

**Diesel Aftertreatment
Accelerated Aging Cycle Development
(DAAAC)**

Based on EPA Final Rulemaking
for Emissions Durability Test Procedures
12/29/2005



SYMPOSIUM INTRODUCTION, JOHN MILLER

BACKGROUND (1)

- In 2000, EPA Issued a Comprehensive Update to the Certification Regulations for LD Vehicles and Trucks

**Compliance Assurance Program
(CAP 2000)**

- CAP 2000 Eliminated the Requirement for Use of the Approved Mileage Accumulation (AMA) Driving Schedule for Durability Demonstrations
- Manufacturers Required to Develop an Emission Durability Process, Approved by EPA.
 - Could be mileage accumulation or accelerated aging using bench engine



BACKGROUND (2)

- Ethyl Corp. Petitioned to Courts Claiming CAP 2000 Durability Provisions Unlawful as 'EPA had not promulgated methods and procedures for making tests by regulation as required by the Clean Air Act, section 206(d)'
- On 22 October 2002, The Court Found that CAP 2000 did not Satisfy CAA Section 206(d)
- Court Required EPA Establish Procedures 'by Regulation'



3

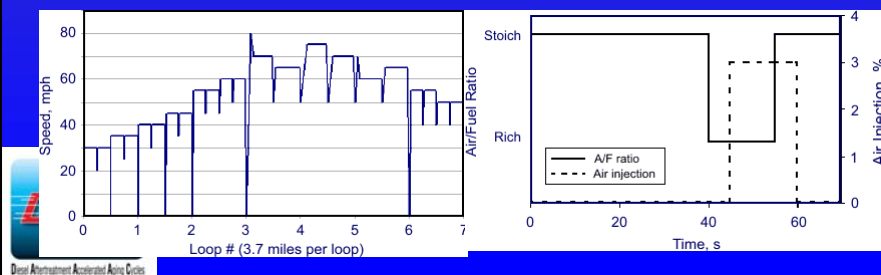
BACKGROUND (3)

- EPA Published its Final Rule for Emissions Durability Test Procedures on 12-29-2005
 - Applies to LD vehicles and trucks + some HD vehicles
 - Affects durability procedures of the vehicle certification program

A Standard Bench Cycle - SBC (Accelerated Aging Cycle)
Can be Used in Place of the Standard Road Cycle – SRC
(Mileage Accumulation) to Obtain Vehicle Certification

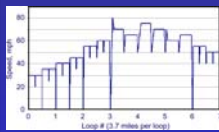
SRC

SBC



4

BACKGROUND (4)



Standard Road Cycle - SRC

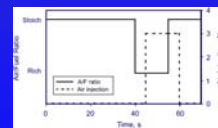
- 7-Laps, 3.7 miles each
- Average speed=46.3 mph
- Max cruise = 75 mph
- Light to hard accelerations
- No WOT-accelerations

Time = 108 days
Fuel @ 22 mpg ≈ 5455 gal.

Standard Bench Cycle - SBC

Time = 5 – 20 days
Fuel @ 4.5 gals/hr ≤ 488 gal.

- 1-minute cycle
- 4 modes
- Mode 1 – 40s stoich.
- Mode 2 – 4s rich
- Mode 3 – 10s rich + air
- Mode 4 – 6 s lean



5

BACKGROUND (5)

However:

- EPA Stated The SBC “Cannot be Effectively Used for Diesel-Fueled Vehicles”
- Volkswagen and Cummins Both Commented on the Prohibition in Writing
 - VW stated that the prohibition was “inappropriate”
 - VW and Cummins both asked for EPA approval of an “appropriate bench aging procedure for diesel vehicles which EPA would approve on a case-by-case basis”



6

BACKGROUND (6)

- EPA Responded:

- “VW’s and Cummins suggestion does not fulfill the Court’s mandate. Nor does it fulfill the Clean Air Act requirement.....”
- “The comments did not suggest a bench aging procedure that was effective for diesel vehicles”

