Information About the Diesel Emission Control – Sulfur Effects (DECSE) Program

Background. Diesel engines, also called compression ignition (CI) engines, are used to power most heavy vehicles as well as some light trucks, mini vans, and sport utility vehicles (SUVs). More stringent federal engine exhaust emissions standards for all trucks and SUVs weighing more than 8,500 pounds (heavy-duty vehicles) are to be implemented in 2004. These standards require exhaust from diesel trucks to be 40 percent cleaner than 1999 models.

In addition, by late 1999 or early 2000, the U.S. Environmental Protection Agency (U.S. EPA) expects to propose even more stringent emissions standards that could take effect as early as 2007. These standards could require reductions in emissions of 75 to 90 percent of nitrogen oxides (NO_x) and 80 to 90 percent of particulate matter (PM).

To encourage the development of new emissions control technologies, EPA is also planning to propose reducing the maximum sulfur content of highway diesel fuel by approximately 90 percent of the current level of 500 parts per million (ppm).

DECSE. To address this challenge, the U.S. Department of Energy (DOE), two national laboratories, and manufacturers of diesel engines and exhaust emissions control systems are collaborating in the Diesel Emission Control-Sulfur Effects (DECSE) test program.

Objective. The objective of DECSE is to determine the impact of fuel sulfur levels on emissions control systems that could be implemented to lower emissions of NO_x and PM from diesel engine vehicles in the years 2002 to 2004. Diesel fuel sulfur is known to adversely affect the operation of diesel exhaust emissions control systems.

Initially, DECSE will identify the effects of various levels of sulfur in diesel fuel on the operation of exhaust emissions control systems (see Table 1). Tests are being conducted and data collected and analyzed for various combinations of fuel sulfur levels, engines, and exhaust emissions control systems. The targeted fuel sulfur levels are: 3 ppm, 30 ppm, 150 ppm, and 350 ppm. During each test, the diesel engine operates for 250 hours (or more) to detect any decline in performance.

To expedite development of the new technologies, data from the program will be made available to the public in interim reports. Three reports on test results through November 5, 1999, have been issued: No. 1, August 1999, diesel oxidation catalyst, lean-NO_x catalyst, and diesel particle filter; No. 2, October 1999, NO_x adsorbers; and No. 3, November 1999, particulate matter. The data will fill a critical void in the publicly available technical information needed for future research and

Table 1. Summary of Phase 1 Experimental Design

TECHNOLOGY	250 hours aging at various fuel sulfur levels (ppm): 3 / 30 / 150 / 350 / 30*	Evaluation: 3 / 30 / 150 / 350 / 30*	ENGINE	REMARKS
Diesel Oxidation Catalyst	Special Navistar aging cycle	Navistar 9-mode & simulated FTP-75	T-444E (Navistar)	High precious metal loading
Diesel Oxidation Catalyst	Modified OICA** aging cycle	Stabilized OICA & heavy-duty FTP	ISM 370 (Cummins)	Low precious metal loading
Active Lean-NO_x Catalyst	Special Navistar aging cycle	Navistar 9 mode	T444E	Low temp. catalyst
Active Lean-NO_x Catalyst	Modified OICA aging cycle	Stabilized OICA	ISM 370	High temp. catalyst
CR-DPF and CDPF***	No aging test, used special tests to determine regeneration temperatures and emissions	Steady-state exhaust temperature tests & stabilized OICA	3126 (Caterpillar)	Determine sulfur effect on regen. temp.
NO_x Adsorber	3 / 16**** / 30: 3-hour aging cycle using 9 temperature points in sequence	3 / 16**** / 30: NO_x conversion every 50 hours	HSDI (Daimler-Chrysler DDC prototype)	150- and 350-ppm fuel not used based on initial results on lower sulfur levels.

* Recovery experiment.
** A test cycle developed during European work; OICA is the International Organization of Motor Vehicle Manufacturers
*** Continuously Regenerating Diesel Particulate Filters (CR-DPF) and Catalyzed Diesel Particulate Filters (CDPF)
**** 16-ppm sulfur fuel added to test matrix after 3- and 30-ppm fuel tests were completed.

development on emissions control technology options.

