



# AGENDA

## 32nd CRC REAL WORLD EMISSIONS WORKSHOP

### *Co-Sponsors*

California Air Resources Board  
National Renewable Energy Laboratory  
South Coast Air Quality Management District  
US Environmental Protection Agency  
Truck and Engine Manufacturers Association

### *Workshop Organizers*

Scott Mason, Co-Chairman, Phillips 66 Company  
Michael Viola, Co-Chairman, General Motors  
Sam Cao, South Coast Air Quality Management District  
David Choi, US Environmental Protection Agency  
Tao Huai, California Air Resources Board  
Aaron Katzenstein, South Coast Air Quality Management District  
Yusuf Khan, Cummins, Inc.  
Andrew Kotz, National Renewable Energy Laboratory  
Amber Leland, Coordinating Research Council  
Joseph Martin, US Environmental Protection Agency  
Rada Purushothaman, Caterpillar Inc.  
Alexander Voice, Aramco  
Heidi Vreeland, US Environmental Protection Agency  
Seungju Yoon, California Air Resources Board

Hyatt Regency Mission bay, San Diego, CA  
March 13-16, 2022

The purpose of this workshop is free exchange of ideas, research, data, etc. Please do not record or take photos of presentations. All submitted presentation content will be available to participants in the Workshop Proceedings. Sponsorship of or participation in the workshop by CRC or others does not reflect any endorsement of information.

# Keynote Speakers

## **Tim Seidel**

General Manager  
Phillips66 Company

Mr. Timothy J. (Tim) Seidel, General Manager, Los Angeles Refinery, is a chemical engineer with 24 years of experience in the oil and gas industry. In this capacity, Mr. Seidel directs the efforts of the refinery's management team to safely operate oil facilities in Carson and Wilmington, CA as well as the Port of Los Angeles that together make up the Phillips 66 Los Angeles Refinery.

The Phillips 66 Los Angeles Refinery processes mainly heavy, high sulfur crude oil at a capacity of 140,000 barrels per day. It receives domestic crude oil by pipeline from California and foreign and domestic crude oils by tanker through a third party terminal in the Port of Long Beach. The refinery produces a high percentage of gasoline, diesel and aviation fuels at a capacity of over 5 million gallons per day. The facilities operate on 660 acres in the greater Los Angeles area and employ over 875 full-time employees including on-site contractors.

Before joining the Los, Angeles Refinery in 2018, Mr. Seidel served as the Ponca City (OK) refinery manager. Within the company, he has held the roles of production manager, Ponca City Refinery, where he continued in that capacity until April 2014. From 2009 to 2012, Mr. Seidel served as site manager, Santa Maria (CA) Refinery, receiving the National Petrochemical & Refiners Association's (now American Fuel & Petrochemicals Manufacturers) Distinguished Safety Award for two consecutive years. From 2006 to 2009, he was the technical manager at the Billings (MT) Refinery. Prior to that, he served as regional optimization manager within the commercial organization in Houston.

Mr. Seidel began his refining career in 1997 as a chemical engineer at the Sweeny (TX) Refinery for the Phillips Petroleum Company where he worked in various positions of increasing responsibility at Sweeny, including roles in engineering, operations, project development and construction.

Mr. Seidel graduated from Montana State University in Bozeman in 1996 with a bachelor's degree in chemical engineering.

## **Annette Hebert**

California Air Resources Board

Annette Hebert was appointed Deputy Executive Officer of the California Air Resources Board on February 2, 2021. In this capacity, Ms. Hebert will serve as lead for CARB's new Southern California Headquarters, guiding the work of over 350 engineers, scientists, policymakers, and support staff primarily in the area of CARB's extensive mobile source programs. Ms. Hebert's focus is on emissions certification and compliance, mobile source emissions warranties, and various mobile source testing and field assessment tasks. Ms. Hebert also lead workforce and facility transition planning in advance of the move to the Southern California Headquarters opening near the campus of UC Riverside in 2021.

A Cajun native of Louisiana, Ms. Hebert holds a Bachelor of Science degree in Petroleum Engineering from the University of Louisiana, Lafayette.