But:

- “At a later date, EPA may choose to propose regulations providing bench aging procedures applicable to diesel-fueled vehicles”
- Note: Even if EPA does not write DAAAC into law, it will still be extremely useful to industry



7

WHAT IT MEANS

- Accelerated Aging Cycles on Bench Engines May be Used for Gasoline-Fueled Vehicles, Saving Time and Money
- Accelerated Aging Cycles May NOT be Used for Diesel-Fueled Vehicles
 - Diesel vehicles must undergo full 120,000 miles driving the SRC
- If Industry Can Develop a Bench Engine Accelerated Aging Cycle that EPA Accepts, EPA May be Willing to Write it into the Future Regulations

8

BENEFITS OF A DAAAC

- **SwRI Believes there is Value in Developing a Diesel Aftertreatment Accelerated Aging Cycle (DAAAC)**
 - To address common need for aging cycle procedures
 - To reduce aging time by ~ 90% and fuel use by ~ 90%
 - For inclusion in future EPA vehicle certification regulation

9

SYMPOSIUM

- **The DAAAC Symposium Provides a Forum for Those Interested in Developing a DAAAC to:**
 - Show their interest by their presence
 - Share their experiences and understanding of diesel aftertreatment deactivation mechanisms and methods of accelerating aging
 - Express their opinions and concerns
 - Begin the process of a unified, visible effort to develop a DAAAC



10

SYMPOSIUM ATTENDEES

● 40 Companies / Organizations:

| | | | |
|-------------------|--------------------|------------|-------------|
| BMW | Caterpillar | Chrysler | Cummins |
| DAF Trucks | Ford | GM | Honda |
| Hyundai | International | John Deere | Komatsu |
| MAN Diesel | MTU Detroit Diesel | | Mitsubishi |
| PACCAR | PSA | Scania | Toyota |
| Volvo Pwt/Renault | | | |
| | | | |
| BASF | Cataler | Corning | Continental |
| Dayco ENSA | Dow | Eaton | Emitec |
| EPA | GE Global R. | Honeywell | HiLite |
| Johnson Matthey | Lubrizol | MECA | MIT |
| NGK | Ono Sokki | PRI | Umicore |



11

SYMPOSIUM AGENDA

| | |
|------------|--|
| 8:00 a.m. | Coffee & Pastries |
| 8:30 a.m. | <i>Welcome</i> by Bruce Bykowski, Ex. Director, SwRI |
| 8:40 a.m. | <i>DAAAC Symposium Introduction</i> – John Miller, SwRI |
| 9:00 a.m. | <i>Overview of Diesel Powertrain Emission Control Systems</i> – Magdi Khair, SwRI |
| 9:30 a.m. | <i>Diesel Catalyst Aging: Findings from Engine and Vehicle Testing</i> – John Yan, Eaton |
| 10:00 a.m. | Break |
| 10:15 a.m. | <i>DOCs and LNCs</i> – Dr. Gordon Bartley, SwRI |
| 10:45 a.m. | <i>LNT Durability with In-Cylinder Rich Combustion without Post Injection</i> – Gary Neely, SwRI |
| 11:05 a.m. | <i>DPF Durability</i> – Dr. Reggie Zhan, SwRI |
| 11:45 a.m. | Lunch |
| 12:15 p.m. | <i>Accelerated Oil Ash Accumulation Methodology</i> – Dr. Gordon Bartley, SwRI |
| 12:45 p.m. | <i>Title - ??, Cummins</i> |
| 1:15 p.m. | <i>Zeolite SCR Aging Modes</i> – Dr. Theodore Kostek |
| 1:55 p.m. | <i>DAAAC Consortium Proposal</i> – Dr. Gordon Bartley, SwRI |
| 2:15 p.m. | Break |
| 2:30 p.m. | Open Discussion |
| 3:50 p.m. | Closing Statements |
| 4:00 p.m. | Close |



12