



MARCH 29, 2001

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**TO: BOARD OF DIRECTORS**

**FROM: THOMAS K. CONNER  
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**SUBJECT: STATUS OF EC DIESEL TEST PROGRAM**

**ISSUE**

This report provides a status update to a motion approved by the Board at the May 25, 2000 meeting, which directed that:

- a) Within 30 days, staff initiates an expansion of the existing ultra low sulfur diesel fuel (EC Diesel) test program to evaluate the installation of continuously regenerating traps (CRT's) or other similar particulate filters on ten methanol conversion buses.
- b) That upon successful completion in February 2001 of the low sulfur diesel fuel (EC Diesel) test program currently underway at the Arthur Winston Division, staff be directed to initiate a program to install CRT's or other similar particulate filters by February 2002 on the entire remaining diesel fleet projected to remain in service after January 2003.
- c) Staff provides status reports to the Board on a quarterly basis on the ultra low sulfur diesel test program.

**DISCUSSION**

In February 2000, the MTA began a one-year test to identify emissions benefits and reliability issues of using low sulfur fuel in diesel transit buses. The test was conducted at the Arthur Winston Division on twenty 1998 New Flyer diesel buses. Of these buses, twelve buses operated on EC Diesel and a control group of eight buses operated on standard #2 diesel fuel. Two buses operating on EC Diesel were also equipped with exhaust after-treatment devices called continuously regenerating traps (CRT's).

The California Air Resources Board (CARB) has mandated use of low sulfur diesel fuel for transit buses in 2002 and will require transit agencies to begin retrofitting older diesel buses with CRT's or other similar after-treatment devices by 2003 to lower particulate matter (PM) emissions.

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At the May 25 Board meeting, a motion was approved to initiate an expansion of the existing EC Diesel test program to evaluate the installation of CRT's or other similar particulate filters on ten methanol conversion buses. In response to the Board's direction, staff has developed and begun implementation of a comprehensive test program to evaluate the performance and reliability of particulate filters on the 2-cycle, Detroit Diesel 6V-92 engines used on the methanol conversion buses.

**STATUS OF EXPANDED TEST PROGRAM**

The following status update will discuss both the favorable results of the particulate filters installed on the 1998 New Flyer buses with 4-cycle engines and problems that the manufacturers of particulate filters are having with the retrofitting of older buses with 2-cycle engines.

**1998 New Flyer Buses** – The original EC Diesel program that evaluated the use of particulate filters on newer 1998 model year buses with 4-cycle engines has had very favorable results. In December 2000, staff completed the evaluation of the vehicle reliability phase of the program. A review of the maintenance records of the test buses operating on standard CARB diesel fuel and EC Diesel fuel revealed no discernable difference in the reliability between buses operating on low sulfur diesel fuel and standard diesel fuel. The particulate filters on the test buses have also proved to be very reliable with no failures recorded during nearly one full year of in-service field-testing.

Emissions tests on the EC Diesel buses are being conducted in two phases. The initial tests were conducted about 2 - 3 weeks after installation of the particulate filters and showed a reduction of approximately 80 percent in PM emissions. A final series of emissions tests are scheduled to occur in April 2001 to identify any potential degradation of the exhaust after treatment after a year of in-service operation.

**Buses with 2-Cycle Engines** – Both manufacturers of particulate traps, Johnson Matthey and Engelhard, have encountered delays in the development of particulate filters for older diesel buses with 2-cycle engines, which have further delayed the MTA test program and the plan to install particulate filters on the remainder of the diesel bus fleet. Johnson Matthey has reported that initial projections of in-use particulate matter emissions for buses with 2-cycle engines are not supported by the results from recent field tests. The higher level of particulate matter emissions in these tests has caused concern that the particulate filter, as originally designed, is susceptible to becoming plugged which will increase exhaust back pressure and could damage the 2-cycle engines.

To determine emission levels under typical operating conditions and to define the minimum particulate filter sizing requirements, Johnson Matthey is conducting emissions tests on Detroit

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Diesel 6V-92, 2-cycle engines, which are currently used in most older transit buses. In addition, MTA staff completed in-use emissions tests on a TMC bus with a Detroit Diesel 6V-92, 2-cycle engine on a chassis dynamometer in February 2001. The results of the engine and chassis emissions tests are expected to provide the information required to complete the development of the prototype particulate filters.

Engelhard has encountered similar obstacles in their development of a particulate filter for the Detroit Diesel 6V-92 engines. Engelhard had originally proposed the installation of a particulate filter within the confines of the existing muffler; however, the size of the mufflers currently installed on these buses would result in restricted exhaust flow and increased exhaust back pressure similar to the problem identified by Johnson Matthey. To provide sufficient exhaust flow, Engelhard is evaluating two new designs for their particulate filter. The first design would utilize the existing exhaust system hardware but is likely to be expensive due to limited demand for this application. The second system would use a common filter used in other vehicles but would require modification of the bus exhaust system.

The diesel fleet as of January 2003 will consist of approximately 330 buses equipped with 2-cycle engines and 20 buses equipped with 4-cycle engines. Due to delays in the development of particulate filters for buses equipped with 2-cycle engines, the installation of particulate filters on these buses will be delayed by several months. The reliability of the particulate filters on buses with 2-cycle engines must be proven before installation on the remainder of this fleet.

Due to the successful testing of particulate filters on buses with 4-cycle engines, staff will begin preparing for the installation of particulate filters on the remaining eighteen buses with 4-cycle engines that are projected to remain in service as of January 2003. The existing procurement of low sulfur diesel fuel will be increased to account for the additional fuel required to operate the eighteen buses, and the low sulfur diesel program will be expanded to include Division 6. Staff will also initiate a procurement for the eighteen particulate filters that will be installed on the remaining 1998 New Flyer diesel buses.

**NEXT STEPS**

During the next quarter, staff will continue to work with Johnson Matthey and Engelhard to finalize their particulate filter designs and to install the first prototype particulate filters on the TMC buses with 2-cycle engines. Once this is accomplished, the first two buses will be tested for a period of one month to ensure that exhaust system back-pressure remains within the limits specified by the engine manufacturer. If the test results are favorable, each manufacturer will provide four additional particulate filters for installation on eight methanol conversion buses. The ten buses with particulate filters will be tested for a period of six months to ensure the durability of the particulate filters prior to expanded use on the remainder of the diesel fleet.

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