# Workshop Chairs

## Michael Viola

### General Motors

Michael Viola is a Staff Researcher in the Chemical and Materials Systems Laboratory at General Motors Research and Development Center. Mr. Viola has been with GM for 37 years and has held several roles that involved advanced fuels, lubricants and emissions research. He has led and been involved in many projects including working on the first prototype Urea-SCR vehicle at GM. He has won an R&D Magazine, One of the 100 Most Technologically Significant New Products of the Year, for "Ionic Liquid Anti-Wear Additives for Fuel Efficient Engine Lubricants." He holds 16 patents, has published many peer reviewed journals and papers on fuels, lubricant's and emissions.

Mr. Viola is the co-chairman of the Emissions Committee and the Real World Working Group and serves as a member of the Advanced Vehicle Fuels and Lubricants (AVFL) Committee and the Fuels for Advanced Combustion Engines (FACE) Working Group within the Coordinating Research Council (CRC). He is a GM representative on the Fuels Working Group and the Transmission Fluid Working Group within the United States Council for Automotive Research (USCAR). He holds both a Master of Science and Bachelor of Science in Mechanical Engineering from Wayne State University.

## Scott Mason

### Phillips66 Company

Scott Mason has a Master of Business Administration, Oklahoma State University and a Bachelor of Science in Chemical Engineering, University of Nebraska at Lincoln. He is currently Scientific Advisor & Fuels Specialist for Phillips 66. In this role Mr. Mason directs development and regulatory registration of new biofuels, as well as development of future fuel specifications through Coordinating Research Council and ASTM. Mr. Mason is active in several committees within the US Dept of Energy USDRIVE program.

Mr. Mason has many years' experience in many businesses within the oil refining, technology licensing, chemicals, and plastics industries. Mr. Mason has been a petroleum refinery engineer, sales and procurement managers, commodity trader, business development manager, and project manager. Mr. Mason has extensive experience managing university research contracts both in the U.S. and internationally.

Scott was appointed to the U.S. Department of Energy Biomass Advisory board and served 2 terms. Scott is a registered Professional Engineer, and a member of ASTM and NCWM.

# Session Chairs

## Joseph Martin

US Environmental Protection Agency

Joseph is a researcher with the USEPA's Office of Research and Development, in the Surface and Fine Scale Branch of the Center for Environmental Modeling and Measurement. He received an MPH in Environmental Quality and Health from the University of Michigan's School of Public Health and a Ph.D. in Soil Chemistry from Purdue University. At EPA, Joseph's work is centered on characterization of IVOC/SVOC emissions from multiple sources, supporting method development, emissions inventories, and regulatory action.

## Alexander Voice

Aramco

Andrew is a Senior Research Engineer at the U.S. Department of Energy National Renewable Energy Lab where he is part of the Center for Integrated Mobility Science's Commercial Vehicle Technology team. Andrew received his Ph.D. in Mechanical Engineering from the University of Minnesota where he researched real-world transit bus NOx emissions and vehicle big data. At NREL, Andrew's work focuses on heavy duty electrification, vehicle emissions and big data that help advance energy efficient and renewable transportation.

## David Choi

US Environmental Protection Agency

David Choi is the Director of the Air Quality and Modeling Center within the Assessment and Standards Division of EPA's Office of Transportation and Air Quality. He manages the development of mobile source emission inventory models, including MOVES, Nonroad, and Marine. His group is also responsible for supporting EPA programs and regulations through emissions and activity research, developing emissions inventory for mobile sources, and supporting air quality modeling. David holds a B.A. in Biology from Johns Hopkins University and MPH in Occupational and Environmental Epidemiology from the University of Michigan.

## Heidi Vreeland

US Environmental Protection Agency

Heidi Vreeland is a researcher at the U.S. Environmental Protection Agency in the Office of Research and Development. Her work at EPA includes investigating air quality impacts from combustion source emissions, and managing light-duty and heavy-duty dynamometer research. Heidi holds a M.S. from the Georgia Institute of Technology and Ph.D. from Duke University in Environmental Engineering.

# **Sam Cao**

## **South Coast Air Quality Management District**

Sam is a Program Supervisor at the Technology Demonstration group at South Coast AQMD. He has a Ph.D. in Chemical and Environmental Engineering University of California, Riverside, specializing in in-use emissions measurement from off-road construction equipment and a MBA from Indiana University. Sam currently manages various low-emissions and zero emission technology demonstration and research projects. Prior to joining South Coast AQMD, he worked at Cummins Inc. in Advanced Emissions Development group for 5 years.

