. The goal of the study is to understand which data elements State mandatory reporting programs have in common with EPA's GHGRP required data elements. This will help inform what may be needed to move to a combined emissions platform involving GHG reporting. The States of Massachusetts, Minnesota, and Oregon, together with staff from EPA's GHGRP compared data elements required for submission by the different state and federal programs respectively.

9:15 ***"Combined Air Emissions Reporting (CAER): A Research and Development Project on Quality Control/Quality Assurance (QA/QC)",*** B. Way, Wyoming Department of Environmental Quality, J. Mangino and R. Ryan, US EPA; T. Manning, North Carolina Department of Environment and Natural Resources; D. McClard and C. Bedenbaugh, South Carolina Department of Health and Environmental Control; R. Hines, Virginia Department of Environmental Quality.

This presentation will discuss the outcome of a CAER R&D project focused on the identification and evaluation of a common set of emissions data QA/QC procedures for potential application in a shared emission reporting system. The research and development project on QA/QC project collected and compiled existing QA/QC protocols used for emission inventory reporting programs at both EPA (EIS and TRI) programs and state and local air agencies. A preliminary characterization was completed on the extent/potential to which such checks, including both front- and back-end checks, could be automated within an electronic reporting system, and possibly within the framework of a shared, common emissions reporting platform. Suggestions for a next phase of the project will be presented.

9:40 BREAK

10:10 ***"Combined Air Emissions Reporting (CAER): A Research and Development Project on SCCs, WebFIRE and Combined Reporting",*** T. Shanley and D. McGeen, Michigan Department of Environmental Quality; M. Wert, Massachusetts Department of Environmental Protection; J. Gamas, K. Patel and M. Ciolek, US EPA.

This presentation will describe the results of the CAER R&D project focused on understanding state needs regarding Source Classification Codes (SCC) and WebFIRE (a system designed to retrieve emissions factors for emissions estimation and reporting). The States of Massachusetts, Michigan and South Carolina designed a survey that was sent out to State, Local and Tribal programs to collect information on how they currently use SCCs and WebFIRE and the issues that would need to be addressed for combined reporting to be successful.

10:35 ***"Streamlining and Integrating Industrial Emissions Reporting in Europe: Transatlantic Differences and Similarities with the US Combined Air Emissions Reporting Project",*** M. Gibbs, Aether Oxford, UK.

With support from the European Topic Centre on Air Pollution and Climate Change Mitigation, the European Environment Agency and the European Commission are engaged in a limited streamlining of industrial pollution reporting that comprises: (i) the establishment of a reference dataset, known as the EU Registry on Industrial Sites, which brings together administrative and identification data for regulated facilities; and (ii) the integration of emissions reporting under the European Pollutant Release and Transfer Registry (E-PRTR) Regulation and under Article 72 of the Industrial Emissions Directive on large combustion plants (LCPs). This effort aims to reduce the administrative burden on Member States while enhancing the knowledge base to better inform the public as well as business and government decision makers. Once in place, the new system will replace the existing separate E-PRTR and LCP reporting data flows in 2019.

There are remarkable parallels between this effort and the E-Enterprise for the Environment Combined Air Emissions Reporting (CAER) and Facility Integration projects currently underway in the US. Lessons learned from the US experience have already informed the development process in Europe. Multiple common challenges face regulators at all government levels in the US and Europe including: identifying facilities across different reporting programs; handling association versus direct equivalence of facility and emissions characteristics; dealing with key constraints imposed by governing legislation and regulations; devising robust data models; and successfully communicating the project vision and requirements to affected agencies. Approaches and solutions to these challenges will be explored.

Wednesday Morning - August 16, 2017

(Session 2 continues)

11:00 ***"The New Facility Registry Service (FRS) Data Model",*** M. Kelly, US EPA.

The Facility Registry Service (FRS) integrates information from over 90 EPA and state databases into one database to provide information on over 4 million facilities or sites that are subject to environmental regulation. In 2016, FRS released a new facility data model that meets longstanding requirements, such as the ability to capture the relationship of sub-facility components to facilities, view the history of facility data changes, and the ability to view a facility profile from a program perspective. This session will cover details of the new facility data model, how it will be leveraged for regulatory air programs, and future plans for the data model.

11:25 ***"Streamlining Facility Data Collection Using the Facility Registry System to Support Residual Risk and Technology Reviews",*** M. Houyoux, K. Patel, J. Drukenbrod, R. Wayland, S. Dombrowski, B. Shrager, E. Goehl, K. Hanks, K. Spence, J. Bradfield, and M. Kelly, US EPA.

The EPA is required by the Clean Air Act Amendments (CAAA) of 1990 to evaluate both risk and technology after the application of maximum achievable control technology (MACT) standards to control hazardous air pollutants (HAPs) from certain industrial facilities. Section 112(f)(2) of CAAA 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. Section 112(d)(6) of CAAA requires EPA to review and revise MACT standards, as necessary, taking into account developments in practices, processes and control technologies. To help meet these requirements, the EPA's Residual Risk and Technology Review (RTR) program seeks to use robust emissions and facility attribute data to support risk modeling. In some cases, that work necessitates collecting data from industry to improve the data available through the National Emissions Inventory (NEI). For this paper, we describe work done to streamline data collection of facility attributes through electronic reporting approaches, which are aligned with the EPA's E-Enterprise initiative. This work has resulted in a user interface for collecting detailed facility attributes, bulk upload capability, automated quality assurance, and use of the Facility Registry Service (FRS) to share data with other environmental programs included in the Combined Air Emissions Reporting (CAER) E-Enterprise project. Our results include how this work (1) leverages the Compliance and Emissions Data Reporting Interface (CEDRI), (2) improves timeliness and availability of facility attribute data collected for RTR, and (3) helps to promote sharing of that data with the NEI and other systems.

11:50 LUNCH

Wednesday Morning - August 16, 2017

Session 3: Nonpoint and Point Sources

Chairs: Rich Mason, US EPA
Chun Yi Wu, MPCA

8:00 ***"New Approach for Building the 2017 Nonpoint NEI",*** R. Mason, J. Snyder, V. Rao, S. Dombrowski, US EPA; A. Bollman, NC DEQ; C. Wilbanks, SC DHEC; B. Kim, GA DNR.

The existing process for compiling the nonpoint component of the NEI has many problems; it is fraught with unreliable milestones, unstable resource allocation, and unavailable or uncertain benchmarks. As a result, time for adequate quality assurance for each of the more than two dozen nonpoint tools developed by EPA results in a cycle of nonpoint tool revisions caused by condensed time schedules and inadequate resource allocation for quality assurance of the final estimates. We propose a LEAN-based approach for the 2017 nonpoint NEI that relies more on earlier coordination and implementation of nonpoint tool development. One component of this is the development of a 3-track set of Nonpoint Emissions Methodology and Operation instructions (NEMOs) that lock in clear, realistic and unwavering milestones. Another significant update will be consolidating the structure of many nonpoint tools to use a "wagon wheel" approach where a central database will be populated with many shared activity data such as EIA SEDS, code tables, emission factors and point SCC crosswalks. The end goal is to create a slightly-delayed, but more "final" nonpoint inventory with the ability to more-quickly incorporate regularly-updated activity data into estimates for annual nonpoint estimates. Ideally, Version 1 of the 2017 nonpoint NEI will be the final 2017 nonpoint NEI. Longer-term, we plan to make the process more-efficient by developing a web-based approach for submitting inputs and parameters and computing nonpoint estimates.

8:25 ***"Quality Assurance Methods for Nonpoint Source Industrial and Commercial/Institutional Fuel Combustion",*** A. Bollman, K. King, M. Davis, and T. Manning, NC DEQ.

Industrial and Commercial/Institutional (ICI) Fuel Combustion is an emissions process responsible for a large proportion of total stationary source emissions. Estimation of nonpoint source emissions from ICI Fuel Combustion is challenging because data are lacking to accurately characterize these emissions sources. The U.S. Environmental Protection Agency (EPA) has developed an ICI Fuel Combustion emissions estimation tool to assist agencies in developing nonpoint source emission estimates. A couple of key elements of this tool are its reliance on energy consumption data from the Energy Information Administration (EIA) to represent total state-level energy consumption by sector and fuel type, and a source classification code (SCC)-based module that subtracts point source fuel consumption (or emissions) estimates by sector/fuel-type from EIA's total fuel consumption (or related emissions) estimates. The North Carolina Division of Air Quality (NC DAQ) has developed a set of quality assurance (QA) methods to improve the quality of the data used in performing point source subtractions in EPA's ICI tool. These methods are designed to ensure that point source data are categorized consistently with EIA's sector definitions, and to identify point source data outliers necessitating detailed review. The purpose of this paper is to describe the NC DAQ's methods for ensuring the quality of point source data used in EPA's nonpoint source ICI Fuel Combustion emissions estimation tool. This information will assist other agencies in developing nonpoint source fuel consumption estimates for this important source category.

Wednesday Morning - August 16, 2017

(Session 3 continues)

8:50 ***"Improvements for the 2014 Industrial, Commercial, and Institutional Combustion Emissions for Texas",*** R. Oommen and M. Pring, Eastern Research Group.

EPA developed a nationwide Industrial/Commercial/Institutional (ICI) calculation tool to support states in the development of calendar year 2014 emissions estimates for submission to the National Emissions Inventory (NEI). The EPA's default fuel allocation data did not accurately reflect fuel allocation at Texas ICI distillate oil and natural gas combustion sources, as well as boiler and engine breakouts. As such, ERG supported the Texas Commission on Environmental Quality (TCEQ) in developing fuel and engine allocation factors, as well as improve spatial allocation factors for ICI sources in Texas. Finally, ERG incorporated point source subtractions to develop county-level ICI emissions estimates. The purpose of this paper is to document the steps and data sources used to develop the fuel and spatial allocation factors to improve ICI emissions, and will compare emission estimates before and after the incorporation of the factors.

9:15 ***"Development and Implementation of a Formal Framework for Bottom-up Uncertainty Analysis of Input Emissions: Case Study of Residential Wood Combustion",*** B. Oztaner, R. Mashayekhi, Environment and Climate Change Canada; S. Zhao, B. Oztaner, S. Saeednooran, and A. Hakami, Carleton University; M. D. Moran, R. Menard, J. Zhang, Environment and Climate Change Canada.

We have developed a formal framework for documentation, quantification, and propagation of uncertainties in upstream emissions inventory data at various stages leading to the generation of model-ready gridded emissions through emissions processing software such as the EPA's SMOKE. To illustrate this framework, we present a proof-of-concept case study of a bottom-up quantitative assessment of uncertainties in emissions from residential wood combustion (RWC) in the U.S. and Canada. Uncertainties associated with key inventory parameters are characterized based on existing information sources, including the American Housing Survey (AHS) from the U.S. Census Bureau, Timber Products Output (TPO) surveys from the U.S. Forest Service, TNS Canadian Facts surveys, and the AP-42 emission factor document from the U.S. EPA. The propagation of uncertainties is based on Monte Carlo simulation code external to SMOKE and Latin Hypercube Sampling (LHS) to generate a set of random realizations of each RWC inventory parameter. Random realizations are also obtained for each RWC temporal and chemical speciation profile and spatial surrogate field external to SMOKE using the LHS approach. SMOKE outputs for primary emissions show relative uncertainties of about 30-50% across the U.S. and about 70-100% across Canada. Positive skewness (up to 2.7) and variable kurtosis (up to 4.8) were also found for SMOKE outputs. Spatial allocation contributes significantly to the overall uncertainty, particularly in Canada. By applying this framework, we are able to produce random realizations of model-ready gridded emissions that along with available meteorological ensembles can be used to propagate uncertainties through chemical transport models.

9:40 **BREAK**

10:10 ***"New Methods for Estimating Livestock VOC and NH3 Emissions",*** S. Fudge, B. Battye, SC&A, Inc; V. Rao, US EPA.

Volatile Organic Compounds (VOCs) emitted by livestock can be defined as any compound of carbon (excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate) that can participate in atmospheric photochemical reactions and is emitted by livestock. Ammonia emissions come from the housing/grazing, storage and application of manure from livestock production. Livestock are domesticated farm animals raised in an agricultural setting for home use or profit. The following livestock categories were evaluated: dairy cattle, beef cattle, swine, layer chickens and broiler chickens. We developed a nationwide livestock NH3 emissions inventory for the 2014 National Emissions Inventory (NEI) version 2 (V2) based on the 2014 NEI livestock NH3 inventory

developed by Carnegie Mellon University (CMU) with their process based model. This effort involved back-calculating the NH3 emission factors (tons/animal) from CMU's inventory and applying those emission factors to 2014 county-level livestock populations. The development of the 2014 NEI V2 VOC livestock inventory used the 2014 NEI V2 livestock NH3 inventory in combination with VOC and NH3 state data. The approach was to first use state-submitted 2014 NEI livestock NH3 and VOC emissions data to construct an average ratio of VOC: NH3. Next, we applied this ratio to the 2014 NEI v2 nationwide NH3 inventory to produce a nationwide VOC emissions inventory for livestock. For future work, we reviewed VOC emissions from dairy farm silage sources for inclusion in the 2017 NEI livestock VOC emissions inventory.

10:35 ***"Assessing Potential Air Pollutant Emissions from Agricultural Feedstock Production using EPA's MOtor Vehicle Emissions Simulator (MOVES)",*** A. Eberle, D. Hettinger, E. Warner, Y. Zhang, A. Carpenter, G. Heath, and D. Inman, NREL.

Biomass feedstock production is expected to grow as demand for biofuels and bioenergy increases. The change in air pollutant emissions that may result from large-scale biomass supply has implications for local air quality and human health. We developed spatially explicit emissions inventories for corn grain and six cellulosic feedstocks through the extension of the National Renewable Energy Laboratory's Feedstock Production Emissions to Air Model (FPEAM). These inventories include emissions of seven pollutants (nitrogen oxides, ammonia, volatile organic compounds, particulate matter, sulfur oxides, and carbon monoxide) generated from biomass establishment, maintenance, harvest, transportation, and biofuel pre-processing activities. By integrating the EPA's MOtor Vehicle Emissions Simulator (MOVES) into FPEAM, we created a scalable framework to execute county-level runs of the MOVES-Onroad model for representative counties (i.e., those counties with the largest amount of cellulosic feedstock production in each state) on a national scale. We used these results to estimate emissions from the on-road transportation of biomass and combined them with county-level runs of the MOVES-Nonroad model to estimate emissions from agricultural equipment. We also incorporated documented emission factors to estimate emissions from chemical application and the operation of drying equipment for feedstock processing, and used methods developed by the EPA and the California Air Resources Board to estimate fugitive dust emissions. The model developed here could be applied to custom equipment budgets and is extensible to accommodate additional feedstocks and pollutants. Future work will also extend this model to analyze spatial boundaries beyond the county-scale (e.g., regional or sub-county levels).

11:00 ***"Natural Dust Emissions Over Cropland and Rangeland of the United States in 2014",*** D. Tong, B. Baker, P. Lee, Y. Tang and L. Pan, NOAA.

Climate models have consistently projected a drying trend in the southwestern United States, aiding speculation of increasing dust storms in this region. There are multiple lines of evidence showing that the western United States has become dustier in recent decades, including increased dust deposition in rainwater and snowpack, and an earlier onset of dust season. This study presents the development of county-level monthly inventories of natural soil dust emissions from cropland and rangeland over the Continental United States for the year of 2014. Emissions of dust $PM_{2.5}$ and PM_{10} (particulate matter less than 2.5 and 10 micrometers, respectively) are calculated from a semi-empirical dust emission model FENGSHA, which estimates the emission strength and timing of soil dust particles for each county based on detailed information of land use, soil texture, vegetation cover, soil moisture, and meteorology. Monthly profiles of dust emissions at selected sites are compared with dust observations from the Interagency Monitoring of Protected Visual Environment (IMPROVE) network. In addition, spatial distribution of dust emissions is validated with satellite dust detection for the same period. Finally, we discuss the relative importance of natural dust emission to total $PM_{2.5}$ and PM_{10} emissions over different regions.

Wednesday Morning - August 16, 2017

(Session 3 continues)

11:25 ***"Estimation of Marine Emissions Inventory from all AIS-installed Vessels",*** Y. Zhang, J. W.M. Chan and A.K.H. Lau, Hong Kong University of Science and Technology.

The Automatic Identification System (AIS) data has been used widely to estimate ship emission inventories. However, while the AIS data can provide high-resolution spatial and temporal information of ship activities (i.e. real-time speed), its derivation of emissions inventories also require pertinent vessel specifications like engine power, which are not necessarily available in the vessel parameter database. Given this limitation of the vessel parameter database, AIS-based emission inventories in earlier studies are mostly restricted to the international registered vessels, and/or locally registered vessel databases. In this study, we shall try to overcome this limitation by first regressing the pertinent vessel parameters (e.g. engine power) for vessels without international registrations from the vessel parameter database of vessels with international registrations based on vessel group, size and capacity, and then estimating the emissions using all the vessels with AIS installed. Using this approach, we have derived the marine emissions inventory in Hong Kong and the Pearl River Delta (PRD) region in southern China. Our results show that the non-identified vessels may contribute 30% to 50% of the SOx emission in the region. Moreover, our results clearly show that the importance of incorporating non-identified vessels, as the associated emission maps show much more distinct and significant emission tracks and hot spots in the inland water channels of the Pearl River Delta region.

11:50 LUNCH

Wednesday Afternoon – August 16, 2017

Session 3: Nonpoint and Point Sources

Chairs: Rich Mason, US EPA
Chun Yi Wu, MPCA

1:20 ***"Mechanical Evaporator Emission Factor Development Studies",*** Dr. A. Glen, Trinity Consultants.

The United States Environmental Protection Agency (USEPA) has developed and published emission factors in AP-42 for various industries and sources. However, since the inception of AP-42, emission factors have not remained up-to-date with all the changes and improvements in the technology which generate the emissions. Stack testing methods provide supporting data in conventional stacks but are often limited when sampling conditions are not ideal. Theoretical calculations are sometimes possible for particular sources but often provide conservative results as the specific situation is overly simplified.

One such example of this is the emissions associated with mechanical evaporators, or more commonly known as turbo-misters or water cannons. These units are typically located on the banks of, or floating on, an evaporative pond. The mechanical evaporator and pond system produce emissions of particulate matter (PM) as solution droplets drawn through the mechanical evaporators and are sprayed over the pond and allowed to evaporate and crystallize solid particles depending on the ambient conditions. Due to both the location of the sources and the change in phase of the emissions from liquid solution droplets to solid PM, quantification of the emissions from these sources is very difficult to characterize.

