Coordinating Research Council (CRC)

Workshop on Vehicle Exhaust Particulate Emission Measurement Methodology

Organized in cooperation with
Society of Automotive Engineers of Japan (JSAE)
CONCAWE and ACEA

To be held in conjunction with the

SAE 2002 Powertrain & Fluid Systems Conference & Exhibition
Manchester Grand Hyatt
San Diego, California USA
October 21, 2002
8:30 AM – 6:30 PM

Workshop Purpose:

- Discuss recent progress in understanding the formation and fate of vehicle exhaust particulate emissions.
- Discuss new measurement techniques (particle size, number, surface area, and composition) that supplement current mass measurements.
- Discuss type of PM measurements needed for future vehicle emission measurements and identify gaps in our knowledge that hinder their development.
- Discuss what needs to be done to progress toward agreed upon methods for regulatory and research needs.

Meeting Output:

CRC will provide a set of meeting minutes that summarizes the meeting and recommendations.

Meeting Format:

The Workshop is intended to be a focus for discussion and identification of agreed upon sampling methodology and future research needs necessary for design of engines, exhaust aftertreatment devices, and anticipated regulatory needs. To facilitate discussion, formal

presentations will be kept to a minimum. Speakers are asked to provide a concise review of current activities and research issues that will be a prelude to discussion, rather than a detailed description of a specific piece of research.

Some of the issues to be discussed are:

- What is the lowest particle size that needs to be measured?
- Significance of volatile nucleation mode particles for air quality and health
- What particle properties need to be measured (mass, number, other)
- What is acceptable sensitivity and accuracy?
- How does one prevent and/or correct for particle losses during sampling?
- How do we condition the vehicle or engine and exhaust train given the apparent storage and release of material during testing?
- How do we properly sample to collect PM for chemical analysis and what should be measured?

Agenda

8:30 Introduction and Overview of Workshop Objectives (15 Minutes)
Tim Belian, CRC & David Rickeard, ExxonMobil

1. PM Health Effects. What particulate measurements are necessary for health research? Presentation & Discussion

8:45 *"Particulate Measurements Necessary for Health Research"* *Daniel Greenbaum, HEI*

9:00 "*Research Activities of Health Effects of Vehicle Exhaust in Japan"* Dr.Hiroshi *NITTA* National Institute for Environmental Studies

9:15 *"Animal Studies of Health Effects of Diesel Exhaust in Japan"* Kazuhito Maejima, *Ph.D* JARI

2. Regulatory interest regarding nanoparticles, composition, and other properties

9:30 PMP – *Speaker to be confirmed*

9:45 *Japan – Speaker to be Confirmed*

10:00 *USEPA – Matt* Spears or Bruce Cantrell U.S. Environmental Protection Agency

10:15 CARB – Tom Cackette California Air Resources Board

10:30-10:50 Break, 20 min

3. Progress in measuring solid particles
(a) Improvements in mass measurement (for US07/Tier 2/Euro 5 etc)
(b) Number, size, surface area etc

10:50 "*Heavy-duty regulations and EPA work to improve mass measurement*" Matt Spears US Environmental Protection Agency

11:10 "*Improved Mass Measurement*" Nigel Clark West Virginia University

11:30 "ACEA Heavy-Duty Vehicle Emissions Program" Jurgen Stein DaimlerChrysler

11:50 "ACEA Light-Duty Vehicle Emissions Program" Stefan Carli/Reiner Vogt Ford Motor Company

12:10 "*What is the Impact of Driving Cycles on Emissions*?" Steve Cadle General Motors

12:30 - 14:00 Lunch break

4. Volatile nucleation mode

(a) How can we measure them
(b) Emission and evolution in the air
(c) What are outstanding questions

14:00 "*Overview of CRC Project E-43 and Major Conclusions*" David Kittelson U. of Minnesota

14:20 "*Chemical & Physical Properties of Nanoparticles*" Paul Ziemann UC Riverside

14:40 "*Measurement of Particle size Distribution of Vehicle Exhaust - How can we reproduce the Vehicular PM Size in the Atmosphere in a Laboratory Test?"* Sosuke Sasaki JARI

15:00 "*Chemical Composition of Nanoparticles Collected with Impactors*" Doug Lawson NREL

15:20 "Transformation of Vehicle Exhaust Particulate in the Atmosphere" Fred Lurmann Sonoma Technology

15:40 "*Nanoparticle Emissions from Light Duty Diesel and Gasoline Vehicles*" Matti Maricq Ford Motor

16:00 - 16:15 Break 15 min

5. Instruments (60 min)

a) How do we measure number, size etc of volatiles?
b) How can we measure composition of volatiles?

16:15 "DG TREN Overview and Major Conclusions" Zissis Samaras

16:35 "New Measurement Methodologies Developed in Europe" - Speaker to be Confirmed

16:55 "Instrument Evaluations" – David Kittelson U. of Minnesota

6. What are the Next Steps? What can we conclude? (75 min)

Panel discussion – methods that we agree on, methods we do not agree on – what are the necessary future challenges, questions, next steps.

Workshop on Vehicle Exhaust Particulate Emission Measurement Methodology
21 October 2002, San Diego, California

D J Rickeard

Background / Objectives

- In conjunction with SAE Fuels & Lubricants Conference
  - Previous workshop held in Paris, June 2000
- Organised by CRC in co-operation with Concawe, ACEA, JSAE

Purpose is to discuss:

- Recent progress in understanding the formation and fate of vehicle exhaust particulate emissions.
- New measurement techniques (particle size, number, surface area, and composition) that supplement current mass measurements.
- Type of PM measurements needed for future vehicle emission measurements and identify gaps in our knowledge that hinder their development.
- What needs to be done to progress toward agreed-upon methods for regulatory and research needs.

Outline of Agenda

- **PM Health Effects**.
  - **What particulate measurements are necessary for health research?**
- **Regulatory interest regarding nanoparticles, composition, and other properties**
  - **Input from Europe, Japan, USA**
- **Progress in measuring solid particles**
  - **Improvements in mass method, driving cycle effects**
- **Volatile nucleation mode**
  - **Physical and Chemical nature of emissions**
  - **Sampling and measurement challenges**
  - **How particles evolve in the atmosphere**
- **Instruments**
  - **Overview of techniques available**
- **What are the Next Steps? What can we conclude?**
  - **Aim to produce a concise summary as meeting output**

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