# **Aaron Katzenstein**

## **South Coast Air Quality Management District**

Dr. Aaron Katzenstein is the Assistant Deputy Executive Officer of the Technology Advancement Office for Science & Technology Advancement. He is responsible for the Technology Advancement Office which oversees several mobile source incentive programs, technology review, and development and commercialization of clean air technologies.

He began his career at South Coast AQMD in 2003 where he worked in the laboratory prior to his role as the Climate and Energy Supervisor in Planning and Rules. He later became an Acting Planning Manager for Area Sources and most recently was the Laboratory and Source Test Manager. He has been heavily involved in numerous Multiple Air Toxics Exposure Studies, Air Quality Management Plans, policy development, research projects, air quality studies, and technology/infrastructure projects.

Dr. Katzenstein received his undergraduate degree in Chemistry with a minor in Physics from the University of Redlands. He graduated with a M.S. and Ph.D. in Chemistry with a focus on Atmospheric Chemistry from the University of California Irvine where he studied regional and global air quality.

# **Seungju Yoon**

## **California Air Resources Board**

Seungju Yoon is a manager with California Air Resources Board, Research Division. He oversees on-road and off-road mobile source research programs of mitigating greenhouse gas emissions from mobile air conditioners (MVAC), characterizing in-use vehicle emissions and activity and their impact on air quality, investigating emissions reduction opportunities using laboratory, remote-sensing, and engine and activity data-logging technologies, and understanding non-tailpipe emissions such as brake and tire wear.

Seungju holds a master's degree in environmental engineering – air pollution control and a Ph. D degree in civil engineering – transportation systems from the Georgia Institute of Technology. He has over 20 years of experience in transportation and air quality research and policy development.

# **Andrew Kotz**

## **National Renewable Energy Laboratory**

Andrew is a Senior Research Engineer at the U.S. Department of Energy National Renewable Energy Lab where he is part of the Center for Integrated Mobility Science's Commercial Vehicle Technology team. Andrew received his Ph.D. in Mechanical Engineering from the University of Minnesota where he researched real-world transit bus NOx emissions and vehicle big data. At NREL, Andrew's work focuses on heavy duty electrification, vehicle emissions and big data that help advance energy efficient and renewable transportation.

# **Tao Huai**

## **California Air Resources Board**

Dr. Tao Huai is Chief of the Freight Emissions Testing and Research Branch in the Mobile Source Laboratory Division at the California Air Resources Board. Over the past sixteen years, Tao has overseen the development of regulations requiring lower global-warming potential automotive refrigerants, conducted research studies assessing the effectiveness of light- and heavy- duty vehicle advanced emission control technologies, and supported adoption of the ultralow particulate matter standards for the Advanced Clean Car Regulation.

Tao earned a Bachelor of Science degree in Thermal Engineering and a Master of Science degree in Management Science and Engineering from Beijing's Tsinghua University, followed by a Ph.D. in Chemical and Environmental Engineering from the University of California, Riverside. Tao is also an Adjunct Assistant Professor in the Department of Environmental Health Sciences at the University of California, Los Angeles.

# **Rada Purushothamon**

**Caterpillar, Inc.**

Radha Purushothaman is an Engineering Specialist, Global Engine Development at Caterpillar. Radha joined Caterpillar as an intern in Advanced Materials Technology in 2006. He worked as an engineer for Heat Treatment and Furnace Atmosphere Monitoring Systems. Radha joined the Engine Emissions Measurement team in 2009 to support the Non-Road Tier IV engine development. His team is responsible for gaseous, particulate and particle emissions measurement for testing and compliance to various global emissions regulations. Radha is also a member of Truck and Engine Manufacturers Associations' (EMA's) Emissions Measurement and Testing Committee (EMTC). Radha's research interests include Particulate and Particle Measurement and Emissions Measurement Uncertainty. He holds a M.S. and Ph.D. from Worcester Polytechnic Institute, Massachusetts in Manufacturing Engineering.

# **Yusuf Khan**

**Cummins, Inc.**

Yusuf is a Technical Advisor in the department of Product Compliance & Regulatory Affairs at Cummins Inc. He joined Cummins in 2013 after obtaining his Ph.D. in Chemical & Environmental Engineering from the University of California, Riverside. At Cummins, he is emissions measurement and test procedures expert supporting global sites. He is the owner of Cummins global emissions post-processing tool, emissions database, and retrieval programs. He is responsible for ensuring correct implementation of new test procedures at global test sites. He is currently co-chair of the Engine Manufacturer Associations - Emissions Measurement & Testing Committee, represents Cummins in European Automobile Manufacturers' Association, SAE Emission Standard Committee, and represents the US for ISO Technical Committee.