Trinity Consultants has developed a novel method for estimating a site specific emission factor for mechanical evaporator systems using a combined ambient monitoring and modeling technique. This method has been used at three different facilities to provide an emission factor for mechanical evaporators as a function of the Total Dissolved Solids (TDS) present in the evaporative pond. Applications using this technique have been submitted to two independent state agencies for review and received approval to be used in future permitting actions as a method of quantifying emissions from on-site mechanical evaporators.

1:45 ***"Challenges in Determination of Control Efficiencies for PM Condensable",*** C. Y. Wu, M. D. Smith, N. Edel and K Palmer, Minnesota Pollution Control Agency.

The Minnesota Pollution Control Agency (MPCA) has collected emissions of particulate matter (PM) from permitted facilities since the 1980's. Starting from the 2011 emission inventory, the MPCA has required large facilities to report filterable and condensable PM components as applicable. This requirement has posed new challenges because emission factors for PM condensable (PM-CON) are not always available and the MPCA permitting program does not collect PM-CON information explicitly. Although the MPCA encourages facilities to report process-specific emissions for PM-CON, it is impossible to expect all facilities could obtain process-specific information. Therefore, the MPCA has developed state-specific speciation factors based on the Environmental Protection Agency PM calculator. In the preparation of the 2014 emission inventory, MPCA realized that ratios of PM-CON to PM10 filterable in the PM calculator were for uncontrolled emissions. Using those ratios in controlled processes could underestimate PM-CON emissions because the majority of PM control devices only control PM filterable component. Since then, the MPCA has set no control for PM-CON for processes without specific control efficiencies and/or emissions. This approach led to a large increase of PM-CON emissions that might involve an overestimation. In 2016, the MPCA conducted a case-by-case analysis that reviewed control device types and conditions applying control devices. Control efficiencies were set for those processes where PM-CON should be controlled. PM-CON emissions were revised for both 2014 and 2015 inventories. This paper will present the detailed analysis approach and results, which could be useful for others in the compilation of their respective emission inventories.

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(Session 3 continues)

2:10 "***Emission Characterizations from a Pilot-Scale Combustor Operating on a Variety of Coals",*** T. Yelverton, A. T. Brashear, D. G. Nash, and J. E. Brown, US EPA; C. F. Singer, Jacobs Technology; P. H. Kariher, and J. V. Ryan, US EPA.

Gaseous and particulate emissions generated from the combustion of coal have been associated with adverse effects on human health and the environment, and have therefore been the subject of regulation by federal and state government agencies. Detailed emission characterizations are needed to better understand the impacts of pre- and post-combustion controls on a variety of coals found in the United States. The U.S. Environmental Protection Agency (EPA) requires reporting by industry for criteria and many hazardous air pollutants (HAPs), but many of the methods for monitoring and measuring these gaseous and particulate emissions rely on time-integrated sampling techniques. The current study not only characterizes emissions from three coals, but also investigates the use of instrumentation for improved measurement and monitoring techniques that provide real-time emissions data. This allows for updates to EPA's National Emissions Inventory while expanding potential emissions measurement capabilities for industry. Testing was completed using the U.S. EPA's Multi-Pollutant Control Research Facility, a pilot-scale coal-fired combustor using industry-standard emission control technologies, in Research Triangle Park, North Carolina. Emissions were calculated based on measurements from the flue gas (pre- and post-electrostatic precipitator), to characterize gaseous species (CO, CO2, O2, NOX, SO2, other acid gases, and several organic HAPs) as well as fine particulate (mass, size distribution, number count, elemental carbon, organic carbon, and black carbon). Comparisons of traditional EPA methods and those made via FTIR for CO, NOX, and SO2 are also reported.

2:35 ***"Greenhouse Gases from Power Sector – Keys to Improve Estimations",*** K. Narasimhan, VA DEQ.

Power sector happens to be second largest GHG emitter next to transportation. Also, many states owe its emissions indirectly to that part of power consumed due to imports across the state line. State Inventory Tool (SIT) provided by the Environmental Protection Agency (EPA) relay on the top down approach of emission assessment on the basis of energy consumption data available in the State Energy Data System (SEDS) maintained by the Energy Information Administration (EIA) of the Department of Energy (DOE). SIT also provides an alternative to the estimation on the basis of power actually bought & consumed individually by four major consumers viz. residential, commercial, industrial, and transportation that in effect represents a bottoms-up approach. This also takes into account emissions due to power imported. This paper demonstrates a refinement to the method of estimation by relying on power generation performance data obtained as a bottoms up approach in a greater detail in another section of EIA based on EIA-906/920/926 submissions. Similarly, refinements are suggested on the basis of projected future generation by the Eastern Regional Technical Advisory Committee (ERTAC). Above ideas as applicable to the case of Virginia by way of example are discussed for the period 1990-2030 in comparison to historic and projected emissions resulting from SIT. Suggested improvements also take into account the emissions reported under EPA's Greenhouse Gas Reporting Program (GHGRP) in the recent years. It is observed that the difference in estimated emissions range between 10 and 17 percent and even more in some instances

3:00 BREAK

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3:30 ***"Relation between PM2.5 and Ozone in Ambient Air and Local Emissions at County Levels Relation between Ground Level Ozone and Local Emissions at County Level",*** K. Narasimhan, VA DEQ.

With the availability of monthly emissions of criteria pollutants at county level for 2011, it has been possible to derive an empirical relation between the tonnage emissions of pollutants and the reported monthly maximum particulate concentration (PM2.5). Dependent parameters established during the process of multiple regression analyses are particulates below 10 microns (PM10) & below 2.5microns (PM2.5) having a direct impact, along with monthly maximum temperature (T) and other pollutants including oxides of nitrogen (NOX), sulfur dioxide (SO2), ammonia (NH3), volatile organic compounds (VOC), and carbon monoxide (CO). The empirical relation applicable to any county is given below:

CPM2.5 = a*PM10 + b*PM2.5 + c*T + d*NOX + e*SO2 + f*NH3 + g*VOC + h*CO
Where CPM2.5 = Monthly maximum PM2.5 concentrations in ambient air, microgram/m3,
PM10, PM2.5 = Monthly particulate emissions, tons
T = Monthly maximum temperature, degrees C,
NOX, SO2, NH3, VOC, CO = Monthly emissions, tons, and
a to h = Numerical constants unique to a county.

The above relation is found to hold good for all the 314 counties in the nation with high correlation confidence (R2), of above 90% except for 8 counties. 20 of these counties, some together as contiguous areas, were still in non-attainment in 2012 for CPM2.5 based on 2008 standards. The relation that holds equally good for contiguous areas also, can be useful in projecting future PM2.5 concentrations at county or area level based on estimated emissions as may be required in drafting State Implementation Plans(SIP). Further, spatial and temporal variations in concentration and composition of particulates during2011 are studied based on the available speciation data. Results reveal that while particulates are generally richer in sulfates in summer with nitrates being higher in winter months, two distinct patterns emerge in the monthly variations of ambient air PM2.5 concentrations in the country. In one set of counties particulate concentrations are at a maximum during the middle of the year following the pattern of maximum daily temperature. In the other group, concentrations are equally high or higher in winter months at the beginning and end of the year.

3:55 ***"Developing Maricopa County's Emission Reduction Credit Program",*** H. Valenzuela, MCAQPD.

MCAQD will present an overview of the agencies development of an emission reduction credit (ERC) program including the challenges of developing and implementing the program. MCAQD will summarize our internal process utilizing the departments existing emissions inventory system and the recent local ERC legislative changes. The presentation will also discuss using traditional and nontraditional sources for offsets and the issues with estimating emissions reductions from nontraditional sources.

4:20 ***"Estimating Emissions of Volatile Organic Compounds due to Leaks from Piping System",***

A. Parchamdar, Tehran University; E. Rezaei, and F. Azarmi, Sharif University of Technology; K. Ashrafi, Tehran University and M. Arhami, Sharif University of Technology.

Piping system in various industries such as chemical, and oil and gas industries have the potential to emit volatile organic compounds (VOCs) through possible leaks. These emissions can cause serious impacts on the surrounding environment and public health but enough studies to accurately estimate these emissions were not conducted. Two major leak sources in piping systems are valves and flanges. In this study VOC emissions were estimated from these two sources. More than 6000 valves and flanges in several pipe line systems transporting natural gas were assessed. In order to obtain required data such as operational parameters and the concentration of pollutants around each equipment for estimating emission rates, measurements were made over the period of a whole year. Initially in order to identify leaking components from non-leaking ones, screening values were determined by measuring VOC levels around piping system. These measurements helped to detect the major sources of the VOCs. Then the identified leaking components were sealed and VOC samples were collected. The composition of the collected samples from emissions of equipment's leak were analyzed by GCMS at laboratory. The results indicated the main components from natural gas lines are methane, ethane and a group of BTEX including benzene, toluene, ethyl benzene and xylene. The results showed almost all of BTEX chemicals, including benzene, toluene, ethyl benzene, xylene and more than 60% of total TVOCs in the flanges and valves were released to the environment during the equipment's leaks. Moreover, for valves and flanges, correlation equations were established to estimate the amount of emissions by correlating the amount of emission to screening values. The average of TVOCs emission rate were estimated to be 65±5 tons/year. The key findings of this work would help to establish the local emission factors that are useful inputs to develop emission inventories and framing guidelines for estimating emission through leaks.

4:45 ***"Chemical Composition of Particles from Traditional Burning of Pakistani Wood Species",***

I. Sahid, Institute of Space Technology, Islamabad Pakistan.

Total particulate matter (TPM) emitted during burning of three types of Pakistani wood (eucalyptus camaldulensis, local name Safeeda; acacia nilotica, local name Kikar, Babul; dalbergia sissoo, Shisham, Tali) in a traditional brick stove were collected and analyzed for anhydrosugars, sugar alcohols, trace metals, soluble ions and carbonaceous species. This is a first study reporting anhydrosugars in wood smoke particles emitted during traditional burning of common wood types in Pakistan. Carbonaceous species showed the highest contribution to the particulate matter. Although the total carbon (TC) contribution was similar for all burnings (64.8e70.2%), the EC/OC ratio varied significantly, from 0.2 to 0.3 for Accacia and Dalbergia to 0.7e0.8 for Eucalyptus and Wood-mix. Among inorganic constituents' potassium chloride and silicon were found at levels higher than 1%. The levoglucosan concentrations ranged from 3.0 to 6.6% (average 5.6%) with the highest value for Accacia and lowest value for the wood-mix. The high levoglucosan/mannosan ratios of 20e28 were typical for hardwood. The ratio between levoglucosan and galactosan varied stronger and was found to be around 13e20 for Accacia, Eucalyptus and Wood mix, and 43 for Dalbergia. The determined levoglucosan concentrations allowed assessing the conversion factor for calculation of biomass smoke contribution to ambient particulate matter levels in Pakistan.

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Session 4: International Emission Inventories **Chairs: Erik Von Schneidemesser, IASS**
Terry Keating, US EPA

1:20 ***"Trends in Anthropogenic Emissions from 1960 to 2015",*** C. Granier, Laboratoire d'Aerologie, France and NOAA/CIRES, University of Colorado, USA; T. Doumbia, Meteo-France, L. Granier, Laboratoire d'Aerologie, France; K. Sindelarova, Charles University, Czech Republic; C. Liousse, Laboratoire d'Aerologie, France; S. Darras, Observatoire Midi-Pyrenees, France; I. Bouarar, Max-Planck Institute for Meteorology, Germany; H. D. Van Der Gon, TNO, Netherlands; G. J. Frost, NOAA; G. Janssens-Maenhout, European Commission Joint Research Centre, Italy; M. Crippa, European Commission Joint Research Centre, Italy; J. Stavrakou, Belgian Institute for Space Aeronomy, Belgium; R. Hoesly and S. Smith, PNNL, USA.

Different research teams worked during the past years to develop anthropogenic spatial and temporal distributions for different periods and regions. These inventories provide emissions either on a national basis for different countries, or gridded emissions at the global or regional scale. We will present an evaluation of the most recent emissions datasets providing emissions for the 1960-2013 period, for different gaseous and particulate compounds, i.e. carbon monoxide, nitrogen oxides, volatile organic compounds, sulfur dioxide, ammonia, black and organic carbon, and particulate matter (PM10 and PM2.5). We will discuss the consistency between global and regional inventories, as well as between the different chemical compounds, for 22 world regions. This work will help quantifying the uncertainties on anthropogenic emissions in the different regions. The simulations performed in support of the 2013 report of the Intergovernmental Panel on Climate Change (IPCC) used surface emissions from the Representative Concentration Pathways (RCPs) future scenarios. These scenarios provide emissions of greenhouse gases and atmospheric pollutants from 2000 to 2100. We will compare the emissions provided by the four RCPs emissions scenarios from 2000 to 2015 with the most recent information on emissions during the past fifteen years. From these comparisons, we will assess if the RCPs emissions can be used for forecasting the distribution of atmospheric pollutants in the recent past and near future. This assessment, which will focus on the emissions of nitrogen oxides, sulfur dioxide and volatile organic compounds, will include estimations of emissions using inverse modeling techniques and satellite observations

1:45 ***"Regional and Global Long Term Emissions Constrained by NO2 and SO2 Satellite Observations",*** Z. Qu and D. Henze, University of Colorado; J. Wang, X. Xu, and Y. Wang, University of Iowa.

Quantifying emissions trends of nitrogen oxides (NOx) and sulfur dioxide (SO2) is important for improving understanding of air pollution and the effectiveness of emission control strategies. We estimate long-term (2005-2012) NOx and SO2 emissions for China at the 0.5° x 0.7° resolution through multi-species top-down constraints by extending a recently developed hybrid (mass-balance / 4D-Var) method and using a new sector-based inversion formulation. We begin by optimizing NOx and SO2 emissions simultaneously, using both NO2 and SO2 observations from the OMI remote sensing instrument. Due to chemical interactions between these two species, inclusion of SO2 observations leads to ~30% grid-cell level differences in posterior NOx emissions compared to those constrained only by NO2 observations. Apart from these interactions, NOx and SO2 emissions are correlated through the amount of fuel combustions, since each of them is the product of species emission factors and the amount of combusted fuels. To incorporate this correlation in the inversion, we assimilate NO2 and SO2 observations to optimize seven sector-specific emission scaling factors, including industry, energy, residential, air, transportation, ship and agriculture. These scaling factors are applied to NOx, SO2, CO, NH3, BC, OC and NMVOCs. Changes of emissions from anthropogenic sectors over the years are studied. We also compare posterior emissions from inversions optimizing only species' emissions, only sector-based emissions, and both species' and sector-based emissions. Pseudo-observation tests are performed to study the accuracy of posterior emissions. These hybrid joint inversions will be applied to estimate global (2° x2.5° resolution) NOx and SO2 emissions.

2:10 ***"Increased Atmospheric Ammonia over the World's Major Agricultural Areas Detected from Space",*** J. X. Warner, R. R. Dickerson, and Z. Wei, University of Maryland, College Park; L. L. Strow, University of Maryland, Baltimore County; Y. Wang, University of Houston; Q. Liang, NASA/GESTAR.

This study provides evidence of substantial increases in atmospheric ammonia (NH3) concentrations (14-year) over several of the world's major agricultural regions, using recently available retrievals from the Atmospheric Infrared Sounder (AIRS) aboard NASA's Aqua satellite. The main sources of atmospheric NH3 are farming and animal husbandry involving reactive nitrogen ultimately derived from fertilizer use; rates of emission are also sensitive to climate change. Significant increasing trends are seen over the US (2.61% yr-1), the European Union (EU) (1.83% yr-1), and China (2.27% yr-1). Over the EU, the trend results from decreased scavenging by acid aerosols. Over the US, the increase results from a combination of decreased chemical loss and increased soil temperatures. Over China, decreased chemical loss, increasing temperatures, and increased fertilizer use all play a role. Over South Asia, increased NH3 emissions are masked by increased SO2 and NOx emissions, leading to increased aerosol loading and adverse health effects. Details of the global ammonia distributions and trends will be discussed in the presentation.

2:35 ***"Gasoline Vehicle Refueling Emissions: How Inventories Can Inform Regulatory Policy",*** G. Passavant, Ingevity Corporation.

Vehicle refueling emissions from volatile liquid fuels such as gasoline and gasoline-ethanol blends are among the most ubiquitous in the atmosphere. They contribute VOCs which contribute to ozone and secondary organic aerosol formation and contain air toxic compounds which impact occupational health and community environments. There have been a wide variety of control responses from governments, ranging from extensive fuel quality programs and technology requirements to no regulatory requirements at all. This presentation reviews the basic factors impacting the VOC and benzene emission rates, examines the VOC and benzene inventory impacts of regulatory requirements or lack thereof in the US, China, Brazil, and the EU, and draws inferences for the potential effectiveness of future control program initiatives in other areas.

3:00 BREAK

3:30 ***"A Global Inventory of Speciated Non-methane Volatile Organic Compounds Emissions from Anthropogenic Sources",*** G. Huang, University of Stuttgart, Germany; R. Brook, Aether, United Kingdom; M. Crippa and G. Janssens-Maenhout, European Commission Joint Research Centre, Italy; C. Schieberle, University of Stuttgart, Germany; C. Dore, Aether, United Kingdom; D. Guizzardi, Didesk Informatica, Italy; M. Muntean and E. Schaaf, European Commission Joint Research Centre, Italy; R. Friedrich, University of Stuttgart, Germany.

Knowledge of the chemical species of non-methane volatile organic compounds (NMVOC) is essential for ozone and secondary organic aerosols chemistry. It is important that chemical transport models (CTMs) simulate the chemical transformation of the different NMVOC species in the troposphere consistently. The main objective of this study is to disaggregate NMVOC emissions data in the Emission Database for Global Atmospheric Research (EDGAR) on a high sector resolution to individual species or species groups, thus enhancing the usability of the EDGAR data by the modelling community. Region- and source-specific speciation profiles of anthropogenic NMVOC emissions are compiled and mapped to EDGAR processes with corresponding quality codes specifying the quality of the mapping. Individual NMVOC species in different profiles are aggregated to 25 species groups, in line with the common classification of the Global Emissions Initiative (GEIA). Comparison of the generated emission data set with the RETRO emission inventory shows good agreement for sectors in Europe and the United States, and higher regional

specificity of the produced data set. Global annual grid maps with a resolution of 0.1° × 0.1° for the period 1970-2012 are produced by sector and species. A case study of Germany shows that total NMVOC emissions of transport and residential sectors decreased dramatically from late 1980s to recent years. Implementation of transport emission control strategies and the fuel shift from coal to cleaner fuels (oil, natural gas, and solid biomass) have led to increased shares of alkanes and alkanals, as well as decreased share of aromatics.

