Portable Emission Measurement Strategy

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EPA Mobile Source Present and Future Models Workshop

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Measuring Emissions in the Field

CAT Dozer D8R →

← CAT Scrapper 627B

Why In-Use?

- Cost-effective vs. lab measurements
- Can be 10 to 50 **x** less expensive
- Realistic data for assessment and modeling
- In-use compliance presence
- Transition toward in-use certification

Measuring Emissions in the Field

- **Portable emission measurement systems:**
  - Allows us to bring the lab to the car or engine and test it on the road or in the field under normal operating conditions
  - Frees us from the few laboratories around the country
  - Expand our vehicle sampling and modeling capabilities
  - Reduced cost per vehicle tested
  - Advancement in new technology make it practical

PEMS: Design Features

- **Design Requirements**
  - Simple installation
    - Wide variety of vehicles
  - Unattended operation
    - Weather & tamper-proof
    - Low power consumption
    - Remote communication
  - Engine and emissions data
    - Fast-response sensors
    - Stand-alone flow measurement
    - Ambient conditions
    - Engine speed, temperatures, etc.

PEMS: Different Uses

- **On-Highway Sources**
  - LDVs, LDTs (for all emission standards)
  - LHDVs, MHDVs & HHDVs
  - HHDVs Not-To-Exceed (NTE) Consent Decree
- **Nonroad Sources**
  - Most engines/vehicles (> 25 Hp)
  - Electronic Controlled (EC) and non-EC engines
- **Activity Information (PAMS)**

EPA's Own History on Developing On-Vehicle Systems

- **EPA investigated and developed on-highway applications (i.e. ROVER)**
- **Continued development for on-highway heavy-duty applications through the HD Consent Decree (i.e. work done by WVU on MEMS and EPA)**
- **EPA continued development work for non-road applications (i.e. SPOT)**
- **EPA encourages continued advancements by industry in PEMS technology**

Technology Development

- **Goals**
  - Bring technology to market
  - Make accurate, accepted equipment that is readily available
  - EPA specified its needs so manufacturers can respond
- **Approach(s)**
  - Cooperative Research & Development Agreements (CRADA)
  - Small Business Innovative Research (SBIR) program
  - Development through OTAQ lab and contractor(s)
  - Work with experts in the field:
    - PEMS and sensor manufacturers
    - Vehicle and engine representatives
    - Universities

Sec-by-Sec Data

- **Where is this "sec-by-sec" Data?**
  - Data Generated by EPA
    - LDVs/LDTs/LHDVs/LHDTs/HHDVs (lab & in-use)
    - Tested 15 in-use Diesel Buses (in-use)
    - Tested 15 in-use LDVs/LDTs (in-use)
    - Tested 50 in-use nonroad vehicles (in-use)
  - Data Generated by Other Parties
    - Acquiring lab or in-use data
    - Reviewing data and documentation (including QA/QC) for potential use in developing a new model (MOVES).

2002-2003 PEMS Plans

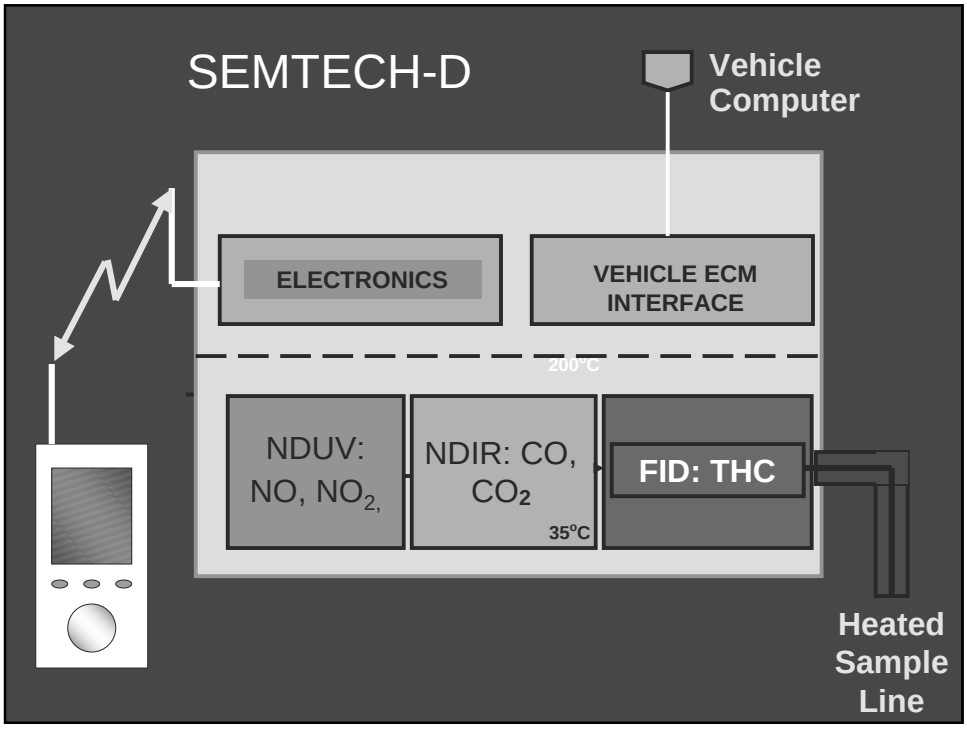
- **Acquire four commercially available systems to measure all gaseous regulated pollutants**
  - CO, CO_2, NO_x, HC
  - For gasoline and diesel (2 each)
- **Develop continuous PM *mass* measurement instruments for both laboratory and on-vehicle**
  - EPA is reviewing and testing with TEOM, PDM, & QCM
    - Includes proportional, partial-flow sampling research & sample conditioning
  - SwRI investigation of TEOM and QCM
    - Sampling from CVS

ON-ROAD, IN-USE DIESEL VEHICLE EMISSIONS ANALYZER (SEMTECH-D)

SEMTECH-D
(DIESEL VEHICLE ANALYZER)

Technologies employed:

- HC: Heated FID (200^{o}C)
- CO: NDIR (35^{o}C)
- CO_2: NDIR (35^{o}C)
- NO: NDUV (60^{o}C)
- NO_2: NDUV (60^{o}C)
- CPU: Pentium MMX
- Vehicle ECM Interface(s)
- Wireless Communications
- GPS



2002-2003 PEMS Plans

- **Evaluate PEMS systems against engine dyno, chassis dyno and in-use operations (gasoline & diesel)**
  - Accuracy
  - Durability
  - Sensivities
  - Interferences
  - Comparisons to laboratory test methods/operations

2002-2003 PEMS Plans

- **Develop procedures and methodologies including QA/QC for PEMS use by:**
  - Use EPA's resources to gather additional experience on in-use testing
    - Expertise
    - Equipment
  - Cooperative research programs that include funded test programs
  - Work w/ PEMS manufacturers on improvements
  - Work w/ industry (vehicle, engine) to develop test procedures

2003-2004 PEMS Plans

- **Kansas City PM Test Program**
  - To determine the % of the LDV population that are high emitters.
  - Use PEMS/PAMS to gather in-use information for both light-duty and nonroad vehicles.
  - Use continuous mass PM measurement devices (if available)

Questions ?