## Sunday, March 13, 2022

4:30-6:00 PM Registration in the Bayview Foyer and Poster Setup in the Regatta Pavilion

6:00-7:00 PM Welcome Reception in Banyan Court and Lawn

## DAY ONE Monday, March 14, 2022

*All sessions take place in Bayview Ballroom, unless otherwise noted*

7:00 AM Registration in Bayview Foyer and Continental Breakfast in Regatta Pavilion

8:00 AM Welcome from the Chairs: Mike Viola, General Motors, & Scott Mason, Phillips 66

8:15 AM **Keynote Address: Tim Seidel, Phillips 66**

### SESSION 1

9:00 AM **In-Use Emissions for Light- and Heavy-Duty Vehicles**

*Introduction by Session Leader: Tao Huai, California Air Resources Board, and Andrew Kotz, NREL*

9:05 AM Wintertime Measurements of Heavy-duty Vehicle Emissions at a Utah Port of Entry Molly Haugen University of Cambridge

9:20 AM In-Use Emissions Testing And Fuel Usage Profile Of On-Road Heavy-Duty Vehicles – 200 Vehicle Study Chassis Hanwei Zhu\* University of California, Riverside

9:35 AM Analysis and Summary of Manufacturers In-Use Testing Data Collected from Heavy-Duty Diesel Engines for 2012-2019 Test Orders Using PEMS Systems Allen Duncan US EPA

9:50 AM Comparison of NOx and Greenhouse Gas Emissions between Diesel and Natural Gas Heavy-Duty Vehicles During Real-World Operation Arvind Thiruvengadam West Virginia University

10:05 AM **Poster Session Break and Demonstrations in Regatta Pavilion**

10:40 AM Development, Application, And Demonstration Of A Sensor-Based Onboard Sensing, Analysis, And Reporting (OSAR) For Emission And Activity Data Collection Kent Johnson University of California, Riverside

10:55 AM Port Drayage Electrification for Coastal and Inland Ports Andrew Kotz National Renewable Energy Laboratory

11:10 AM Estimating Limits of Quantitation in Remote Sensing of Automobile Emissions James Warila US EPA

11:25 AM Impact of Regenerative Braking, Heating, and Air Conditioning on Energy Consumption of Light-Duty Plug-in Electric Vehicles Chris Ruehl California Air Resources Board

11:40 AM **Lunch Break in Banyan Court and Lawn**

1:10 PM **5 Minute Lightning Round Talks**

*Introduction by Scott Mason, Phillips 66*

1:15 PM Ozone Trends in the South Coast Air Basin Through 2021 and Their Implications on Ozone Mitigation Control Strategies Ralph Morris Ramboll

1:20 PM Absorber Windows for Very Low Soot Mass Concentration using a Photoacoustic Instrument Imad Khalek Southwest Research Institute

1:25 PM Real-World Speciated Volatile Organic Compounds: Comparison Of Old And New Gasoline Cars Nick Molden Emissions Analytics



## DAY ONE Monday, March 14, 2022

### SESSION 2

1:35 PM	<b>Emissions Control Measures: I/M, OBD, Technologies and Strategies</b>		
	<i>Introduction by Seungju Yoon, California Air Resources Board</i>		
1:40 PM	The Story Of The (Near) Elimination Of Gasoline Vehicle Emissions – CRC Project E-130	Kent Hoekman	Desert Research Institute
1:55 PM	California’s Heavy-Duty I/M Pilot Study – Evaluation Of Best Practices For A Full-Scale Program	Michael Sabisch	Eastern Research Group
2:10 PM	Identifying High Emitting Heavy Duty Diesel Vehicles Using Portable Emission Acquisition Systems (PEAQS) To Support Roadside Enforcement In California	Isaac Lino	California Air Resources Board
2:25 PM	Demonstration Of Sensor Technologies For On-Road And Off-Road Heavy-Duty Diesel Vehicles	Kent Johnson	University of California, Riverside
2:40 PM	Advanced Inspection And Maintenance Methods To Identify High Emitters	Daisy Thomas	3DATX Corporation
2:55 PM	General Discussion of Session 2		