3:55 ***"GEIA NMVOC Working Group Activity: Comparing Measurements and Emission Inventory Data for NMVOCs in Urban Areas",*** E. von Schneidemesser, Institute for Advanced Sustainability Studies, Potsdam, Germany; M. Crippa, Joint Research Center, Ispra, Italy; H. Denier van der Gon, TNO, Utrecht, the Netherlands; L. Feng, Pacific Northwest National Laboratory-Joint Global Change Research Institute, College Park, MD, USA; J. Gilman, NOAA, Boulder, CO, USA; G. Frost, NOAA, Boulder, CO, USA; G. Huang, University of Stuttgart, Stuttgart, Germany; G. Jansens-Maenhout, Joint Research Center, Ispra, Italy; B. McDonald, NOAA, Boulder, CO, USA; C. Ou-Yang, National Central University, Taoyuan 32001, Taiwan; S. Smith, Pacific Northwest National Laboratory-Joint Global Change Research Institute, College Park, MD, USA; S. Tisinai, NOAA, Boulder, CO, USA; C. Warneke, NOAA, Boulder, CO, USA; the GEIA NMVOC Working Group Members.

Common relationships among non-methane volatile organic compounds (NMVOCs) across urban areas globally have indicated a substantial similarity in the dominant emission source, specifically motor vehicles (Parrish et al., 2009; von Schneidemesser et al., 2010). Furthermore, the use of NMVOC measurements in urban areas has been used to provide a check on the primary emissions for NMVOCs in reported inventories, as in Warneke et al., 2007, Borbon et al., 2013. These studies typically compare measured atmospheric enhancement ratios of individual NMVOCs to carbon monoxide (CO) or acetylene to parallel ratios in emission inventories (EI). In many cases these studies have shown significant measurement-inventory discrepancies by factors of 2 or more for individual species (Warneke et al., 2007; Borbon et al., 2013). Such discrepancies have implications for air quality modeling and the accurate simulation and prediction of not only NMVOCs, but other species such as ozone or secondary organic aerosol. This study is an effort of the GEIA Working Group on NMVOCs and brings together measurements of NMVOCs from urban areas globally in conjunction with two global emission inventories (EDGARv4.3.2 and CEDS) to provide a synthesis of such comparisons against the same baseline (a global inventory for all areas rather than comparison with many different local emission inventories). Comparisons between measurements in urban areas and the respective information from global EI will be shown, with more extensive comparisons included for a few urban areas that include comparison with national inventories as well.

4:20 ***"A High Resolution Technology-based Bottom-up Emissions Inventory for Nepal",*** P. H. Sadavarte, Institute for Advanced Sustainability Studies, Germany; B. Das, International Centre for Integrated Mountain Development and Tribhuvan University, Nepal; K. Shakya, International Centre for Integrated Mountain Development; M. Rupakheti, Institute for Advanced Sustainability Studies, Germany; P. V. Bhave, International Centre for Integrated Mountain Development, Nepal; R. M. Byanju, Tribhuvan University, Nepal; M. G. Lawrence, Institute for Advanced Sustainability Studies, Germany.

The lack of a comprehensive, up-to-date emission inventory is a major challenge in understanding atmospheric processes, impacts, and mitigation of air pollutants in the central Himalayan region. This study develops a high resolution (1km × 1km) present-day emission inventory for Nepal with a higher-tier approach to understanding the current combustion technologies and sectoral energy consumption. We estimate aerosols, trace gases and greenhouse gases emissions from non-open burning (residential, industry, transport, commercial) and open burning sources (agro-residue and trash burning) for the base

year 2013 using bottom-up methodologies. Local practices and activities are explicitly accounted for dispersed sources like brick production, diesel generators, agricultural and trash burning. Newly-measured country-specific emission factors are used for emission estimates. A GIS-based population density map was developed incorporating land-use and land cover data, settlement points, and topography for spatial distribution of emissions. Geospatial locations were assigned to point sources, while activity-based proxies were used for other sources. The energy use estimates in the industrial and commercial sectors exceed governmental reports by a factor of two, whereas in the residential sector there is a good agreement (±15%) with the government data. National annual PM2.5, BC, OC, and SO2 emissions estimated from these three sectors were 158Gg, 22Gg, 82Gg and 15Gg, respectively. Emissions varied widely across grids, even within the Kathmandu Valley – for example, BC emissions varied between 0.5 and 20 tonnes/grid. These revised emissions will serve as valuable input for analyses of atmospheric processes, impacts, and mitigation of air pollutants in Nepal and the Himalayan region.

4:45 ***"Anthropogenic Emissions in South America for Air Quality and Climate Modelling",***
N. Huneeus, University of Chile and Centre for Climate and Resilience Research, Chile; C. Granier, Laboratoire d'Aerologie, France and NOAA/CIRES, University of Colorado; L. Dawidowski, CNEA, Argentina; H. D. Van Der Gon, TNO, The Netherlands; M. Alonso, Universidad Federal de Pelotas, Brazil; P. Castesana, National University of San Martin, Argentina; M. D. Resquin, CNEA, Argentina; G. J. Frost, NOAA, USA; L. Gallardo, University of Chile and Centre for Climate and Resilience Research, Chile; D. Gomez, CNEA Argentina; R. Hoesly, PNNL, USA; M. de F. Andrade, University Sao Paulo, Brazil; M. Melamed, CIRES/University of Colorado, USA; M. Osses, Technical University Federico Santa Maria, Chile; E. Puliafito, Universidad Tecnologica Nacional, Argentina; N. Rojas, Universidad Nacional de Colombia, Colombia; O. S. Ccoyllo, National Service of Hydrology and Meteorology of Peru; S. Smith, PNNL, USA; S. Tolvett, Metropolitan Technological University, Chile; R. Ynoue, University Sao Paulo, Brazil.

A workshop was held in Santiago, Chile, in March 2017, gathering experts in emissions from different countries in South America, Europe and the USA. Current status of emission inventories in five South American countries (Argentina, Brazil, Chile, Colombia and Peru) was presented and discussed. This information will be summarized in a document that will be used to seek international funding to generate a consistent emission inventory for each one of these South American countries. National emission inventories in South America are prepared as part of the obligations of these countries to the United Nations Framework Convention on Climate Change within the framework of their national communications. These inventories include the emissions of greenhouse gases as well as non-GHG gases subject to complementary reporting under the Convention. Several pollutants with important impact on climate change and air quality are not included in these estimates. Emission inventories developed in different Latin America (LA) countries are typically developed at national level, providing an annual total, not necessarily for all criteria pollutants and without information on spatial and temporal emission patterns. There are also inventories for a number of LA cities, particularly large urban conglomerates, but these are not necessarily consistent with the corresponding national inventories. There is need to harmonize these estimates, and to fill the gap associated with the knowledge of spatially distributed and temporally disaggregated emissions. A network was established between members of the LA Emissions Inventory Group (LAEIG) from five countries (Argentina, Brazil, Chile, Colombia and Peru) and international researchers with the aim to build a consistent and shared emission inventory in the near future for these five countries.

Wednesday Afternoon - August 16, 2017

Session 5: Intersection Between Inventories and Life-Cycle Emissions Impacts

Chairs: Christy Parsons, US EPA
Chris Tessum, Univ of WA

1:20 ***"Intersection of Life-Cycle Analysis Data and Emissions Inventories: A Case Study of Mobile Source Fuel Production",*** C. Parsons, R. Cook, M. Zawacki, and K. Borgert, A. Verma, J. Brown, A. Eyth, J. Vukovich, US EPA; A. Zubrow, VOLPE Center/DOT.

Life-cycle analyses (LCA) and emissions inventories (EI) provide process- and source-specific data, respectively, which are often utilized separately; however, it is increasingly useful to integrate the process- and source-specific approaches in order to evaluate temporal and spatial aspects of emissions. Ongoing work at the US Environmental Protection Agency (EPA) and elsewhere is thus focused on refining data and methods to utilize the spatial and temporal information included in EI in conjunction with LCA process-based data. As an example, we present a case study of methods under development to combine existing EI data with additional data sources in order to allocate emissions from particular sources to a specific process. This case study focuses on the production of fuel used in mobile sources (e.g., highway trucks, passenger cars) and demonstrates the allocation of emissions from one source, petroleum refineries, to a process, gasoline production, which is one of many processes occurring at the source. In addition to providing spatial and temporal granularity to process-based data, this example discusses the value of integrating data on multiple pollutants in a single analysis. The combination of spatial and temporal data with information across multiple pollutants may inform future method development for inventories that support a variety of analyses.

1:45 ***"Considerations in Projecting Energy-related Emissions Multiple Decades into the Future",*** D. Loughlin, L. Ran, and C. Nolte, US EPA.

Use of fossil fuels for energy is the primary source of anthropogenic emissions of many air pollutants. Thus, the evolution of the energy system into the future can influence future emissions, driving those emissions up or down as a function of shifts in energy demand and fuel use. Energy system models can be used to analyze alternative energy system scenarios and develop associated emission projections. These projections, in turn, can support air quality modeling, life cycle analysis, and other applications. In this presentation, we discuss how we have used the MARKet ALlocation (MARKAL) energy system model to develop inputs to the Sparse Matrix Operator Kernel Emissions (SMOKE) processor. In particular, we discuss development of multiplicative emission growth and control factors, spatial adjustments made to account for population and land use changes, and temporal adjustments made to account for fuel switching and changes in diurnal demand profiles. We conclude the presentation with an identification of outstanding issues, such as determining the appropriate level of technological aggregation, siting new electric generation capacity, and accounting for uncertainty.

2:10 ***"A Framework to Analyze Emissions Implications of Manufacturing Shifts in the Industrial Sector through Integrating Bottom-up Energy Models and Economic Input-output Environmental Life Cycle Assessment Models",*** P. O. Kaplan, T. Hottle, and R. Dodder, US EPA.

Future year emissions depend highly on economic, technological, societal and regulatory drivers. A scenario framework was adopted to analyze technology development pathways and changes in consumer preferences, and evaluate resulting emissions growth patterns while considering future uncertainty. The framework integrates EPA's MARKet ALlocation (MARKAL) energy systems optimization model with an economic Input-Output (I/O) Life Cycle Assessment model. The EPAUS9r database, utilized with the MARKAL model, includes technologies to represent the U.S. energy system from resource extraction, process and conversion technologies to convert resources into useful energy, to end-use technologies for meeting demands. The demands for goods and services are represented exogenously in MARKAL. It is important to characterize these exogenous inputs appropriately, especially for the industrial sector as

energy and emissions outlooks are driven by it. An economic I/O model of the U.S. economy can provide variations in demand and the share of consumer income expended on a given good when a change in input requirements (e.g., energy intensity or a structural change in how this good is made) occurs. Linking an I/O model with MARKAL facilitates analysis of changes in technological progress and consumer preferences in a systematic manner. The framework will then be extended to track life cycle emissions associated with a good. A case study on upstream raw material manufacturing shifts induced by vehicle mass reduction activities in the automotive-industry will be used to illustrate the framework. The study will analyze life cycle emissions and economic implications.

2:35 ***"Spatially Explicit Life Cycle Assessment for Air Pollution Health Impacts",*** C. Tessum, University of Washington; J. D. Hill, University of Minnesota; and J. D. Marshall, University of Washington.

When assessing the air-quality related health impacts of regulations or other interventions, it is often important to consider changes in emissions in the "life cycle" or supply chain of a product or process being regulated in addition to emissions from the product or process itself. Life cycle assessment is a method for accounting for emissions and impacts from these supporting processes. Because air pollution health impacts are highly dependent on emission location, the accuracy of life cycle assessment in estimating air pollution health impacts is enhanced with increasing spatial detail. This presentation will describe our work in developing model frameworks for spatial life cycle impact assessment at 1 km2 resolution by coupling the US National Emissions Inventory (NEI), the GREET and EIO-LCA life cycle assessment models, and the InMAP reduced complexity air quality model. I will also present several case studies of the application of these frameworks, including assessments of the air quality-related health impacts of US economic activity by sector, air quality-related health impacts of corn production, and air quality-related health impacts of conventional and alternative light duty vehicle production and use

3:00 BREAK

3:30 ***"Rapid Life Cycle Inventory Modeling of Chemical Manufacturing Using the US EPA's Emissions Inventories."*** D. Meyer, US EPA; S. Cashman, Eastern Research Group; W. W. Ingwersen, US EPA; A. Edelen, Oak Ridge Institute for Science and Education; M. Gonzalez and R. Smith, US EPA.

Demands for quick and accurate life cycle assessments create a need for methods to rapidly generate reliable life cycle inventories (LCI), which are models of inputs and outputs for industrial production processes or activities in other sectors that can be integrated into full life cycle models of products or industries. This work proposes a method to standardize the discovery and use of publicly-available data from the United States Environmental Protection Agency (EPA) for use in chemical manufacturing LCI. The method is developed using a series of chemical case studies. Our method integrates data from the EPA's Facility Registry Services (FRS), Substance Registry Services (SRS), Chemical Data Reports (CDR), Toxic Release Inventory (TRI), National Emissions Inventory (NEI), Greenhouse Gas Reporting Program (GHGRP), RCRA Info database (RCRAInfo), and Discharge Monitoring Reports (DMR). A comparison of the generated LCIs with existing models revealed the data mining LCIs are in reasonable agreement with more traditionally-developed LCIs and may provide a more comprehensive inventory of air emissions and water discharges, but have key data gaps that include material inputs, water usage, purchased electricity, and transportation requirements. The challenges of using and scaling-up this approach include the need to query and reconcile data from all these EPA data sources as they are continually updated and improved. In this light, researchers are coordinating with EPA's Office of Environmental Information on the use of a linked open data framework for managing these data sources

3:55 ***"A Life Cycle Analysis of Refinery Fuel Products Air Emissions Using Refinery Emissions Inventory Data",*** P. Sun, A. Elgowainy, Z. Lu, J. Han, and M. Wang, Argonne National Labs; T. Hawkins and B. Morelli, Eastern Research Group.

With the transportation sector being a major source of air pollutant emissions, this study focuses on evaluating air emissions (criterion pollutants and greenhouse gases) related to vehicle applications with petroleum fuels on a life cycle basis using the GREET® (Greenhouse gases, Regulated Emissions, and Energy use in Transportation) model. The life cycle analysis of petroleum fuels includes major stages of crude recovery, crude transportation, crude refining, fuel distribution and fuel combustion (vehicle operation). The present work is specifically featured by an ongoing research effort to create a refinery emissions inventory dataset to quantify refinery emissions associated with different refinery fuel products. The approach is distinguished by combining top-down refinery emission inventory data with bottom-up unit-level emissions factors via a research-and-match effort. Triangulating estimates with these two data resourcing methods not only enables validation of results, but also reveals sub-facility level (unit level) details. The methodology of transforming facility level emission information to unit level emission data at petroleum refineries will be discussed here. The unit level information not only enables an allocation of air emissions and resource use to individual refinery products, but also allows for a projection of future refinery emission trend via re-combining process units to reflect future refinery configurations. The present work also investigates the refinery emissions in breadth by grouping the emission data in a PADD level along with the energy use in each PADD. These detailed, updated refineries emission results will ensure GREET and other LCA models to accurately model petroleum fuels life-cycle emissions.

4:20 ***"Integrating Data Sources, Geo-Spatial Analyses, and Engineering-Based Calculations to Model Life-Cycle Emissions in Crude Oil Transport for Mobile-Source Fuels",*** A. Verma, ORISE/US EPA, C. Parsons, R. Cook, M. Zawacki, K. Borgert, J. Brown, A. Eyth, and J. Vukovich, US EPA; and A. Zubrow, VOLPE/DOT.

Emissions from transporting crude oil from a well to a refinery gate for use in finished mobile source fuels (e.g., gasoline, diesel) contribute to the overall well-to-wheel emissions attributed to mobile sources. Most studies and models in the existing literature evaluate emissions associated with crude oil transport using nationally aggregated emissions, and thus do not evaluate the associated local scale impact of these emissions. In addition, existing literature primarily focuses on emissions of greenhouse gases, not other pollutants, during crude oil transport. This ongoing study is working to fill a gap in the literature by better accounting for where emissions of multiple pollutants occur during the transport of crude oil from the well to the refinery gate. We discuss a unified approach that incorporates geo-spatial analysis and engineering-based calculations to model the activity (mass and distance during transport) and emissions impact of a given type of transport mode (i.e., rail, pipeline, marine, or truck). Multiple sources of geospatial data, reported freight fuel use, and other datasets are integrated in the approach. Based on available data, this study presents initial results that quantify and spatially resolve emissions impacts of various activities (loading, unloading, and transport) in a given transport mode. The approach discussed in this study may lead to a better understanding of methods to evaluate environmental impacts of crude oil transport.

4:45 ***"Quantifying Uncertainty in Life Cycle Assessments of Transportation Fuels",*** A. Kumar and G. Di Lullo, University of Alberta, Canada.

A life cycle assessment (LCA) is used to compare well-to-combustion greenhouse gas (GHG) emissions of various crudes. Using an LCA raises the question: are bottom-up LCA models accurate enough for this comparison? Current LCA model inputs use single point estimates. Due to the lack of quality data, assumed input values are often subjective, leading to variations in the output GHG estimates across different models. Previous work failed to include uncertainty ranges for the GHG estimates, without which it is not possible to confidently state if one crude has higher or lower GHG emissions than another. By using a Monte Carlo simulation with probability distributions for each key input rather than single points, our model is able to quantify the uncertainty of the GHG emission estimates introduced by the uncertainty in the input values. Our analysis used an improved version of the Excel-based FUNdamental ENgineering PrinciplEs-based ModeL for Estimation of GreenHouse Gases (FUNNEL-GHG). A sensitivity analysis was used to identify key inputs for each of the eleven crude scenarios examined. The resulting uncertainty in the GHG emissions ranged from ±3% to ±11%. While there was significant overlap among the uncertainty ranges, it was still possible to differentiate between high and low emission crudes. This work will provide additional insight into the accuracy of GHG emissions' estimates of various crudes. Additionally, due to the large variation in the GHG emissions among crudes, this work suggests that regional policy-makers should use crude-specific emission estimates rather than national averages when developing policy.

Thursday Morning – August 17, 2017

Session 6: Oil and Gas

Chairs: Tom Moore, WRAP/WESTAR
Adam Eisele, US EPA
Julia Gamas, US EPA
Regi Oommen. ERG, Inc
Jennifer Snyder, US EPA

8:00 ***"Texas 2014 Area Source Oil and Gas Emissions Estimates",*** M. Ege, TCEQ.