Program leaders. DECSE includes representatives from the DOE's Office of Heavy Vehicle Technologies within the Office of Transportation Technologies (OTT), the National Renewable Energy Laboratory (NREL), Oak Ridge National Laboratory (ORNL), and members of the Engine Manufacturers Association (EMA), the Manufacturers of Emission Controls Association (MECA), and EPA.

Test program. There are four principal emissions control technologies being tested by DECSE:
The schedule for the first phase of testing, shown in Table 2, will provide results in late 1999.
The test program is being governed by the DECSE Steering Committee and several technical committees (see Figure 1).

Table 2. DECSE Program Schedule

Task	Start	Finish
Program design	9/98	1/99
Test engines selected, delivered	12/98	4/99
Emissions control systems selected, delivered	9/98	4/99
Test fuels, lubricants, delivered	1/99	5/99
Contract with testing laboratories	12/98	2/99
Conduct tests		
Particle trap/filter	4/99	12/99
NO_x adsorber catalyst	5/99	12/99-2/01
Lean NO_x catalyst	5/99	04/00
Diesel oxidation catalyst	5/99	04/00
Interim test reports available	10/99	11/99
Final test reports available	TBD	TBD

DECSE funding. Funding for phase 1 of the DECSE program includes about $1.8 million in direct funding and $1.6 million in in-kind contributions. The in-kind contributions include engine and emissions control hardware and engineering planning and technical support (Table 3).

Table 3. DECSE Resources

	Government	Industry	Total
Direct Funding	$1,500,000	$310,000	$1,810,000
In-Kind Contributions	$400,000	$1,200,000	$1,600,000
Total	$1,900,000	$1,510,000	$3,410,000

Phase 2 of DECSE is being planned. Representatives of oil and additive industries are participating in discussions about Phase 2's design.

For further information:

Visit the DECSE website:
http://www.ott.doe.gov/decse

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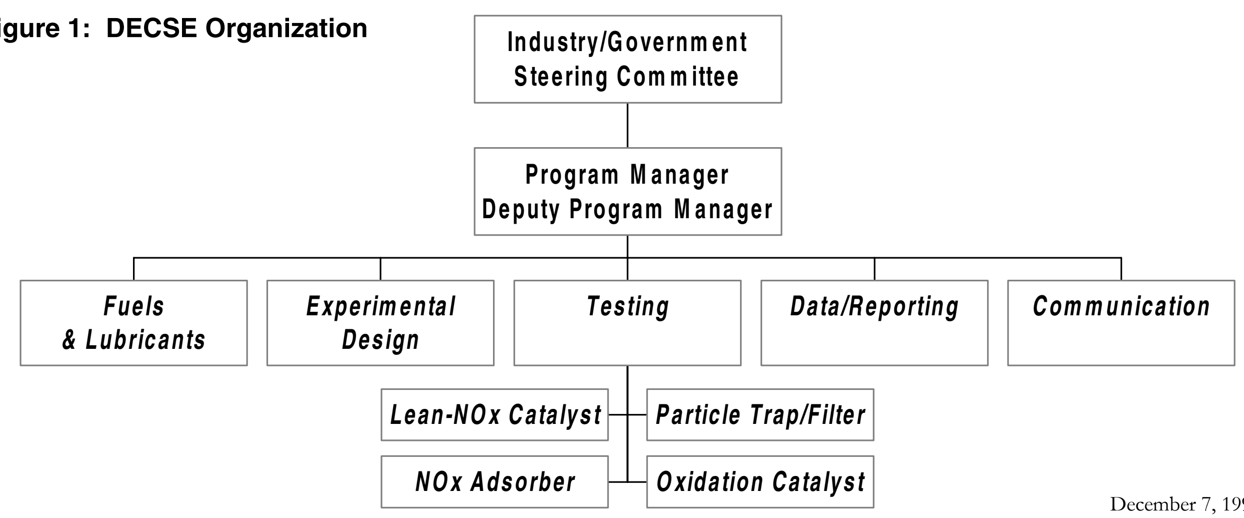
Figure 1: DECSE Organization



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