### 3:05 PM Poster Session Break and Demonstrations in Regatta Pavilion

### SESSION 3

3:25 PM	<b>Emissions Measurement Methods</b>		
	<i>Introduction by Tao Huai, California Air Resources Board and Joseph Martin, U.S. Environmental Protection Agency</i>		
3:30 PM	Opening the “CAN” - Exploiting the Wealthof Data within a Vehicle’s ECM	Michael Sabisch	ERG
3:45 PM	Technical Perspective of the Roadside Exhaust Plume Capture Emissions Measurement System for Heavy-Duty Vehicles	Okjoo Park	California Air Resources Board
4:00 PM	Apportioning Emissions to TRU and HD Trucks from On-Road Remote Sensing	Daniel Phillips	California Air Resources Board
4:15 PM	Denver On-Road Running Loss Trends by Remote Sensing	Tim DeFries	Eastern Research Group
4:30 PM	An Update on Continuing Progress at SwRI Towards 2027 Heavy Duty Low NOX Targets	Chris Sharp	Southwest Research Institute
4:45 PM	General Discussion of Session 3		
4:55 PM	Logistics for Dinner Event	Jan Tucker	Coordinating Research Council, Inc.
5:00 PM	<b>END OF DAY</b>		
5:45 PM	Meet in Lobby to Leave for Networking Dinner, Last Bus Leaving at 6:00 PM		

**DAY TWO Tuesday, March 15, 2022**7:00 AM **Registration in Bayview Foyer and Continental Breakfast in Regatta Pavilion**8:00 AM **Keynote Introduction by Workshop Co-Chair, Mike Viola, General Motors**8:05 AM **Keynote Address: Annette Hebert, California Air Resources Board****SESSION 4**8:50 AM **Fuel Effects on Exhaust Emissions***Introduction by Session Leader: Alexander Voice, Aramco*

8:55 AM Aiming At The Increase Of California's Ethanol 'Blend Wall': Gaseous And Particulate Emissions Evaluation From A Fleet Of GDI And PFI Vehicles Operated On E10 And E15 Fuels Tianbo Tang\* University of California, Riverside

9:10 AM Quantifying Ethanol Carbon Intensity in Gasoline Blends Nigel Clark Transport Energy Strategies

9:25 AM Impact Of Aromatic Content And Species Optimization On Engine Compatibility And PM Emissions Bhupendra Khandelwal University of Alabama

9:40 AM Exhaust Emissions From A Heavy-Duty Engine Running On DME Fuel Gilles Hardy Ivan Tate FPT Motorenforschung AG

9:55 AM Fuel Effects On Engine Out And Tailpipe Emissions Of An Ultra-Low Emissions Vehicle Alexander Voice Aramco

10:10 AM General Discussion of Session 4

10:20 AM **Poster Session Break and Demonstrations in Regatta Pavilion****SESSION 5**10:45 AM **Emissions Modeling***Introduction by Session Leader: David Choi, U.S. Environmental Protection Agency*

10:50 AM Accuracy Of The Predictions Of Modeled Emission Hotspots Based On Real-World Measured Traffic Activity And Emissions. Christina Quaassdorff Universidad Politécnic de Madrid / North Carolina State University

11:05 AM Predicting Light-Duty Vehicle Emission Using Deep Neural Networks Abdul Motin Howlader California Air Resources Board

11:20 AM MOVES 3 Experiences, Results, And Observations By The DFW Metropolitan Planning Organization Chris Klaus North Central Texas Council of Governments

11:35 AM General Discussion of Session 5

11:45 AM **Lunch Break in Banyan Court and Lawn**1:15 PM **5 Minute Lightning Round Talks***Introduction by Scott Mason, Phillips 66*

1:20 PM Integrated Simulation Platform to Enable Near-Zero Emissions Heavy-Duty Vehicles Andrea Strzelec University of Wisconsin-Madison

1:25 PM Updating And Improving The National Inventory For Mobile Sources In Mexico Using MOVES-Mexico Mauro Alvarado-Castillo LT Consulting Group

1:30 PM Real-world Gaseous and Particulate Emissions Characteristics from Current Technology Heavy-Duty Diesel and Natural Gas Vehicles Tianyi Ma\* University of California, Riverside