Presented is a review of Texas data contained in the 2014 version of the EPA oil and gas emissions estimation tool (EPA tool), by the Texas Commission on Environmental Quality (TCEQ). The EPA tool is an Access database that allows for the estimation of area source oil and gas emissions using county-level activity data (well counts and production data) and county-level or basin-level equipment profiles and emission factors. The EPA tool is provided by the EPA to assist states with their oil and gas air emissions estimations. While the EPA tool includes default equipment profiles and emission factors that can be used to estimate default emissions (and is actually used in this manner by the EPA to estimate emissions for states that do not submit their own estimates), states are encouraged to update the tool with state-specific values to improve emission estimates. This presentation discusses the Texas-specific updates provided by the TCEQ for inclusion in the 2014 version of the EPA tool. The TCEQ has also developed its own Texas-specific oil and gas calculator, which is used to estimate Texas area source oil and gas emissions. While the emissions from many oil and gas sources in the EPA tool and the TCEQ calculator use the same calculation methodologies and equipment factors, some sources (such as compressor engines and glycol dehydrators) are estimated differently. This presentation also includes comparisons between some of the methodologies used by the EPA tool and the TCEQ calculator.

8:25 ***"Developing a Utah Oil and Gas Inventory",*** W. Oswald, Utah Division of Air Quality.

For almost a decade the 2006 Western Regional Air Partnership (WRAP) Phase III oil and gas emissions inventories were relied on for the Uinta Basin, the main oil and gas producing region in Utah. Although these inventories were projected forward using up-to-date annual production and drilling activity data from the region, the inventories still lacked the ability to capture the technological advancements that occurred over the period. In 2013 the Utah Division of Air Quality (UDAQ) started working to develop an up-to-date and improved oil and gas emissions inventory for the Basin. This process involved the cooperation of various stakeholders, including federal and state regulators, oil and gas operators, and tribal entities. In 2015, an emissions inventory workbook and request for completion was sent to each operator in the Uinta Basin active in 2014. In 2016 the data was compiled into a 2014 Uinta Basin oil and gas emissions inventory database. I will present the process UDAQ used to develop the new inventory, and discuss what challenges were faced along the way. In addition to the collected inventory DAQ has worked to determine and begin collecting supplemental data needed to create a truly comprehensive 2014 inventory, including additional equipment categories not addressed through the workbook request, uncaptured emissions from equipment leaks or malfunctions, specifically those from storage tanks, and improved speciation profiles. I will also discuss the results from DAQ's inventory effort and the implications of the results for our future modeling and other regulatory work in the Uintah Basin.

8:50 ***"Consequences of the Evolution of Control and Production Technology in the Denver Ozone Nonattainment Area (NAA"),*** D. Wells, Colorado Public Health Department.

Over the last ten years the Denver Ozone Nonattainment Area (NAA) has seen a large increase in oil and gas production. This expansion was enabled by a change from the use of vertical wells in sandstone formations to horizontal wells in deeper shale formations and required new drilling technology. This activity together with violations of the ozone standard brought about more emission control. Calculation of emissions from these changes requires data about the chemical composition of the various oil and gas streams and control technology data such as capture efficiency and rule effectiveness. All of these parameters are difficult to measure so top down inventories are used to provide information about how the values of the parameters should be adjusted to fit ambient air measurements. Inventory development over this time period shows how control requirements differ across political and geographic boundaries, how oil and gas activity data and emissions factors vary from state to state, and how they vary from the national average. Spatial patterns of emission control and technology in the NAA will be compared to other basins illustrating the kind of activities EPA and states should be documenting on non-point oil and gas sources. The effect of the patterns on the associated data in the EPA Oil and Gas Tool will be discussed. Progress in controlling the effects of increased oil and gas production can only be achieved effectively if quality emission data is available to the public and other decision makers.

9:15 ***"EPA's Oil and Gas Emissions Estimation Tool Improvements for 2014",*** M. Pring and R. Oommen, Eastern Research Group; and J. Snyder, US EPA.

Nonpoint source emissions from the oil and gas exploration and production sector has gained interest in recent years as drilling technology has allowed development of unconventional oil and gas plays (such as shale or tight sands) in areas where there was previously no activity, or where activity had subsided after depletion of the conventional reserves. While the major emissions sources associated with oil and gas collection, processing, and distribution have traditionally been included in the National Emissions Inventory (NEI) as point sources (e.g. gas processing plants, pipeline compressor stations, and refineries), the activities occurring "upstream" of these types of facilities were not as well characterized. To address this deficiency, OAQPS developed the Nonpoint Oil and Gas Emission Estimation Tool in 2012 to develop nonpoint oil and gas emission estimates for the 2011 National Emissions Inventory (NEI). This paper presents a summary of the improvements made to the tool to develop the 2014 inventory through collaboration with other EPA offices, states, local air quality agencies, and non-governmental organizations (NGO). These improvements include incorporation of process characterization data from Subpart W of the GHGRP, disaggregation of activity between conventional and unconventional formations, incorporation of updated gas composition data, emission factor updates, and various updates as provided by state and local tool users. Planned improvements to the tool in preparation for the 2017 inventory are also discussed.

9:40 BREAK

10:10 ***"Using the Greenhouse Gas Reporting Program Data to Improve the National Greenhouse Gas Emissions Inventory for Petroleum and Natural Gas Systems",*** K. Ritter, American Petroleum Institute; M. Lev-On, The LEVON Group, LLC; T. Lauderdale, AECOM.

The American Petroleum Institute (API) has been engaged for close to two decades in improving methodologies for estimating greenhouse gas (GHG) emissions from petroleum and natural gas industry operations. In 2010 the U.S. Environmental Protection Agency (EPA) promulgated a nationwide mandatory Greenhouse Gas Reporting Program (GHGRP) with detailed guidance for measurements and calculations of GHG emissions from 41 industry sectors. Petroleum and natural gas industry facilities emitting over 25,000 tons of CO2-equivalent/year have reported their GHG emissions since 2011 under the provisions of Subpart W of the GHGRP. API has collaborated with the EPA

throughout the years to improve the reporting program, analyze industry data, and provide expert feedback on how to best improve the national GHG emissions inventory (GHGI). This paper describes the wide ranging efforts undertaken by the API to ensure the incorporation of robust GHGRP data into the GHGI. The paper will focus on improved assessment of the dynamic scope of activities - and corresponding emissions - from petroleum and natural gas production and natural gas processing operations. The approach to refine the GHGI will be addressed by comparing various sources to properly document the scope of industry activities, as reflected by the national count of operating wellheads and natural gas processing plants. As a case in point, the paper will demonstrate how the GHGRP measurement data could be used to derive updated methane emission factors for sources in the natural gas processing segment of the industry as part of methodological improvements for the GHGI.

10:35 ***"Long-term Atmospheric Monitoring of CH4 Emissions from Gas Production activities in the Marcellus Shale Area",*** Z. Barkley T. Lauvaux, K. J. Davis, T. Murphy, N. L. Miles and S. J. Richardson, Penn State University; C. Sweeney, UC Boulder/NOAA; K. McKain, NOAA.

The development of monitoring systems to quantify methane (CH4) emissions from hydraulic fracturing activities requires both spatial and temporal coverage to provide key information for greenhouse gas inventories. Atmospheric methods, such as aircraft campaigns or automobile surveys, provide primarily spatial data but lack temporal resolution due to short deployments and limited revisits. We describe here a long-term monitoring strategy based on multiple instrumented surface towers measuring continuously atmospheric CH4 and isotopic 13CH4 mixing ratios over a large shale gas region. The atmospheric measurements combined with state-of-the-art meteorological models produce optimal emission estimates of CH4 at 3 km resolution and at monthly to weekly time scales. Estimates from the monitoring systems are compared to aircraft mass-balance estimates with comparable precision. The accuracy of the system requires careful calibration of the instruments to reach NOAA standards for greenhouse gas measurements. Automated calibration of the analyzers is presented with an evaluation of the calibrated data against co-located flask samples. A demonstration of the method is presented over the northeastern region of the Marcellus shale for both long-term monitoring of CH4 emissions but also detection of large emitters over shorter periods of time. Applicability of such systems is discussed in the context of national scale CH4 emission monitoring across multiple shale gas regions.

11:00 ***"U.S. National Oil and Gas Emission Inventory Improvements",*** J. Grant, A. Bar-Ilan, R; Parikh and R. Morris, Ramboll Environ; T. Moore, WESTAR and WRAP; M. Gibbs, UK (Aether-UK.com).

In recent years there have been several efforts to develop and refine oil and gas (O&G) inventories at national, state and local levels including development of the National O&G Tool to estimate nonpoint source O&G emissions in the 2011 National Emission Inventory (NEI) and enhancements to the National O&G Tool for the 2014 NEI. In this work, which was funded by CenSARA, LADCO, MARAMA, WESTAR, and WRAP, we analyzed the representativeness and completeness of the data used to develop the on-shore production and processing emissions estimates in the 2014 NEI version 1. We also surveyed state/local/tribal (S/L/T) agencies to determine emissions thresholds above which each S/L/T agency reports O&G facility emissions as point sources to the NEI. Our analysis indicates that there are gaps in the 2014 NEI v1 inventory as a result of underreporting of pipeline emissions, gathering and boosting and gas processing facilities that fall below emission reporting thresholds, and high emitting O&G sites. We also note well-site equipment input factor and emission factor assumptions in the EPA O&G Tool that are not expected to be representative of basin specific O&G operations and which are candidates for update. We analyzed O&G sector organization in the NEI and suggest enhancements to allow for delineation of O&G emissions by subsectors/segments consistent with the Greenhouse Gas Reporting Program. We will report on basin specific analyses which address some of the improvements recommended in our 2014 NEI review.

11:25 ***"Advancing the Understanding of Emissions from Oil and Natural Gas Production Operations",*** R. Matichuk, G. Tonnesen, A. Eisele, C. Beeler, E. D. Thoma, M. Kosusko, and M. Strum, US EPA.

Environmentally responsible development of national energy assets requires well-developed emissions inventories and measurement techniques. To properly model the energy production sector impacts on air quality, it is also critical to have accurate activity data, emission factors, and chemical speciation profiles for volatile organic compounds (VOCs) and nitrogen oxides (NOx). A multi-phase study conducted by the United States (U.S.) Environmental Protection Agency (EPA) aimed to understand the capability of different measurement methods and to improve the characterizations of emissions from oil and gas operations. The first phase of the study explored a novel measurement approach that used ground-based remote sensing technologies for characterizing emissions from enclosed combustion devices (ECD) at upstream oil and natural gas well pads. The second phase of the study reviewed the data collected from the field campaign, as well as data from other oil and gas measurement studies, to develop speciated emissions information for the oil and natural gas sector. This component of the study contributed significantly to improvements to EPA's SPECIATE database, which is a key tool for air quality models. The results from this study assist in identifying source contributions to air quality problems and designing effective strategies to reduce harmful air pollutants.

11:50 LUNCH BREAK

Thursday Morning – August 17, 2017

Session 7: Emissions Inventory Preparation for Air Quality Modeling

Chairs: Alison Eyth, US EPA
Andy Bollman, NC DEQ

8:00 ***"Reflecting on Progress Since the 2005 NARSTO Emissions Inventory Report",*** M. Day, AAAS Fellow/US EPA; S. Hunt, US EPA; G. J. Frost, NOAA; K. Baker, US EPA.

In order to identify the strengths and weaknesses of North American emissions inventories, years of research were compiled in the 2005 publication "Improving Emission Inventories for Effective Air Quality Management Across North America: A NARSTO Assessment." The 2005 assessment was conducted by NARSTO, a public/private partnership that worked towards improved air quality management in North America. They examined the current state of emission inventories for Canada, the United States, and Mexico, and offered eight main suggestions for improvement. Over the past 12 years, a significant amount of research has been conducted and numerous advances have been made in the understanding of emissions and inventory development in North America. What work has been done to strengthen the scientific basis for quantifying emissions of criteria pollutants, greenhouse gases, and air toxics? How can emissions inventory development be improved? This presentation will review and highlight accomplishments, advancements, and opportunities for future work within the eight focus areas identified in the 2005 report.

8:25 ***"Leveraging Receptor Modeling to Evaluate Oil and Gas Speciation Profiles in the Colorado Front Range",*** S. Capps, Drexel University; K. Kurashima, G. Paranjothi, and J. Milford, University of Colorado; and G. Pierce, CO DPHE.

Increased oil and gas (O&G) development, particularly through the use of hydraulic fracturing, in the Denver-Julesburg Basin (DJB) in Colorado over the last decade has been identified as a source of emissions of air pollutants. Among other efforts to evaluate its impact, ambient concentrations of volatile organic compounds (VOCs) that serve as precursors to ozone formation were measured in an Ozone Precursor Study conducted by the Colorado Department of Public Health and Environment. The study included 6 – 9 a.m. measurements of an extensive suite of ozone-precursor VOCs from a site in an area of intensive O&G development in Platteville, CO, and another site in downtown Denver, CO. To evaluate the influences of urban activity or O&G development on these ambient concentrations, we used the U.S. EPA's Positive Matrix Factorization (PMF) tool with data from 2013-2015. The PMF solution was selected as providing the best fit to the dataset comprised of VOC measurements for all three years at both sites. We compare the PMF factors most resembling O&G activity to the Western Regional Air Partnership speciation profiles of similar sources for use in chemical transport modeling in the region. The contribution of this factor to individual and total VOC concentrations and ozone production reactivity is evaluated for Platteville and Denver.

8:50 ***"Parameterization of MOVES Emission Factors Lookup Tables: An Approach for Computational Enhancements in Mobile Emissions Simulation",*** B.H. Baek, A. Valencia, and M. Snyder, UNC Institute for the Environment.

Recent versions of the Community Multiscale Air Quality (CMAQ) model integrate its chemistry and transport processes with meteorologically-driven emission processes which are biogenic emissions, bi-directional NH3 from fertilizer applications, and point source plume rise calculation. Simulating emissions inline in CMAQ is especially crucial for real-time air quality forecasting because it allows the model to include the influences of the most recently forecast meteorological fields on emissions from key sources such as mobiles, vegetation, fertilizer applications, and wildfires. Especially, the on-road mobile sector, which is one of the largest emitters of NOx, PM2.5, and CO, has significant temperature and relative humidity dependencies, particularly for NOx, VOC, and PM2.5 emissions. We propose the plan to enhance SMOKE and CMAQ models to process mobile emissions efficiently inline using the state-of-the-science Motor Vehicle Emissions Simulator (MOVES) emission factors for a better representation of the meteorological influences on emissions without any computational bottlenecks.

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(Session 7 continues)

9:15 ***"Review of Georgia Onroad Mobile Source Emissions in NEI2014: Georgia EPD Inventory MOVES and EPA SMOKE-MOVES Methodology Comparisons",*** G. Grodzinsky, D. Tian, and J. Boylan, Georgia Department of Natural Resources.

Georgia Environmental Protection Division (GAEPD) has carefully reviewed Georgia on-road mobile sources emissions in the 2014 National Emission Inventory (NEI), which were estimated using SMOKE-MOVES by the U.S. Environmental Protection Agency (EPA). The U.S. EPA SMOKE-MOVES emission estimates are compared against GAEPD MOVES inventory mode emission estimates using monthly average meteorology inputs. The inputs for SMOKE-MOVES and MOVES inventory mode runs were identical (to the extent possible). The differences between the SMOKE-MOVES and MOVES emission estimates with NEI2014 were found to be less with NEI2014 than NEI2011 since most of the issues identified from the NEI2011 comparison have been resolved. This new comparison is made to identify potential issues in the SMOKE-MOVES modeling for 2014 with the new MOVES2014a model.

9:40 BREAK

10:10 ***"Evaluation of the Community Multiscale Air Quality Model for Simulating Winter Ozone Formation in the Uinta Basin",*** R. Matichuk, G. Tonnesen, R. Payton, D. Luecken, R. Gilliam, B. Murphy, S. L. Napelenok, S. Roselle, D. Schwede, K. R. Baker, and C. Misenis, US EPA.

Elevated levels of ozone (O3) are typically associated with summer-time episodes characterized by stagnant meteorological conditions and photochemical reactions of O3 precursors. However, measurements collected near oil and gas (O&G) operations in Utah and Wyoming have identified high O3 levels during winter months. The United States (U.S.) Environmental Protection Agency (EPA) used a photochemical grid model to better understand the formation and distribution of winter O3 in the Uinta Basin, Utah. Using the latest National Emissions Inventory (NEI), including an updated O&G inventory, the standard model simulation had a large negative bias when compared to volatile organic compounds (VOC) and nitrogen oxides (NOx) measurements across the Basin. Emissions adjustment, model parameter sensitivity, and model Process Analysis (PA) simulations were performed to better understand the poor performance. The simulations suggest that NOx and VOC emissions are generally under-estimated at many sites within the Basin. An analysis of NOx emissions plume rise height showed improved model performance. The analysis of model surface deposition algorithms found that winter O3 deposition velocities are likely to be over-estimated when vegetation is suppressed and snow cover is present. Finally, PA simulations showed modeled night-time hydrolysis of N2O5 was a major-to-dominant pathway for NOx removal at these sites in the winter. These results suggest continued work is needed to improve the characterization of emissions and meteorology in the Basin to best replicate periods of elevated O3 associated with cold pools.

10:35 ***"Spatially and Temporally Resolved Emissions and Hydrocarbon Source Fingerprints for Oil and Gas Sources in Shale Gas Production Regions"***, D. Allen, F. C. Saldaña, and Y. Kimura, University of Texas—Austin.

A gridded regional inventory for methane, ethane, propane and butane emissions from oil and gas production sources in the Barnett Shale production region in north central Texas has been developed. This inventory extends previous analyses, which have provided inventories with detailed spatial resolution of emissions, by characterizing the molecular variability in emissions at an hourly time resolution. This type of inventory, with detailed spatial, temporal and molecular resolution, is necessary when reconciling emissions with ambient observations that have a time resolution of days, hours or shorter time periods. The stochastic hourly emission inventories have wide confidence intervals for the magnitude, spatial distribution, and composition of emissions.

11:00 ***"Gas and Oil Activity Related Emission Study in the Context of Air Quality Forecasting",*** P. Lee, NOAA, L. Pan, NOAA/University of Maryland, D. Tong, NOAA/University of Maryland/George Mason University; Y. Tang, NOAA/University of Maryland; and B. Baker, NOAA/University of Maryland.

The Mid-Atlantic region experienced a large increase in oil and gas production activity primary due to the Marcellus Shale gas production. In a decade, since 2007, the Marcellus Shale gas production has roughly increased from 1 x 108 ft-3 to 25 x 109 ft-3 – a dramatic increase. The drilling activities accompanies air pollution emission of anthropogenic volatile organic carbon (VOC) and nitrogen oxides. The emission acted as precursors to ozone production and exacerbated the air pollution problem in the PA, WV, OH and NY areas where the gas production activity occurred. The daily maximum eight-hour average ozone standard has recently been violated more frequently in those areas prompting a better emission modeling of the pollution in association of the gas production activity in the shale plays. We did an upper-bound air pollutant impact study of the emission level for the Marcellus Shale Play and quantify the possible enhancement in surface ozone concentration in the vicinity if the shale play. We postulate that this phenomenon is also application in other shale plays in other parts of the country.