1:35 PM Activity and Performance for Heavy-duty Diesel and Battery Electric Vehicles in Real-world Operations Tianyi Ma\* University of California, Riverside

1:40 PM Activity of Zero and Near-Zero Emissions Vehicles and Equipment Chas Frederickson\* University of California, Riverside

1:45 PM Practices Of Diverse Aerosol Generators To Improve The Measurement Of Particulate Matter Qianfeng Li California Air Resources Board

**DAY TWO Tuesday, March 15, 2022****SESSION 6****1:55 PM Off-Road / Non-Road Emissions***Introduction by Rada Purushothaman, Caterpillar, Inc.*

2:00 PM	Application of the 3-Bin Moving Average Window Method for Off-Road Diesel Engines	Yi Tan	California Air Resources Board
2:15 PM	In-use Particle Measurements of Maritime Emissions in Rafina, Greece	Molly Haugen	University of Cambridge
2:30 PM	California's All New 2021 Forestry Equipment Emissions Inventory	Julie Schiffman	California Air Resources Board
2:45 PM	General Discussion of Session 6		

**2:55 PM Poster Session Break and Demonstrations in Regatta Pavilion****SESSION 7****3:20 PM Improving the Emissions Inventory***Introduction by Sam Cao and Aaron Katzenstein, SCAQMD*

3:25 PM	Causes of 2020 Ozone and Ability of Photochemical Models to Predict Observed Ozone Changes in the South Coast Air Basin Due to Emissions Reductions from COVID-19	Ralph Morris	Ramboll
3:40 PM	Low CO <sub>2</sub> , Ultralow NO <sub>x</sub> Heavy Duty Diesel Engine	Fabien Redon	Achates Power
3:55 PM	Characterizing PM <sub>2.5</sub> and NO <sub>x</sub> Emissions for Off-Road Construction Equipment with DPF and SCR Using an Engine Power Binning Method	Qi Yao	California Air Resources Board
4:10 PM	Modeling The Emissions Impact of Heavy-Duty Inspection and Maintenance Program	Ali Davari	California Air Resources Board
4:25 PM	Investigating Real-World Emissions From Light-Duty Vehicles Across Mexico Using Remote Sensing Measurements.	Claudia Toro	Eastern Research Group
4:40 PM	Air Conditioning Refrigerant Leakage For Model Year 2021 Heavy-Duty Vehicles Certified For Sale In California	Tao Zhan	California Air Resources Board
4:55 PM	Characterization of Trip Starts, Including Initial Idle Time and Acceleration, for 82 Real-world Internal Combustion Engine Light-duty Vehicles	Chris Ruehl	California Air Resources Board
5:10 PM	General Discussion of Session 7		

**5:20 PM END OF DAY****6:00 PM One Hour Evening Poster and Demonstration Reception in Regatta Pavilion**

**DAY THREE Wednesday, March 16, 2022**7:30 AM **Registration in Bayview Foyer and Continental Breakfast in Regatta Pavilion****SESSION 8****8:00 AM Brake and Tire Wear***Introduction by Seungju Yoon, California Air Resources Board*

8:05 AM New Research On Brake Wear Particulate Matter Emissions From Several Heavy Truck Vocations In California John Koupal Eastern Research Group

8:20 AM Concentration and Chemical Characteristics of PM2.5 and PM10 near California Highways with a Focus on Non-Tailpipe Emissions Xiaoliang Wang Desert Research Institute

8:35 AM Contribution Of Non-Exhaust Vehicle Emissions To Near-Road PM2.5 And PM10: A Chemical Mass Balance Study Antony Chen University of Nevada

8:50 AM Instrumentation and Methods for Quantifying Brake Emissions Andrea Tiwari TSI Inc.

9:05 AM Chemical Fingerprinting Tires To Understand Tire Wear Emissions Nick Molden Emissions Analytics

9:20 AM TiO2 Enhanced Roadways to Reduce Vehicular Emissions &amp; Microplastic Debris Michael Durante Pavement Tech

9:35 AM General Discussion of Session 8

**9:45 AM Poster Session and Demonstrations in Regatta Pavilion****SESSION 9****10:15 AM Particulate Emissions***Introduction by Yusuf Khan, Cummins and Heidi Vreeland, US EPA*

10:20 AM Influence of Combustion Strategy and Fuel Ethanol Content on Effective Density, Concentration, and Size of Particles Emitted by a Lean Burn Gasoline Direct Injection Engine David Kittelson University of Minnesota

10:35 AM Evaluation of Tailpipe Solid Particle Number Measurement Methodologies for Euro VII Yusuf Khan Cummins Inc.

10:50 AM Evaluation of Finnish vehicle fleet exhaust solid particle number emissions with respect to upcoming European periodic testing legislation Erkki Lamminen Dekati Ltd.

11:05 AM Evaluation of a New TSI Engine Exhaust Particle Sizer with Two-stage Dilution and Catalytic Stripper for Solid Particle Number Measurements Yusuf Khan Cummins Inc.

11:20 AM In-Use Vehicle Emissions of Black Carbon (BC) and Brown Carbon (BrC) from roadside field campaigns using a Portable Emissions Acquisition System (PEAQS) Michael Olson California Air Resources Board

11:35 AM PAH Emissions from a GPF-Equipped Light Duty Truck during Soot Accumulation and Regeneration Stanislav Bohac US EPA

11:50 AM General Discussion of Session 9

**Closing Remarks from Real World Group Chairs**12:00 PM **Scott Mason, Phillips 66**  
**Mike Viola, General Motors****12:10 PM Lunch in Banyan Court and Lawn****1:30 PM END OF WORKSHOP**

## POSTERS

### Brake And Tire Wear

Chemical Fingerprinting Tires To Understand Tire Wear Emissions	Nick Molden	Emissions Analytics
Tio2 Enhanced Roadways To Reduce Vehicular Emissions & Microplastic Debris	Michael Durante	Pavement Tech, Inc.

### Emissions Measurement Methods

On-Road Light-Duty Vehicle Emissions Measurements Using A Plume Capture Method	Okjoo Park	California Air Resources Board
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### Emissions Modeling

Intermodal Comparison Of Tailpipe Emission Rates Between Transit Buses And Private Vehicles For On-Road Passenger Transport	Tongchuan Wei	North Carolina State University
RDE Plus – Rapid Characterisation Of Vehicle And Powertrain Performance And Emissions Using Digital Twin, Dynamic Design Of Experiments And Environmental Emulation Hardware Methodologies	Phil Roberts	HORIBA MIRA Ltd

### Fuel Effects On Exhaust Emissions

Analysis Of Vehicle Emissions With Different Fuel Formulations In Mexico	Mauro Alvarado-Castillo	LT Consulting
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### Improving The Emissions Inventory

Updating And Improving The National Inventory For Mobile Sources In Mexico Using MOVES-Mexico	Mauro Alvarado-Castillo	LT Consulting
Comparison Of Phase 1 And Phase 2 GHG Regulations, Emissions And Technology Improvements	Jade Jiang	California Air Resources Board

### In-Use HD

In-Use Emissions Testing And Fuel Usage Profile Of On-Road Heavy-Duty Vehicles – 200 Vehicle Study On Road	Hanwei Zhu*	University of California, Riverside
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### Off-Road/Non-Road

In-Use Equipment And Engine Activities Of Construction Equipment In California	Chas Frederickson*	University of California, Riverside
Carb's Off-Road In-Use Compliance Pilot Program	Hyun Ji (Julie) Lee	California Air Resources Board

### Particulate Emissions And Measurement

Innovative Approaches To Measuring And Improving Cabin Air Quality Using Filtration	Ameya Joshi	Corning, Inc.
Recalibration Of The Parsync© Particulate Calculation Matrix And Investigations Into PN And PM Reported From Different Emissions Measurement Systems During Chassis Dynamometer Testing Of A GDI Vehicle	Daisy Thomas	3DATX
Measuring Real-World Ambient Particulate Concentrations Using Mobile Monitoring Within Urban Communities.	Angus Craig	Corning, Inc.
Practices Of Diverse Aerosol Generators To Improve The Measurement Of Particulate Matter	Qianfeng Li	California Air Resources Board

## DEMONSTRATIONS

3DATX Parsync FLEX iPEMS	David Miller	3DATX
Demonstration of Dekati and Pegasor Instruments for PM Sampling	Tyler Beck	Particle Instruments, LLC.
Instrumentation and Methods for Quantifying Brake Emissions	Bob Anderson	TSI Inc.

\*Student Presenter







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