11:25 ***"Development of Oil and Gas Spatial Surrogates and Monthly Temporal Profiles for 2014"***, R. Oommen, H. Perez, and B. Do, Eastern Research Group; A. Eyth and M. Strum, US EPA.

The exploration and production of oil and gas has increased in terms of quantities and locations over the last five years, primarily through the use of new technologies, such as hydraulic fracturing. As part of the 2014 National Emissions Inventory (NEI) cycle, EPA prepared county-level emission estimates for the oil and gas sector. Since the 2011 NEI, the oil and gas sector emissions have been more comprehensive on a geographic, source category, and pollutant coverage basis when compared to prior NEI base years for this sector. The purpose of this paper is to summarize procedures used to develop spatial and temporal modeling allocation factors for the 2014 Oil and Gas county-level emissions using data primarily from a third-party database of oil and gas wells, and other sources. EPA developed spatial allocation factors at both the 2-km and the 4-km grid scale level. Further, EPA was able to separate natural gas production activities from coalbed methane (CBM) activities to better match the level of specificity from the 2014 NEI emissions. Additionally, EPA developed 2-km and 4- km shapefiles for Alaska, which previously did not have spatial allocation factors at these levels. Finally, EPA developed monthly temporal allocation factors by SCC, which are useful for air quality modeling

11:50 Lunch Break

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Session 8: Tools and GIS

Chairs: Sally Dombrowski, US EPA
Zac Adelman, UNC Environment

8:00 ***"Spatial Surrogate Development for Modeling 2014 U.S. Emissions Sources"*** Z. Adelman, B. Naess, J. E. Brandmeyer, C. Seppanen, D. Yang, and B.H. Baek, UNC Institute for the Environment; A. Eyth, J. Vukovich, and M. Strum, US EPA.

Spatial surrogates are geospatial data that are used to allocate nonpoint emissions inventory sources to air quality modeling grids. A major update to the spatial surrogates used to locate U.S. air pollution sources was initiated following the 2010 Census. This presentation describes further updates to the surrogates recently completed to support modeling the 2014 National Emission Inventory and recent National Air Toxics Assessment modeling. In particular, we describe new spatial surrogates for the sources simulated by MOVES 2014, off-road mobile sources, and oil and gas sources. We will also present a new open-source PostgreSQL database system for computing spatial surrogates. We compared surrogates generated with the PostgreSQL tool to the Spatial Allocator Surrogate Tool for verification and quality assurance of the new software. We used the PostgreSQL tool to produce gridded surrogates on national 12-km, and 4-km grids as well as polygon surrogates on U.S. census tracts. This paper describes the database of underlying shapefiles, the surrogate creation methodology, and outstanding issues with the new surrogate data.

8:25 ***"Emission Inventory of Fine Particulate Matter Based on Aerosol Optical Depth (AOD) Retrieved from Remote Sensing in Massachusetts"*** L. Li, P. Koutrakis, and J. Lawrence, Harvard University.

Emission inventories based on satellite have the advantages over bottom-up ones because they have larger spatial coverage, higher temporal resolution and ability to capture unaccounted sources. Past studies have shown the potential of emission inventories derived from remote sensing products (e.g., Aerosol Optical Depth, AOD). However, for fine particulate matter (PM2.5) whose transportation effects and secondary formation cannot be neglected, getting high resolution emission inventory from large-scale inversion is computationally prohibitive. An approximation algorithm is presented on estimating PM2.5 emissions in Massachusetts during 2011.

8:50 ***"Integrating Criteria Pollutant and Greenhouse Gas Emissions for Stationary Sources Using GIS: California's Integrated Emissions Visualization Tool"*** D. Edwards and G. Ruiz, California Air Resources Board.

The California Air Resources Board's (CARB) efforts to meet air quality standards, achieve greenhouse gas (GHG) emission reduction targets, and reduce exposure to toxic air contaminants requires an increasing emphasis on integrated, multi-pollutant approaches. In addition, Assembly Bill 197 (Garcia, 2016) sets out specific requirements for enhanced emissions inventory reporting and transparency, as well as interpretation of emission trends and the impact of control programs across all pollutants. A multi-pollutant emissions inventory framework must therefore be developed to support an integrated assessment of GHG, criteria pollutant and toxic air contaminants across CARB programs. As a first step, CARB staff has developed the GIS-based Integrated Emissions Visualization Tool (IEVT). The IEVT, Version 1.0 maps stationary sources subject to CARB's mandatory GHG reporting program and shows the greenhouse gas (CO2, CH4 and N2O) and criteria pollutant emissions (NOx, SOx, VOC, PM2.5, PM10 and NH3) for the 2008-2015-time frame. Features of the IEVT include graphical plots of single or multiple pollutants, viewing emissions by county, air district, or air basin and the ability to download data for further evaluation. Users of the tool can also evaluate the emissions at a neighborhood level to evaluate localized pollution impacts, particularly in disadvantaged communities. The IEVT demonstrates that the use of GIS-based technology to display greenhouse gas and criteria pollutant emissions inventory data in a user-friendly format is feasible. By the end of this year, CARB plans to add an air toxic contaminant emissions layer to the IEVT.

9:15 ***"Tableau as an Innovative Tool for Improving the Sharing of Emission Inventory Data",*** A. Kovacevic and J. Ojiaku, Minnesota Pollution Control Agency.

The Minnesota Pollution Control Agency (MPCA) has been making emission inventory data more available with the use of an inexpensive data visualization tool: Tableau. In the past, MPCA's options were limited to creating complicated tables and spreadsheets for end users or developing expensive stand-alone IT projects, which required IT developers to create and maintain. While IT built systems were useful, the expense and scarcity of IT resources resulted in these data sharing systems becoming outdated and error prone. MPCA needed a way to share data in an automated, interactive, and user-friendly format without the constraint of IT time and resources. The solution came in third party software systems, which allowed staff to independently create web applications sharing their data.

MPCA has successfully created numerous Tableau workbooks, free of IT resources. Publishing these workbooks containing emissions data externally has increased transparency and reduced the number of data requests, as end users can go directly to the data online. End users have hands-on access to emissions data, which they can view and use in an interactive format. Staff can update workbooks quickly, which allows end users access to the most up-to-date information. Using Tableau also solved the issue of on-going maintenance and updating of a custom system. The third party company updates the system regularly in order to improve usability, features, and to keep up-to-date with new operating systems for all its customers. This protects MPCA from the need for expensive new projects to update and maintain its system.

9:40 BREAK

10:10 ***"SLEIS – The Next Generation",*** K. Jeffery, Windsor Solutions; S. Hanks, Utah Department of Environmental Quality; B. Smith, Windsor Solutions**.**

The State and Local Emissions Inventory System (SLEIS) allows permitted facilities to submit point source emissions inventory data and related meta-data to state and local agencies via a Web-based, CROMERR-compliant reporting system. SLEIS positions organizations to better manage and review collected data, including the quality assurance of emissions inventory data submitted by regulated entities. SLEIS also includes an Exchange Network interface to manage the generation and submission of XML files to U.S. EPA's Emissions Inventory System (EIS). SLEIS was designed and developed by Windsor Solutions, Inc. for a consortium of state and local environmental agencies with shared needs for emissions inventory development. By combining resources and collaborating throughout the software development process, the consortium was able to deliver a shareable emissions inventory data management system that is an extremely powerful, and yet cost-effective, solution for the partner organizations. Since being completed in early 2011, SLEIS is now being used by twelve regulatory agencies across the country, including state, local, and tribal authorities. As SLEIS has matured, a number of exciting new features have been added to the software. Significant improvements have been made with the latest version released in mid-2017, with support for complex emissions calculations using WEBFire formulas, and minor source inventories, among others. We will review how SLEIS is being used today and look at what's next for the product. We will also discuss some of the future enhancements that will ensure that SLEIS remains a vital and current tool for emissions inventory development.

10:35 ***"Minnesota's Air Emission Inventory System (CEDR)"*** M. D. Smith, C. Y. Wu, N. Edel, J. Ojiaku, K. Palmer and A. Kovacevic, Minnesota Pollution Control Agency.

Consolidated Emissions Data Repository (CEDR) system is a product combining a database software application and online services. The Minnesota Pollution Control Agency (MPCA) uses CEDR to compile air emission inventories for point, nonpoint, onroad, nonroad, event, and biogenic sources for criteria pollutants, air toxics, and greenhouse gases. CEDR database design is based on the National Emission Inventory (NEI) structure and includes resources needed by MPCA. There are reference tables, such as those for source classification codes and emission factors, and data tables, such as those for facility information and emissions. CEDR software application includes a user interface that allows users to review, analyze, update, and calculate emissions. The application provides import and export functions for data in a tab-delimited text format and in the NEI staging-table format. CEDR online service portal is designed for different types of point sources. Facilities can report the current year data by modifying the prepopulated previous year information. The portal directly connects to the CEDR database, so that facilities can report their data, as well as review and edit the data online. The online portal calculates emissions automatically in real time. It has many built-in QA/QC checks to prevent errors in reporting. Users are also able to review, update, and download emissions prior to submittal.

11:00 ***"Advanced Emissions Inventory Web Tool Based on Permit Profile and Device level to Streamline Reporting of Point Sources Criteria, Toxics, and GHG Emissions",*** N. Meskal and M. Meskal, ECOTEK.

The SCAQMD Annual Emissions Report (AER) web reporting tool is currently used by over 2000 facilities to report their annual criteria, toxics, and Air Toxics "Hot Spots" (AB 2588) program quadrennial toxics emissions inventory. The SCAQMD has provided reporting facilities with electronic reporting option that has evolved since 1996. The collected data provides the basis for the point source emissions inventory for the development of the State Implementation Plans (SIP), control strategies, rules and regulations, public policy, and emission fees. The consolidated AER web tool developed by SCAQMD and Ecotek has two modules: one for data collection including data validation, a second for SCAQMD staff to process, audit, generate reports, and export data to the California Air Resource Board's CEIDARS database that is ultimately submitted to EPA. An optional GHG reporting along with consolidated criteria, toxics and AB2588 toxics provides a one-screen total emissions overview. In addition to enhancing data quality, reporting based on device level and permitting profile allows for data sharing with engineering, compliance, and planning divisions at the SCAQMD. To make detailed reporting easier, the AER web tool was designed to be intuitive and easy to use by offering specific worksheets for common equipment/processes with built-in calculation methodology and defaults for selected sources, as well as calculation wizards, and virtual grouping for selected identical sources. Furthermore, the equipment/processes are described in simple terms, often incorporating applicable Rule designations, with sufficient data collected to assign SCCs.

Thursday Morning – August 17, 2017

(Session 8 continues)

11:25 ***"The Community Emissions Database System (CEDS)",*** R. Hoesly, S. J. Smith, L. Feng, and L. Vu, Joint Global Change Research Institute/PNNL.

We report on the status of the Community Emissions Database System (CEDS), a data system that produces global, historical estimates of anthropogenic acidifying gases (NH3, NOX, SO2), carbonaceous gases (CO2 and CO, CH4) and carbonaceous aerosols (BC and OC). Emissions are estimated annually and resolved by the country, sector, and fuel, and then gridded by year and sector with monthly seasonality. The CEDS estimates rely on existing energy consumption data sets and regional and country-specific inventories, such as EPA Trends and NEI estimates, to produce emission trends over recent decades. The first product (Spring 2016) from this project was an updated historical time series for use in the Coupled Model Inter-Comparison exercise phase 6 (CMIP6). We continue to refine and update these emission estimates, as well as develop comprehensive uncertainty estimates and ensembles of historical emissions trajectories. We are developing techniques to produce more accurate emission data products at the state/province level. For the United States, national emissions estimates are downscaled to the state level using a combination of NEI and state level driver data, such as energy consumption from the US EIA State Energy Data System. Emissions time series at the state level will be incorporated into the gridded data products to produce more accurate emission spatial distributions for global modeling efforts. These techniques are also being applied to other large countries, such as China. The CEDS system and input data will be released as open source software. (http://globalchange.umd.edu/CEDS).

11:50 LUNCH

Thursday Afternoon – August 17, 2017

Session 6: Oil and Gas

Chairs: Tom Moore, WRAP
Adam Eisele, US EPA
Julia Gamas, US EPA
Jennifer Snyder, US EPA
Regi Oommen. ERG

1:20 ***"National Oil and Gas Committee Report",*** K. Pendleton, TCEQ Committee Chair; T. Moore, WESTAR and WRAP; J. McDill, MARAMA; T. Pella, CenSARA.

The National Oil & Gas Emissions Committee (NOGEC) has been engaged for more 5 years in improving methodologies for estimating criteria and toxic air pollutant emissions from petroleum and natural gas industry operations. The NOGEC is a "bottom-up" effort to assist EPA and other air regulatory agencies with coordinated, consistent, and complete estimates of emissions, especially for the triennial National Emissions Inventory (NEI) cycle – given the dynamic scope of production activities and technologies. The NOGEC involves well over 100 individuals from state and local air agencies, EPA national program and regional offices, multi-jurisdictional organizations and invited academics, consultants, and non-governmental organizations. The NOGEC supports and updates the National Oil & Gas Information Repository (http://vibe.cira.colostate.edu/ogec/archive.htm), which acts a public clearinghouse for a wide variety of production and emissions studies and data from the upstream and midstream sectors. A key aspect of the NOGEC's recent efforts is to more closely analyze and understand petroleum and natural gas industry facilities' emissions reported to states, the EPA Subpart W reporting and associated Greenhouse Gas Inventory (GHGI), and to EPA Regional Offices for O&G sources on tribal reservations – addressing the need to work together at a technical level within basins and between agencies. In addition, the relationship of point source reporting and non-point source estimates, which vary widely over the many state air programs and production basins is another area of evaluation between EPA and the states. The committee is primarily focused on the EPA non-point inventory tool used to gap-fill emissions data. The NOGEC report will detail areas of focus and accomplishment since the 2015 EIC and identify future priorities.

1:45 pm – 3:00 pm – ***"Oil and Gas Panel Discussion"***

Purpose: To provide information/create dialogue on improving the 2017 NEI for the Oil and Gas Tool.
Topics:

- Does having distinct oil, gas and CBM well classification help or hurt the way we estimate emissions?
- Many studies have compared top down and bottom up inventories for oil and gas. Is it possible to explore reconciliation between these estimates?
- What improvements could be made to how state regulations are accommodated in inventory?
- Are there inaccurate assumptions in the inventory? (old, missing, misrepresentation)
- What do you think the best way to proceed with estimating emissions for fat tails sources?
- Are there specific source category emissions estimates that should be improved upon by EPA?
- How can we improve upon our chemical composition of VOC from oil and gas operations?
- Regarding the NEI process, what would it take, from an SLT perspective, to accept EPA estimates down the road without having to submit their own emissions?
- What aspects regarding future projections of oil and gas should be taken into account?

Invitees:

1. Cindy Beeler, EPA/R8
2. Greg Frost, NOAA
3. Karin Ritter, API
4. David Lyon, EDF
5. Michael Ege, TCEQ

3:00 BREAK

3:30 ***"Integrating State Data and the National Oil and Gas Emissions Inventory Tool: The Oklahoma Experience",*** C. Schroeder, OK DEQ.

The petroleum industry is a substantial contributor to Oklahoma's economy, employment, and air emissions. The combined oil and gas exploration, production, and midstream sectors account for approximately 20% of statewide nitrogen oxide (NOx) emissions and 41% of volatile organic compound (VOC) emissions. Almost all midstream oil and gas facilities (compressor stations, gas plants, etc.) are located at facilities with air quality permits, but fewer than 10% of the wellhead facilities are permitted. That is important, because the ODEQ collects point source inventory data for all permitted facilities. For the 2014 National Emissions Inventory (NEI), the ODEQ combined point source data for the permitted facilities with estimates of emissions from the unpermitted facilities generated by a modified version of the National Oil and Gas Emissions Inventory Tool. This presentation summarizes the process Oklahoma used to integrate the inventoried data with the national tool to generate area source emissions from this sector for submission to the 2014 NEI.

3:55 ***"Improving Estimates of U.S. Oil & Gas Methane Emissions by Comparing top-down Estimates in Multiple Basins with a Custom County-level Emissions Inventory",*** D. Lyon, EDF.

Top-down measurements of regional methane emissions can be used to assess the accuracy of bottom-up oil and gas (O&G) emissions inventories. In the Barnett Shale, a coordinated campaign sponsored by Environmental Defense Fund successfully reconciled O&G methane emissions estimated with the airborne mass balance method and a custom inventory that integrated site-level measurements from several data sources. Although regional and site-level estimates were not statistically different, empirically-based, production site-level emissions were 50% higher than estimates modeled from component-level emissions. This indicates that component-level inventories are missing emission sources, most likely from super-emitters that have high emission rates due to malfunctions or otherwise avoidable conditions. To more accurately estimate U.S. O&G methane emissions, we construct a county-level national emissions inventory using several data sources including the EPA GHG Reporting Program, the Harvard-EPA gridded U.S. GHG Inventory, and recent bottom-up studies. We include estimates of super-emitter emissions based on recent studies such as the Barnett Shale Campaign. We compare our inventory with top-down estimates in eight basins to assess the accuracy of our inventory. Our findings provide insights into mitigation opportunities, regional variability of emissions, and research priorities for improving the accuracy of emission estimates.

4:25 ***"Developing a Fuel-Based Inventory of Oil and Gas Emissions",*** B. McDonald, NOAA/University of Colorado; A. G. Negron, Brown University; S. McKeen, J. Peischl, NOAA/University of Colorado; J. Gilman, NOAA; R. Ahmadov, NOAA/University of Colorado; G. Frost, T. Ryerson, NOAA; C. Thompson, NOAA/University of Colorado; M. Trainer, NOAA.

Several studies have highlighted overestimates in anthropogenic emissions of nitrogen oxides (NOx) for the U.S., with particular attention on the mobile source sector. In this study, we explore whether there could be overestimates in the emissions of NOx from oil and gas production regions. We construct a bottom-up inventory using publicly available fuel use records of the industry and emission factors reported in the literature. We compare both the NEI 2011 and the fuel-based inventory with top-down emission fluxes derived by aircraft and ground-based field measurement campaigns by NOAA that occurred in 2012-13, including for basins located in Uintah, Haynesville, Marcellus, and Fayetteville. Compared to the top-down fluxes, the NEI overestimates NOx by a factor of ~2 across the four basins. However, the discrepancies are not uniform, reflecting variability in oil and gas engine activity and NOx emission factors. We explore this variability with our fuel-based inventory and perform a Monte Carlo analysis to assess uncertainties in emissions. We find that on average the fuel-based inventory improves the agreement with the top-down emissions, and that the top-down emissions are within the uncertainties of our analysis.

ADJOURN at 4:45 pm for OFFICIAL POSTER VIEWING until 5:30 pm

Thursday Afternoon – August 17, 2017

Session 7: Emissions Inventory Preparation for Air Quality Modeling

Chairs: Alison Eyth, US EPA
Andy Bollman, NC DEQ

1:20 ***"Modules: A New Tool in the Emissions Modeling Framework",*** A. Zubrow, VOLPE/DOT; C. Parsons, A. Eyth, J. Vukovich, and J. Brown, US EPA; C. Seppanen, UNC Institute for the Environment.

The Emissions Modeling Framework (EMF) is used by various organizations, including the US Environmental Protection Agency, to manage their emissions inventories, projections, and emissions modeling scenarios. "Modules" are a new tool under development within the EMF that provide a controlled environment to implement new algorithms and run scenarios to generate both emission inventories and related datasets. Key aspects of Modules include the versioning of the algorithm scripts and versioning of the specific datasets used in any individual scenario or run; Modules systematically track changes in algorithms, inputs and assumptions, and provide a means for documenting changes and decisions made. Modules are a highly flexible environment that could be used in any assessment in which repeatability and traceability are essential. Example modules may include automated emission factor development by region or facility, creation of projection factors, and the allocation of national emissions to counties or regions. We propose that Modules will be a useful tool for the emissions modeler and the emissions inventory developer.

1:45 ***"State-Level Energy and Emissions Projections from GCAM-USA",*** S. Smith, PNNL and C. Ledna, Joint Global Change Research Institute.

We discuss recent work with the GCAM-USA model to produce state level energy and emissions projections. The GCAM-USA (Global Change Assessment Model) is a dynamic-recursive model with relatively technology-rich representations of the energy sector, land use, and water demand linked to a simple climate model with US state level resolution for the energy system and related emissions. The model is open source, runs in 5-year time steps out to 2100, and has been used to explore future emission scenarios with varied socio-economic development pathways, technological options, policy mechanisms, and air pollutant emission goals. The relatively high level of detail in the electric, transportation, building and agricultural sectors facilitates evaluation of specific technologies, renewable energy and energy efficiency measures. The model has now been extended to include air pollutant emissions, calibrated to the US NEI at the state level, and incorporating new source performance standards and other measures currently in place. This framework allows future U.S. scenarios to be evaluated within the context of global scenarios, including consistent changes in both domestic and international emissions. We present an analysis of the impact of renewable energy and energy efficiency measures on air pollutant emissions at the state level, including the impact of different electricity trade assumptions.

2:10 ***"Emissions Projection Methods for Nonroad Mobile and Non-Electricity Generating Unit Stationary Source Emissions Categories",*** A. Bollman, NC DEQ.

The U.S. Environmental Protection Agency (EPA) prepares future year emissions modeling platforms to support various tasks, including analysis of the future impacts of Clean Air Act-mandated regulatory programs. For the most part, EPA modeling platforms have held future year non-electricity generating unit (EGU) stationary source emissions at historical base year levels. Exceptions to this practice have focused on source categories affected by certain Federal regulations. For these source categories, EPA develops and applies both emissions control and emissions activity adjustments, reflecting the projected change in both emissions rates and emissions activity levels relative to base year conditions. To project emissions for most nonroad equipment, EPA combines the projected effects of Federal engine standards with forecasts of activity level changes. To forecast activity level changes, EPA uses national equipment population trends from the early 1990s. The purpose of this paper is to describe the emissions projection methods and data that the North Carolina Department of Environmental Quality (NC DEQ) uses to develop emissions

activity growth factors for non-EGU stationary and nonroad mobile source categories. The NC DEQ projection methods reflects a few key refinements typically not reflected in EPA's past modeling platforms. The refinements include: modeling potential changes in future year activity levels for all non-EGU stationary source categories, utilizing official federal government energy intensity forecasts in developing growth factors for all point source industrial fuel consumption source categories, and incorporating more recent/state-specific historical activity data, when available, into nonroad mobile source activity growth factors.

2:35 ***"Projected Growth in Small-scale, Fossil-fueled Distributed Generation: Potential implications for the U.S. Greenhouse Gas Inventory",*** A. Eberle and G. Heath, National Renewable Energy Laboratory.

The generation capacity of small-scale (less than one megawatt), fossil-fueled electricity in the United States (U.S.) is anticipated to grow by three- to twenty-fold from 2015 to 2040. However, in adherence with internationally agreed upon carbon accounting methods, the Environmental Protection Agency's (EPA's) U.S. Greenhouse Inventory (GHGI) does not currently attribute greenhouse gases (GHGs) from these small-scale distributed generation sources to the electric power sector and instead accounts for these emissions in the sector that uses the distributed generation (e.g., the commercial sector). In addition, no other federal electric-sector GHG emission data product produced by the EPA or the Energy Information Administration (EIA) is able to attribute these emissions to electricity. We reviewed the technical documentation for eight federal electric-sector GHG emission data products, interviewed the data product owners, collected their GHG emission estimates, and analyzed projections for growth in fossil-fueled distributed generation. We show that, by 2040, these small-scale generators could account for at least ~1-5% of total CO_2 emissions from the U.S. electric power sector. If these emissions fall outside the electric power sector, the U.S. may not be able to completely and accurately track changes in electricity-related CO_2 emissions, which could impact how the country sets GHG reduction targets and allocates mitigation resources. Since small-scale, fossil-fueled distributed generation is expected to grow in other countries as well, the results of this work also have implications for global carbon accounting.

3:00 BREAK

3:30 ***"County-level Gridded Livestock Methane Emissions for the Contiguous United States",*** A. Hristov, M. Harper, R. Meinen, R. Day, J. Lopes, T. Ott, A. Venkatesh and C. A. Randles, Pennsylvania State University.

In this analysis we used a spatially-explicit, bottom-up approach, based on animal inventories, feed intake, and feed intake-based emission factors to estimate county-level enteric (cattle) and manure (cattle, swine, and poultry) livestock methane emissions for the contiguous United States. Combined enteric and manure emissions were highest for counties in California's Central Valley. Overall, this analysis yielded total livestock methane emissions (8,916 Gg/yr; lower and upper bounds of 6,423 and 11,840 Gg/yr, respectively) for 2012 that are comparable to the current USEPA estimates for 2012 (9,295 Gg/yr) and to estimates from the global gridded Emission Database for Global Atmospheric Research (EDGAR) inventory (8,728 Gg/yr), used previously in a number of top-down studies. However, the spatial distribution of emissions developed in this analysis differed significantly from that of EDGAR. As an example, methane emissions from livestock in Texas and California (highest contributors to the national total) in this study were 36% lesser and 100% greater, respectively, than estimates by EDGAR. The spatial distribution of emissions in gridded inventories (e.g., EDGAR) likely strongly impacts the conclusions of top-down approaches that use them, especially in the source attribution of resulting (posterior) emissions, and hence conclusions from such studies should be interpreted with caution.

Thursday Afternoon – August 17, 2017

(Session 7 continues)

3:55 ***"International and Interstate Air Pollution Transport: The Role of Emissions in Ozone NAAQS Attainment on the U.S.-Mexico Border",*** Z. Adelman U. Shankar, J. Bowden, K. Talgo, B.H. Baek, D. Yang, and M. Omary, UNC Institute for the Environment; T. Moore, Western States Air Council/WRAP; S. Kemball-Cook and R. Morris, Ramboll Environ; R. Bates, M. Baca, K. Singleton, and M. Jones, New Mexico Environmental Department.

The Southern New Mexico Ozone Study investigated the factors contributing to high observed ozone in Doña Ana County New Mexico during Summer 2011. Meteorology, emissions, and photochemical modeling was carried out for the May 1 – September 30, 2011 timeframe using emissions scenarios for a 2011 base year and a 2025 future year. The modeling showed that all Doña Ana County ozone monitors would have attained the 70 ppb Ozone National Ambient Air Quality Standard (NAAQS) in 2011 but for the ozone contribution due to anthropogenic emissions from Mexico. Regional emissions sources contributing the most to 2011 Doña Ana County ozone were: (1) on-road mobile emissions from Texas, 0Mexico and New Mexico; (2) power plant emissions from Mexico; and (3) natural emissions (mainly from plants as well as lightning and fires) from Mexico. The 2025 future year design value projections indicate that all Doña Ana County ozone monitors are expected to attain the 70 ppb Ozone NAAQS in 2025. The modeled decreases in Doña Ana County ozone design values between 2011 and 2025 are mainly driven by projected reductions in domestic emissions from cars, trucks and other on-road mobile sources. We will present modeling methods and results that demonstrate the importance of transport in determining ozone levels along the border of the U.S. and Mexico. Ozone from emissions sources outside the New Mexico border region, including transport from the U.S. west coast and beyond, was the largest contributor of ozone in Doña Ana County; this is a typical result for a regional modeling study. For most Doña Ana County monitors, the individual ozone contributions from Texas and Mexico were larger than that of New Mexico sources.

4:20 ***"Recent SMOKE Updates and More",*** B. H. Baek, C. Seppanen, and Z. Adelman, UNC Institute for the Environment; A. Eyth and M. Strum, US EPA; J. Beidler, CSRA.

In cooperation with the U.S. Environmental Protection Agency (EPA), the Lake Michigan Air Directors Consortium (LADCO), and Korea National Institute of Environment and Research (NIER), the UNC Institute for the Environment have been updating the Sparse Matrix Operator Kernel Emissions (SMOKE) system to enhance the quality of emissions modeling input to air quality models. This paper describes a list of recent updates made to SMOKE version 4.0 released on September 2016 which includes:1) SMOKE4AERMOD tool development to generate AERMOD ready input files based on the U.S. EPA's National Emission Inventory (NEI); 2) Simulating real-time transponder data based emissions from Commercial Marine Vessels in the Great Lake; 3) Parameterizing MOVES emissions factors lookup tables, and 4) various updates to support recent versions of US EPA NEI.

ADJOURN at 4:45 pm for OFFICIAL POSTER VIEWING until 5:30 pm

Thursday Afternoon – August 17, 2017

Session 8: Tools and GIS

Chairs: Sally Dombrowski, US EPA
Zac Adelman, UNC Environment

1:20 ***"Potential Energy and Emission Benefits of Vehicle Automation through Cooperative Adaptive Cruise Control Technology",*** A. Eilbert, VOLPE/US Department of Transportation.

The US Department of Transportation is working on an interdisciplinary framework to evaluate the expected benefits of automated vehicle technologies. Our research integrates a microscopic traffic simulation tool, VISSIM, with the US Environmental Protection Agency's Motor Vehicle Emissions Simulator (MOVES) to assess the potential emission reductions and fuel savings under various scenarios of vehicle automation and connectivity. In a case study, we have investigated the specific emission and energy benefits of cooperative adaptive cruise control (CACC) technology. By decreasing traffic oscillations and vehicle headway, CACC-enabled vehicles follow smoother trajectories with less braking and changes in speed and acceleration than human drivers. When switching from human to CACC driving on an idealized highway segment running at their respective maximum traffic capacities, our findings show decreases across different criteria pollutants and fuel consumption on a per vehicle basis but increases in total inventories. Carbon monoxide (CO) decreases by nearly 60 percent, nitrogen oxides (NOx) decreases roughly 27 percent, and particulate matter of 2.5 microns or less (PM2.5) decreases by almost 30 percent while carbon dioxide (CO2) and fuel use decreases by more than 8 percent per vehicle. As a first-order approximation, we estimate about 1,700 and 1,800 CACC-enabled vehicles per hour could be added to this highway segment to have comparable NOx and PM2.5 emissions as human-driven vehicles, respectively. Our current research explores more complex, real-world road networks as well as varying test parameters such as automated vehicle penetrations, headway, and traffic capacities to provide a range of possible benefits.

1:45 ***"ITRC Team – Evaluation of Innovative Methane Detection Technologies",*** L. M. Dorman, PA DEP; T. Taylor, CO Dept of Health; S. Schow, Schow Consulting.

The oil and gas sector is rapidly changing and frequently in the spotlight as the public becomes more aware and concerned about the dangers of methane emissions. Natural gas leaks contribute to these emissions and detection of these leaks have understandably come into sharper focus. We are currently seeing the development of a wide range of state of the art technologies for detecting and quantifying methane emissions from the oil and gas production and supply chain. The ITRC technical project Methane Team represents state and federal regulators along with private, academic, and stakeholder experts. The Team is tasked with developing a standardized evaluation methodology for methane-detection technologies. The Team will assess the performance of methane detection technologies, as well as regulatory barriers that might hinder the use of a standardized evaluation methodology. The evaluation methodology will be developed via a consensus process and documented in a web-based Technical-Regulatory document. The guidance document will broaden and deepen technical knowledge on the subject and expedite quality regulatory decision-making while helping to protect human health and the environment. This effort will also result in a central repository of information for use by professions from all sectors include extremely sensitive and low-cost optical and chemical sensing devices. However, there is currently no standard methodology to evaluate the performance of these new technologies. The Interstate Technology Regulatory Council (ITRC) is a State led, public private

Thursday Afternoon – August 17, 2017

(Session 8 continues)

2:10 ***"Development of the Agricultural Air Emissions Estimator (AgrEE) Software",*** T. Trask, W. Boulton, C. McClellan, M. Sawycky, and G. Draisey-Collishaw, RWDI; J. Foyle, J. Eisel, M. Raymond, and M. Schwalb, BC Ministry of Agriculture.

This paper describes the development of software which allows users to complete a spatially and temporally resolved air emission inventory of agricultural sources in British Columbia (BC) for the BC Ministry of Agriculture (AGRI). This presentation is an update to one given at the 2015 Emissions Inventory Conference which described the methodology to complete an air emissions inventory. Further to the completion of the inventory, the Agricultural Air Emissions Estimator (AgrEE) tool was developed to automate the emission inventory calculation and allow users to calculate emissions under various scenarios such as applying specific Best Management Practices.AgrEE creates an inventory which can be distinguished from other regional, provincial and federal inventories in Canada as it is sector-based and strives to include sources related to agricultural activities not typically quantified. Emissions are derived from, and calculated at, the smallest census geometry levels available using different geospatial inputs and activity data for different sources and in different parts of the province. Emission sources are grouped into seven categories: organic material; fuel consumption and storage; energy use; burning; soil and amendments; soil and cropping, and animal activity emissions. Methodologies used to quantify emissions for similar sources in other jurisdictions across North America and elsewhere were reviewed and adapted for BC. Geographic Information System (GIS) software and data manipulation techniques were used to assess and reconcile geospatial activity data to arrive at most source-representative inputs available. The underlying goal was to produce an emissions inventory at the Census Consolidated Subdivision (CCS) level.

2:35 ***"SCC Web Service and Web Search",*** M. Kelly, and J. Gamas, US EPA; C. Y. Wu, Minnesota Pollution Control Agency.

The U.S. EPA uses Source Classification Codes (SCCs) to classify different types of activities that generate emissions. Each SCC represents a unique source category-specific process that emits air pollutants. The SCCs are used as a primary identifying data element in several EPA databases including WebFIRE (where SCCs are used to link emissions factors to an emission process), and the National Emissions Inventory (NEI). They are also used by many regional, state, local and tribal agency emissions data systems. As part of Combined Air Emission Reporting (CAER) E-Enterprise workgroup, and at the request of many states, access to the SCC table has been greatly improved. A "short term wins" team (that included states and EPA) provided input and managed the effort to develop two main products to meet SCC reporting and analysis needs, using an agile process. The first product is a web service whereby information systems (such as those from states or within EPA) can leverage the benefits of having a centralized source for SCCs. The web service can be implemented in their information system to search for the most up-to-date SCCs. The second product is a web search page where a user can perform searches and filter SCCs, and download the whole SCC table or portions of it. The web search page also contains background information on SCCs, and contact information for inquiries to EPA. This presentation will demonstrate the products that have been developed and allow attendants to ask questions and provide feedback.

3:00 BREAK

Thursday Afternoon – August 17, 2017

(Session 8 continues)

3:30 ***"Lean in Emissions Data-Related Processes",*** J. Gamas, S. Dombrowski, M. Strum, and R. Mason, US EPA.

Business Process Improvements (BPI) are tools that help streamline processes. Lean is one such tool. The purpose of Lean is to help find and remove wasteful steps in any process, thus streamlining it to reduce the time and effort it takes, while maintaining the quality of the final product. This presentation will be an overview of Lean, what it is, the steps that are followed during a Lean event, and how it has been applied to emissions data-related processes within EPA. Lean events have been conducted in three areas related to emissions inventories: Nonpoint Sources Emissions Inventory, NATA, and Combined Air Emissions Reporting. Highlights of the results from three Lean events will be presented. The types of improvements found were: moving planning and consultation stages to earlier in the process, use of shared facility attributes in reporting, moving tools and documentation to one easy-access area, and standardizing best practices.

3:55 ***"Arizona's Lean Approach to Emissions Inventories",*** M. Burton and M. Sonenberg, Arizona DEQ.

AZ DEQ will present an overview of the agency's philosophy of continuous improvement and lean. AZ DEQ will present a summary of our internal kaizen processes for identifying value streams, engaging stakeholder input, streamlining business processes, and identifying and eliminating waste. Arizona will also highlight kaizen efforts for our state implementation plans which includes the development of emission inventories. Presentation will also touch on AZ DEQ's point source emission inventory program and the strides made in applying the concept of "radical simplicity" to the annual emission inventory reporting program.

4:25 ***"Applying Lean Principles to Inventory Data Management: Improved Data Practices for More Accurate Reporting",*** L. Weinkam and E Manitou, ERA Environmental.

When it comes to inventory development, there are two questions of utmost importance: is the information within the inventory accurate, and was the inventory straightforward to develop? For both reporters and regulators, the promise of Lean and streamlined processes is simpler reporting; however, there are even more benefits when Lean is applied to data management. Data management forms the foundation for all other reporting activities. Improvements made to it create benefits across all reporting and decision making. This presentation outlines the far-reaching benefits of implementing Lean principles to inventory data management, including vastly-improved accuracy in NEI reports; consistency in emission reports across the board for NEI, TRI, Tier II, and GHG reporting; less burden on reporters, and a significant reduction in environmental risks and waste. The talk also outlines realistic measures to apply these Lean principles, as experienced by ERA Environmental Management Solutions. How can data management be made lean? In many businesses, data is siloed according to report and by medium. This creates multiple databases, contradictory data, and a lack of standardization. Under Lean principles, siloes are dismantled in favor of a centralized dataset – eliminating redundancy and inconsistency. When all reports are generated from one dataset, regulators benefit by seeing the entire picture rolled up into TRI, NEI, Tier II, etc. rather than getting conflicting information each report. Lean databases enable business to measure and identify risk more easily, and identify where waste is produced. By implementing Lean as the driving data management principle, report accuracy and ease improve.

ADJOURN at 4:45 pm for OFFICIAL POSTER VIEWING until 5:30 pm

Friday Morning – August 18, 2017

Session 9: Biomas Burning

Chairs: Amara Holder, US EPA
Jeff Vukovich, US EPA

8:00 ***"Development of 2014 Georgia Wildland Fire Emissions Inventory",*** T. Zeng, D. Tian and J. Boylan, GA DENR.

Wildland fires burn about 1.38 million acres in Georgia during 2014 and emitted large amount of air pollutants such as particulate matter, nitrogen oxide (NOx), volatile organic compounds (VOC), and carbon monoxide (CO). These 2014 emissions have been estimated by Georgia Environmental Protection Division (GAEPD) using the same method as used in the previous Georgia wildland fire emission inventories (https://www.epa.gov/sites/production/files/2015-09/documents/tian_pres.pdf). They have also been submitted to Environmental Protection Agency (EPA) to be included as part of 2014 National Emission Inventory (NEI). In addition, GAEPD has compared this wildland fire inventory with EPA national wildland fire inventory. To develop the 2014 wildland fire inventory, GAEPD collected local fire records from the state and federal forestry agencies and military databases. Most wildland fires in Georgia are prescribed fires, which burned 1.36 million acres in 2014, while wildfires only burned 23 thousand acres. The burned area based on local fire records are 58% more than the burned area based on both satellite fire products and local records used by EPA in the national wildland fire inventory (i.e. 0.88 million acres). Except for VOC, GAEPD estimates are close to EPA's estimates due to higher emission factors adopted by EPA, which partially narrows the difference in burned acres from the two data sources. However, a much higher VOC emission factor and higher faction of smoldering phase emissions lead to 2.8 times more VOC emissions in EPA NEI2014 draft than Georgia VOC estimate. The 2014 NEI requires emissions to be reported by two combustion phases (i.e. flaming and smoldering) in comparison to total emissions as required in previous NEIs. NOx emissions are usually higher during flaming combustion phase (a more complete combustion), while emissions of CO, VOC and NH3 are usually higher during smoldering phase due to incomplete combustion. Therefore, the emissions during each combustion phase should be estimated using emissions factors and fuel consumption factors specific to the combustion phases. To develop the emissions by combustion phases, GAEPD employed CONSUME model to separate fire emissions into 3 stages, flaming, smoldering, and residual smoldering. The emissions from both flaming and smoldering stages in CONSUME were combined to represent emissions during flaming phase since emissions from these two combustion stages co-exist and measured emissions factors often represent mixed emissions from these two combustion stages. The emissions from residual smoldering stage in CONSUME were used to represent emissions during smoldering phase. In comparison, CONSUME model was also used to develop the EPA draft 2014 wildland fire emission inventory, but in different ways. Emission during flaming in CONSUME was used to represent emissions during flaming phase, and the combined smoldering and residual smoldering emissions in CONSUME was used to represent emissions during smoldering phase.

8:25 ***"Speciated Emissions from Biomass Burning Separated by Combustion Phase",*** A. Holder, V. Rao and I. George, US EPA.

The U.S. EPA's National Emissions Inventory for 2014 will be reporting wildland fire emissions separated by combustion phase (flaming and smoldering). This is in an effort to improve data inputs to air quality models. However, scant data exist on the speciation of these emissions separated by combustion phase, and what data are available are inconsistent. This limits the robustness of the reported emissions. To address these inconsistencies, a series of laboratory fire simulations were performed to measure PM and VOC speciation by combustion phase. Batch emission samples were taken during the initial flaming phase, and following the smoldering phase of the burns. Fine PM and most VOC emission factors (EF) were greater

during the smoldering phase than the flaming phase. The majority of the fine PM was composed of organic carbon, and the EF was almost twice as high during the smoldering phase compared to the flaming phase. Similarly, the EFs for the speciated VOCs were nearly a factor of two higher during the smoldering phase compared to the flaming phase. Speciated VOCs consisted mainly of carbonyl compounds, where formaldehyde and acetaldehyde were observed to have the highest EFs of all speciated VOCs for both phases. EFs of the more minor PM constituents of elemental carbon, ammonium, sulfate, potassium, and chlorine were 1.3 to 3 times larger during the flaming phase compared to the smoldering phase. These results demonstrate the distinct composition of emissions from each fire phase.

8:50 ***"Vertical Allocation of Wildland Fire Emissions using the 2014 National Emissions Inventory (2014 NEI): Initial Challenges and Future Directions",*** J. Vukovich, V. Rao, G. Pouliot, A. Eyth, US EPA; J. Beidler, CSRA.

For the first time, the 2014 NEI wildfire and prescribed fire inventory provided emissions from two combustion phases: flaming and all smoldering. The smoldering phase emissions included in the 2014 NEI includes both smoldering (co-existing during flaming) and residual smoldering. This presents an opportunity to assess impacts when trying to vertically allocate the fire emissions for use in air quality modeling applications. For CONUS modeling applications, the 2014 NEI fire inventory indicates that 60% of the total PM2.5 emissions (870,000 tons), 65% of the total VOC emissions (2.5 million tons) and 20% of the total NOx emissions (48,000 tons) are from the smoldering phase. Initial vertical allocation methods are examined and impacts discussed including further splitting out smoldering emissions into residual smoldering, some current plume rise algorithm limitations and future directions.

9:15 ***"Characterization of Gas and Particle Emissions from Laboratory Burns of Peat",*** A. Holder, I. George, B. Gullet, M. Hays, C. Geron, D. Tabor, US EPA; R. Black, Oak Ridge Institute for Science Education, Post-Doctoral Fellow at US EPA; J. Aurell, University of Dayton Research Institute

Peat cores collected from two locations in eastern North Carolina (NC, USA) were burned in a laboratory facility to characterize emissions during simulated field combustion. Particle and gas samples were analyzed to quantify emission factors for particulate matter (PM2.5), organic carbon (OC), elemental carbon, light absorbing carbon, absorption Angstrom exponent, metals, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated dibenzodioxins/dibenzofurans (PCDDs/PCDFs). CO from the smoldering burns, up to 7 h in duration, contributed approximately 16% of the total carbon emitted. Emission factors for black carbon (BC) and light absorbing carbon (UVPM) were considerably lower than those found for forest litter burns. Emission factors for PCDDs/PCDFs were several times higher than published values for forest fuels, at 6-9 ng toxic equivalents (TEQ)/kg carbon burned (Cb). Total PAH concentrations of > 12 mg/kg were higher than published data from biomass burns, but roughly the same in terms of toxicity. Application of these emission factors to the noteworthy 2008 "Evans Road" fire in NC indicates that PM2.5 and PCDD/PCDF emissions from this fire may have been 4 -6% of the annual US inventory and 5% of the annual OC amount.

9:40 BREAK

10:10 ***"The 2014 Wildland Fire National Emissions Inventory for the United States",*** S. Huang and N. Pavlovic, Sonoma Technology; V. Rao, US EPA; N. Larkin, US Forest Service.

The National Emissions Inventory (NEI) published by the U.S. Environmental Protection Agency (EPA) every three years details the annual emissions of criteria and hazardous air pollutants from all sources, including wildland fires (wild and prescribed fires). 2014 was the second NEI year in which state, local, and tribal (SLT) fire activity data were incorporated to improve the accuracy and completeness of the emission estimates. In total, we reviewed 54 fire activity data sets submitted by SLT agencies, evaluated their data quality, and reconciled 32 usable SLT datasets with up to seven national fire activity data sources using the SmartFire2 system. Final daily fire activity data were processed through the BlueSky Framework to estimate fuel loading, fuel consumption, and smoke emissions with the Fuel Characteristic Classification System, CONSUME model, and Fire Emission Production Simulator, respectively, with the exception of fires in Hawaii and Puerto Rico, which were processed using the Fire Inventory from the National Center for Atmospheric Research (FINN) module. Results showed that wildland fires were the top-emitting source category of PM2.5 (particular matter less than 2.5 micrometers in diameter) in the 2014 NEI, accounting for 27% of PM2.5 emitted in the United States. Wildland fires were also a significant contributor to total volatile organic compound (VOC) emissions, several hazardous air pollutants (HAPs), and black carbon. We will present details on the development method of the wildland fire emissions inventory, the emissions result and comparisons with other inventories

10:35 ***"The 2015 Wildland Fire Emissions Inventory for the United States, Canada, and Mexico",*** N. Pavlovic and S. Huang, Sonoma Technology; V. Rao, US EPA.

Wildland fire has a significant impact on air quality in the United States. In past National Emissions Inventories (NEIs), wildland fires within the United States have been shown to be the largest-emitting PM2.5 source category. However, air quality in the United States is also impacted by wildland fires that occur in other countries, particularly Canada and Mexico. To better understand the full impact of wildland fires on air quality in the United States, we prepared the wildland fire emissions inventory for 2015 using methods similar to those used to prepare previous NEIs, but including data for Canada and Mexico for the first time. This inventory combines multiple sources of ground reports of fire with satellite detections from the Hazard Mapping System and Moderate Resolution Imaging Spectroradiometer (MODIS). We describe the methods used to prepare the inventory as well as spatial and temporal patterns observed in the fire activity and emissions for each country. In addition, we compare the results of the inventory to other sources of information about fire activity in the United States, Canada, and Mexico. The 2015 wildland fire emissions inventory was developed for the U.S. Environmental Protection Agency (EPA) and will be used in regulatory modeling, exceptional event analysis, and studies of the impacts of not only domestic wildland fires, but also wildland fires in Canada and Mexico, on air quality in the United States.

11:00 ***"Evaluating the Wildfire Emission estimates in an Air Quality Simulation of the 2016 Southeastern United States Wildfires",*** G. Pouliot, R. Gilliam, B. Eder, I. McDowell, J. Wilkins, and T. Pierce, US EPA.

Extreme drought occurred over the southern Appalachian region of the southeastern United States (SE U.S.) during the fall of 2016. Tuscaloosa and Birmingham recorded their longest streak of 71 and 61 days, respectively, with no measurable precipitation; and, Montgomery, Atlanta, and Charleston had no measurable precipitation for 28 days during November. Across the SE U.S. during the month of November, wildfires burned over 180,000 acres. Biomass burning from wildfires has been identified as an important contributor to harmful levels of ozone and fine particulate matter (PM2.5). Using EPA's near-real-time version of the Community Multiscale Air Quality (CMAQ) modeling system for the period of 4-20 November 2016, we will compare near-real-time emission estimates from the Fire Inventory from NCAR (FINN) emission inventory to an approach using fire locations from NOAA's Hazard Mapping System (HMS). We will also consider improvements to the emission estimates based on fire specific information such as daily acres burned, fuel loading, and emission factors. The usefulness of the two near-real-time emission data products will be assessed by comparing CMAQ predictions of PM2.5 with observed data.

11:25 **OPEN SLOT AT THIS TIME**

Friday Morning – August 18, 2017

Session 10: PM and VOC Speciation

Chairs: Madeleine Strum, US EPA
Mike Kosusko, US EPA

8:00 ***"Assessment of Important SPECIATE Profiles in EPA's Emissions Modeling Platform and Current Data Gaps",*** C. D. Bray, M. Strum, H. Simon, L. Riddick, M. Kosusko, V. Rao, US EPA.

The US Environmental Protection Agency (EPA)'s SPECIATE database contains speciation profiles for both particulate matter (PM) and volatile organic compounds (VOCs) that are key inputs for creating speciated emission inventories for air quality modeling. The objective of this work is to identify the most influential profiles based on mass and reactivity for various regions of the US. These profiles will be further investigated to characterize the profile quality and determine whether current matching between profiles and source types appropriately captures source type and regional variability in speciation. In cases where this analysis identified either low quality or poorly matched profiles, an in-depth review of the SPECIATE database and the literature will be conducted to identify currently available suitable replacements. In cases where no suitable replacement profiles are found, this analysis will identify important gaps in the current literature which may be used to prioritize future speciation source testing. Through this process we aim to identify critical research needs, improve the SPECIATE database and improve a critical input for photochemical modeling efforts.

8:25 ***"Temperature and Driving Cycle Significantly Effect Semivolatile Organic Compound Emissions from Diesel Trucks",*** M. Hays, B. George, I. George, R. Snow, J. Faircloth, T. Long and R. Baldauf, US EPA.

The U.S. currently produces roughly 5 billion liters of biodiesel per year. Use of biodiesel is projected to increase based on its potential economic, energy, and environmental benefits. Despite these benefits, there is public health concern about the possible direct and indirect environmental and air quality impacts associated with biofuel use. National biofuel policy includes an anti-backsliding provision based on the risk of negative or adverse air quality impacts following implementation of the Renewable Fuel Standard (RFS). The present study examines the effects of fuel (an ultra-low sulfur diesel [ULSD] versus a 20% v/v soy-based biodiesel—80% v/v petroleum blend [B20]), temperature, load, vehicle, driving cycle, and regeneration technology on semivolatile organic compound (SVOC) emissions from diesel trucks. The study is performed using chassis dynamometer facilities that support low temperature operation (-7 °C versus 22 °C) and heavy loads up to 12,000 kg. Gas- and particle-phase SVOC emissions collected using traditional filter and polyurethane foam sampling media are analyzed using advanced gas chromatography-mass spectrometry methods. Carbon analysis is performed using a thermal-optical technique. Interestingly, replacing ultralow sulfur diesel with B20 did not significantly influence SVOC emissions. However, both low temperature and vehicle cold-starts significantly increase SVOCs in the truck exhaust. Vehicle regeneration technology did influence emissions in real-time; although, regeneration effects went unresolved in bulk samples using chromatography techniques. Finally, our emission rates will be compared with national inventory data, which currently show that individual SVOC emissions from diesel trucks can vary over several orders of magnitude.

8:50 ***"Composition of Organic Gas Emissions from Flaring Natural Gas",*** G. Yarwood, T. Shah, Ramboll Environ; A. Eyth and M. Strum, US EPA.

The composition of total organic gas (TOG) emissions from flares used in oil and gas operations influences photochemical and air toxic assessments. Flares abate venting of natural gas and other combustible gases for safety and to reduce environmental impacts. Flares operated within design criteria can achieve very high destruction and removal efficiency (DRE) of vented gas, approaching 100%. Nevertheless, some unburned vent gas will escape the flare combustion zone and products of incomplete combustion are formed by the flare and may escape the combustion zone. The existing applicable profile in the SPECIATE database (0051: Flares - Natural Gas) is based on engineering judgement and apportions 20% of TOG emissions to formaldehyde which may be unrealistic. The Texas Commission on Environmental Quality (TCEQ) sponsored a flare study in 2010 that quantified TOG composition for several industrial flares over ranges of operating conditions and vent gas composition. The TCEQ flare study is a highly credible source of information on TOG composition of flare emissions. We analyzed data from TCEQ's flare study to characterize combustion product composition and amount at several DRE values. We developed a method for combining the composition of combustion products and vented gas to obtain overall TOG composition. The resulting formaldehyde fraction of TOG emissions from flaring natural gas ranges from 3.48 % at DRE >98 % to 1.05 % at DRE < 80 %. The new speciation profiles for flaring natural gas are based on measured data and should be preferred over SPECIATE profile 0051.

9:15 ***"Volatile Chemical Products Emerging as Largest Fossil-Source of Organics over U.S. Cities",*** B. McDonald, CIRES/NOAA; J. De Gouw, CIRES, J. Gilman, NOAA; S. Jathar, and A. Akherati, Colorado State University; C. Cappa, UC-Davis; Y. Cui, CIRES/NOAA; D. Gentner, Yale University; A. Goldstein and R. Harley, UC-Berkeley; J. Jimenez, University of Colorado; S. Kim CIRES/NOAA; J. Lee-Taylor, CIRES/NCAR, S. McKeen, CIRES/NOAA; J. Roberts, M. Trainer, and G. Frost, NOAA.

There are current gaps in the understanding of urban emissions of volatile organic compounds (VOCs), which contribute to regional ozone (O_3) and aerosol burdens. We expand a previously developed fuel-based inventory of mobile source emissions to include speciated VOCs. We also construct a new inventory of chemical product emissions (also known as solvents) from bottom-up principles. The new inventories are evaluated using extensive VOC measurements made in the Los Angeles basin during the California Nexus Study in 2010. We show that in order to bring closure to missing hydroxyl radical (OH) reactivity and secondary organic aerosol (SOA) formation in cities, emission inventories and models need to properly account for the influence of volatile chemical products (e.g., personal care products, paints, surface cleaners, etc.). These sources now account for half of urban VOCs in a U.S. megacity, and are a larger source of air pollution than previously thought. We find that current emission inventories underestimate VOC emissions from chemical products by a factor of 2.

9:40 BREAK

10:10 ***"Impact of a Major Update to the VOC Speciation Profile Library on Regional Air Quality Model Predictions",*** J. Zhang, M. D. Moran, P. A. Makar, and Q. Zheng, Environment and Climate Change Canada.

Volatile organic compounds (VOCs) are primary precursors to the formation of ozone and particulate matter. Emissions inventories usually report bulk VOC emissions whereas a more detailed description of VOC species is required by air quality (AQ) models. Chemical speciation profiles are typically used to disaggregate bulk VOC emissions to individual model VOC species that depend on the AQ model's gas-phase chemistry mechanism. For Environment and Climate Change Canada's Global Environmental Multiscale – Modelling Air-quality and CHemistry (GEM-MACH) AQ modelling system, the ADOM-2

chemistry mechanism is used. The library of VOC speciation profiles used to speciate bulk VOC emissions for this mechanism was built more than a decade ago (Makar et al., 2003) and is equivalent to the profile library compiled in version 3.2 of the U.S. EPA's SPECIATE data base. Since 2003, however, many new VOC profiles have been created using newer analytical techniques both to update old profiles and to describe VOC emissions from emerging sources such as wildfires and fracking activities. The number of VOC profiles in the SPECIATE data base has increased from 567 in v3.2 to 2,175 in v4.5, the most recent version, and the number of individual VOC species has increased from 789 to 1,858. SPECIATE v4.5 has been used as the basis for updating the VOC speciation profile library for ADOM-2. In this presentation, the resulting changes to speciated model VOC emissions for North America will be characterized and the impact of the use of these updated emissions on AQ predictions by the GEM-MACH model will be shown.

10:35 ***"Speciated VOC Emissions from an Outdoor Residential Pellet-Burning Hydronic Heater",*** I. George, M. Hays, T. Yelverton, and E. Thompson, US EPA, and C. Singer, Jacobs Technology, Inc., W. Linak, and J. Kinsey, US EPA.

Outdoor hydronic heaters used for residential heating emit air pollutants such as particulate matter and volatile organic compounds (VOCs), which can lead to deleterious impacts on local air quality and human health. Detailed speciated emissions measurements are required to accurately assess the environmental and health impacts of these appliances. However, few studies have quantified speciated emissions from hydronic heaters, particularly for those operating on non-woody biomass pellets. To address these data gaps, this work aims to characterize speciated VOC emissions from a commercially-available pellet-burning hydronic heater. The hydronic heater was operated under the Syracuse load cycle and under two steady-state load conditions (low load and full load) using two fuels, hardwood and switchgrass pellets. The hydronic heater emissions were sampled in a dilution duct and diluted with ambient air. VOC emissions from the hydronic heater were sampled from the dilution duct and analyzed according to EPA Methods TO-15 and TO-11A. The effect of load and fuel on the VOC emission profiles will be investigated in detail. VOC emission factors from this study will also be compared to literature values for other hydronic heaters and environmental implications will be discussed.

11:00 ***"Cold Temperature Effects on Speciated VOC Emissions from Modern GDI Light-Duty Vehicles",*** I. George, M. Hays, R. Snow, J. Faircloth, T. Long, and R. Baldauf, US EPA.

Although gasoline direct injection (GDI) vehicles represent nearly half of the light-duty vehicle market share, few studies have reported speciated volatile organic compounds (VOCs) in GDI vehicle exhaust emissions. In this study, speciated VOC emissions were characterized from three modern GDI light-duty vehicles. The GDI vehicles tested in this study were all from Tier 2 Bin 5 emissions class but utilized different fuel injection technology and engine displacements. Vehicle 1 used a 2.4 liter, naturally aspirated, wall-guided GDI; Vehicle 2 used a 1.8 liter, wall and air guided, turbocharged GDI engine; Vehicle 3 used a 1.5 liter, turbocharged, spray-guided GDI engine. The vehicles were tested on a chassis dynamometer housed in a climate-controlled chamber at two temperatures (-7 and 22 °C) over the EPA Federal Test Procedure (FTP) and a portion of the Supplemental FTP (SFTP) that represents more aggressive driving conditions. The vehicles operated gasoline blended with 10% ethanol. VOC emissions from diluted vehicle exhaust were sampled with SUMMA canisters for EPA Method TO-15 analysis and with 2,4-Dinitrophenylhydrazine (DNPH) cartridges for carbonyl analysis by EPA Method TO-11A. This presentation will report the impact of ambient cold temperature, driving cycle, and GDI technology on speciated VOC emissions. VOC emission rates will be compared to previously published emissions data and environmental implications will be discussed.

11:25 ***"Estimating Fugitive Emissions of Volatile Organic Compounds from Evaporation,***

P. Hadavi, Sharif University of Technology; F. Saffarian, Islamic Azad University Kermanshah Branch; M. Safavi, Amirkabir University of Technology; A. Parchamdar and K. Ashrafi, Teheran University; A. Moosavi and M. Arhami, Sharif University of Technology.

The rate of fugitive emission was estimated by studying four large size evaporation ponds used for disposing produced water from oil and gas exploration and production in the Middle East. A measurement campaign was performed for each of these evaporation ponds to gather required data including, geometrical data, operational parameters, and the influent properties. The volatile organic compounds (VOCs) were periodically measured over the period of a whole year in the influent and around these ponds, using both portable VOC concentration analyzer and by taking samples and analyzing them. The VOCs emission were estimated by using evaporation equations and WATER9 model (by EPA) implementing the ponds data including analysis results of samples taken at the influents. To verify the emission estimations, VOCs dispersion from the ponds surfaces was simulated by means of computational fluid dynamics (CFD) based on the estimated and modeled evaporation rates. The emission estimations were adjusted and modeled VOCs concentrations were compared to the field measurements around and downstream of the evaporation ponds. VOCs concentrations modeled by CFD were in a good agreement with the field measurements. The results showed almost all of BTEX chemicals including benzene, toluene, ethylbenzene, and xylene and more than 80% of total TVOCs in the influent fluid are released into the environment when resides in the lake. The average of TVOCs emission factors, emission per volume of the influent, were estimated to be 34 ± 8 g/m^3, and those of BTEX were 20 ± 3 g/m^3.

11:50 CONFERENCE CONCLUDED

Friday Morning – August 18, 2017

Session 11: Reconciling NOx Emissions with Ambient Observations

Chairs: Darrell Sonntag, US EPA
Greg Frost, NOAA

8:00 ***"Diurnal, Weekday and Long-term Patterns in NOx Emissions Based on Decade-long Time Series of Hourly AQS Data and Comparison with Traffic Count Data"*** B. De Foy, St. Louis University.

There are more than a hundred sites in the USA with hourly measurements of NOx concentrations for at least 10 years and at least 90% data completeness. Multiple linear regression analysis is used to identify the patterns in the data at different time scales while taking into account meteorological variations. By accounting for the mixing height, wind speed, wind direction and other meteorological parameters, information can be obtained about the emission trends at the diurnal, weekday and inter-annual time scale. Results will be presented for different locations around the USA. Cluster analysis will be used to show different patterns in the diurnal cycle and the weekday variations around the country. Specific cases will be compared with traffic count data in order to evaluate their usefulness in developing emission inventories. The results will also be compared with results from analysis of NOx columns from the Ozone Monitoring Instrument.

8:25 ***"Satellite NO2 for the Evaluation of U.S. NOx Emissions",*** M. Harkey, T. Holloway, UW-Madison; R. Brad Pierce, NOAA.

The Ozone Monitoring Instrument (OMI) provides daily observations of tropospheric column NO2 during the early afternoon, when observed amounts are strongly emissions-dependent given high rates of removal by photolysis and other reactions. Therefore, combining OMI NO2 observations with photochemical models can yield results specifically helpful for NOx emission inventory analysis in both urban and non-urban areas. We have conducted assessments of two photochemical grid models, CMAQ and CAMx, using data from the OMI instrument. Our assessment includes three broad evaluations: (1) a comparison of regulatory models with OMI NO2 suggests that NOx emissions over urban areas are too high, while emissions over non-urban areas are too low; (2) we employ near-surface and tropospheric column NO2 from the CMAQ model to scale tropospheric column observations from OMI to near-surface amounts, and find scaled-to-surface satellite observations of NO2 may be helpful in constraining NOx emissions where ground-based observations are sparse; (3) satellite-based observations of NO2 have also been assimilated into CMAQ, and results for July 2011 help quantify the NOx emission overestimate seen over urban areas.

8:50 ***"Evaluation of NOx Emissions and Modeling",*** B. Henderson, H. Simon, B. Timin, P. Dolwick, C. Owen, A. Eyth, K. Foley, C. Toro, and K. Baker, US EPA.

Studies focusing on ambient measurements of NOy have concluded that NOx emissions are overestimated and some have attributed the error to the onroad mobile sector. We investigate this conclusion to identify the cause of observed bias. First, we compare DISCOVER-AQ Baltimore ambient measurements to fine-scale modeling with NOy tagged by sector. Sector-based relationships with bias are present, but these are sensitive to simulated vertical mixing. This is evident both in sensitivity to mixing parameterization and the seasonal patterns of bias. We also evaluate observation-based indicators, like CO:NOy ratios, that are commonly used to diagnose emissions inventories. Second, we examine the sensitivity of predicted NOx and NOy to temporal allocation of emissions. We investigate alternative temporal allocations for EGUs without CEMS, on-road mobile, and several non-road categories. These results show some location-specific sensitivity and will lead to some improved temporal allocations. Third, near-road studies have inherently fewer confounding variables, and have been examined for more direct evaluation of emissions and dispersion models. From 2008-2011, the EPA and FHWA conducted near-road studies in Las Vegas and Detroit. These measurements are used to more directly evaluate the emissions and dispersion using site-specific traffic data. In addition, the site-specific emissions are being compared to the emissions used in larger-scale photochemical modeling to identify key discrepancies. These efforts are part of a larger coordinated effort by EPA scientists to ensure the highest quality in emissions and model processes. We

9:15 ***"MOVES-Based NOx Analyses for Urban Case Studies in Texas",*** S. Bai, Y. Du, A. Seagram, and S. Reid, Sonoma Technology.

Emissions inventories are an important component of air quality planning and a key input to photochemical grid models that support air quality assessments. Findings from recent studies suggest that emissions of nitrogen oxides (NOx) may be overestimated in the EPA's National Emissions Inventory (NEI), perhaps by as much as a factor of two. This overestimate has generally been attributed to the mobile source sector, for which emission estimates are prepared using EPA's MOVES model. A number of potential issues have been identified with MOVES, including reliance on the model's default input data rather than more representative local inputs. This study builds on previous work by examining MOVES emission estimates at the local scale using near-road monitoring data. Specifically, the project team is comparing MOVES emission results with ambient monitoring data, using well-established emissions reconciliation techniques. These analyses are being performed for case studies in three Texas metropolitan areas: Dallas-Fort Worth, Houston, and El Paso. In addition, sensitivity analyses featuring MOVES emission results from default vs. local data are being used to identify which input parameters have the greatest influence on NOx emission estimates. To support the analyses, the project team is collecting local MOVES input data from planning agencies such as the North Central Texas Council of Governments (NCTCOG).

The results of this work will support emissions inventory development and air quality management efforts in Texas by providing information on the accuracy of current MOVES NOx emission estimates and the input parameters for which local data are critical.

9:40 BREAK

10:10 ***"United States Light and Heavy-Duty Fuel Specific On-Road NO and NOx Emission Factor Trends and Their Importance in Inventory Calculations",*** G. Bishop, University of Denver.

Mobile source oxide of nitrogen (NOx = NO + NO2) emissions have undergone great changes over the last two decades in the United States. With the introduction of Tier II light-duty vehicles into the fleet beginning in 2004, large reductions in on-road NOx emissions have been realized from the gasoline fueled fleet. On the heavy-duty side, for 2010 and newer diesel engines the Federal and California NOx standards were lowered an order of magnitude (2 g/bhp-hr to 0.2 g/bhp-hr) by introducing heavy-duty vehicles with the potential for significantly lower Nox emissions. Quantifying these emission factor changes for the current in-use fleet is an important step for preparing any emissions inventory.

The University of Denver has been collecting fuel specific on-road NO emissions from both light and heavy-duty vehicles at select sites around the US since 1997 and NOx emissions since 2008 using both optical and extractive techniques. Large reductions have been observed in both fleets' NOx emissions that have coincided with the reductions in tailpipe emission limits. However, the emissions reduction picture is not always uniform for all applications and locations. Historical NOx emission factor trends for the three larger vehicle categories, light-duty gasoline and diesel and heavy-duty diesel, will be presented and discussed. In addition, special considerations that need to be made when using emission factors for inventory purposes will also be presented and discussed.

Friday Morning – August 18, 2017

(Session 11 continues)

10:35 ***"Modeling Ozone in the Eastern U.S. using a Fuel-Based Mobile Source Emissions Inventory",*** B. McDonald, S. McKeen, Y. Cui, R. Ahmadov, and S. Kim, CIRES/NOAA; G. Frost, M. Trainer, NOAA.

A fuel-based mobile source emissions inventory of nitrogen oxides (NOx) and carbon monoxide (CO) is developed for the continental US. Emissions are mapped for the year 2013, including emissions from on-road gasoline and diesel vehicles, and off-road engines. We find that mobile source emissions in the National Emissions Inventory 2011 (NEI11) are ~50% higher and ~100% higher for NOx and CO, respectively, than results from this study. We model chemistry and transport of emissions from the NEI11 and our fuel-based inventory during the Southeast Nexus (SENEX) Study period in the summer of 2013, using the Weather Research and Forecasting with Chemistry (WRF-Chem) model. In the Eastern US, there is a consistent over-prediction of tropospheric ozone (O3) levels when simulating emissions from the NEI11, with the largest biases located in the Southeastern US. Using our fuel-based inventory, we test O3 sensitivity to lower NOx emissions. Lowering NOx emissions improves model biases of 8-hour O3 by up to 4 ppb, and up to 6 exceedance days above the 70 ppb standard during summer 2013. Model results of NOy, CO, and O3 are also compared with aircraft measurements.

11:00 ***"Comparison of Light-duty NOx Emission Rates Estimated from MOVES with Real-world Measurements",*** D. Sonntag, D. Choi, and J. Warila, US EPA.

Recent studies have shown differences between air quality model estimates and monitored values for nitrogen oxides. Several studies have suggested that the discrepancy between monitor and modeled values is due to an overestimation of NOx from mobile sources in EPA's emission inventory, particularly for light-duty gasoline vehicles. Studies that directly measure vehicle emissions provide the most direct data for evaluating MOVES. In this paper, we present comparisons of MOVES to thousands of real-world NOx emissions measurements from individual gasoline vehicles. The emission rates comparison studies include chassis dynamometer tests from the Inspection & Maintenance Program conducted by the State of Colorado and remote sensing data collected in multiple road-side locations in the United States by the University of Denver. In addition, we conduct comparisons of fleet-wide emissions measured from the Caldecott Tunnel near Oakland, California conducted by UC-Berkeley. We will discuss the implications the comparisons have for MOVES emissions and discuss ongoing efforts to evaluate and improve MOVES.

11:25 ***"Technical discussions on Emissions and Atmospheric Modeling (TEAM)",*** G. Frost, NOAA; B. Henderson, US EPA; B. Lefer, NASA.

A new informal activity, Technical discussions on Emissions and Atmospheric Modeling (TEAM), aims to improve the scientific understanding of emissions and atmospheric processes by leveraging resources through coordination, communication and collaboration between scientists in the Nation's environmental agencies. TEAM seeks to close information gaps that may be limiting emission inventory development and atmospheric modeling and to help identify related research areas that could benefit from additional coordinated efforts. TEAM is designed around webinars and in-person meetings on particular topics that are intended to facilitate active and sustained informal communications between technical staff at different agencies. The first series of TEAM webinars focuses on emissions of nitrogen oxides, a criteria pollutant impacting human and ecosystem health and a key precursor of ozone and particulate matter. Technical staff at Federal agencies with specific interests in emissions and atmospheric modeling are welcome to participate in TEAM.

11:50 CONFERENCE CONCLUDED

U.S. Environmental Protection Agency
Office of Quality Planning and Standards, Emissions Inventory and Analysis Group

22nd International Emissions Inventory Conference

"Applying Science and Streamlining Processes to Improve Inventories"

August 14-18, Baltimore, MD

Thank you for attending EPA's International Emissions Inventory Conference in Baltimore. We're very interested in your feedback so we can improve future conferences. Please take a moment to complete this evaluation form and return it to the registration desk. The focus of this evaluation is strictly on the technical parts of the Conference. Thank you!

Please rate the following sessions. If you would like, please provide more specific comments at the end of this document. If you did not attend a training session and/or a technical session, please leave that entry blank.

EIC2017 Training:

Training, August 14-15	Not Useful	Useful	Very Useful
Monday August 14 —Tuesday August 15th, 2017, Training			
Emissions Inventory Preparation for Air Quality Modeling (Base year)			
Projecting Emissions Inventories for Air Quality Modeling of Future Years			
Nonpoint Inventory Tools for the 2017 NEI			
Use of Emissions Inventory Data in Exceptional Event Demonstrations			
AVERT, COBRA, GHG Inventory & Green House Gas Reporting Program Training			
Oil and Gas 101: An Overview of Oil and Gas Upstream Activities and Using EPA's Nonpoint Oil and Gas Emission Estimation Tool for the 2017 NEI			
SPECIATE's VOC and PM Speciation Profiles and Their Use to Prepare for Air Quality Modeling			
MOVES2014a Training			
Toxic Release Inventory (TRI) Training Course – The Quality Behind the Numbers and Helping You Get to the Numbers			
Emission Inventory System (EIS) and the Making of the NEI			

Did the training session meet your expectations? Please list training session attended and what you found most useful and where we can improve next time. _____

For our next Emissions Inventory Conference, what topics would you like to see on the training agenda? What topics do you think are no longer needed? _____

What did you think about the length of the training you attended? Please be specific about which training you attended. _____

Would you recommend the training you took to a colleague? _____Yes _____No ____Yes, with improvements as indicated above

Please provide any other general feedback you have on the training sessions

_____

EIC2017 Plenary Session:

Did the Plenary Session meet your expectations? Why or why not?

_____

Did you find the presentations followed by an open Q&A session with the audience useful? If not, how would you improve that portion of the plenary program? _____

We wanted to achieve a balance between scientific methods for inventories with programmatic goals of producing and using an inventory, were those goals met when the entire plenary session is considered as a whole? If not, how can we bridge whatever gap exists?

_____

EIC2017 Technical Sessions:

Technical Sessions, August 16-18, 2017	Not Useful	Useful	Very Useful
Technical Sessions at EIC2017			
Wednesday, August 16th, 8 am – 5:10 pm			
Mobile Sources			
Nonpoint and Point Sources			
International Emission Inventories			
Intersection Between Inventories and Life-Cycle Emissions Impacts			
Combined Air Emissions Reporting (CAER)			
Thursday, August 17th, 8 am – 4:45 pm			
Emissions Inventory Preparation for Air Quality Modeling			
Oil and Gas			
Tools and GIS			
Friday August 18th, 8 am - Noon			
PM and VOC Speciation			
Reconciling NOx Emissions with Ambient Observations			
Biomass Burning			

Of the technical sessions you attended, which did you find most useful? Where did you see the need for improvements?

_____
_____

Did you find the panel discussions in the Oil and Gas session to be useful? What suggestions do you have for improvements, beyond just having podium presentations?

_____
_____

Did you find that the technical sessions covered the range of topics that are the most pressing for current inventory efforts? If not, what sessions/topics would you suggest adding (or removing) next time?

_____
_____

Are there any other suggestions you have on the technical sessions that you would like to pass on?

_____
_____

EIC2017 Poster Session:

Did you find our poster program this year to be a good complement to the oral presentations? Please provide specific comments on posters you found to be interesting.

_____
_____

What suggestions do you have for improving the poster displays and the poster program in general? Did you find having the posters up for viewing during all 3 days of the conference useful? Did you find having some dedicated Conference time to view posters useful?

_____
_____

EIC2017 General Questions:

How many years of experience do you have in EI development/use?? ___ years. Do you plan to stay in the EI development/use area 3-5 years from now? __yes ___no

Do you have any general comments/suggestions on the Training, Plenary, Technical Session or Poster Session portions of our 2017 conference?

_____
_____
_____

Did the Conference meet your expectations? _____ yes __ no If no, why not? _____
_____

What could be improved? _____
_____

Any other comments or suggestions: _____
_____