OCTCET 35

Case Study

DALLAS COUNTY SCHOOLS

Dallas County Schools

OCTCET35

CONTENTS

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Serial number 85893483
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Dallas County Schools

BACKGROUND

Dallas County Schools (DCS) was the original school district in Dallas County. DCS is a county school district that, in response for the need for support services for other school districts, began providing transportation services in 1927.

As the needs of School Districts and other Governmental entities expand and change, DCS develops and implements economical, efficient, effective solutions at the same time, maximize resources and improve efficiency.

As of 2016-2017 school year, DCS will be providing transportation services to 12 school districts in North Texas. The DCS Transportation Team consists of more than 2,500 professionals providing various services to approximately 425,000 students within Dallas County and throughout the State. DCS has been recognized as the fourth largest pupil transportation organization in the country.

Providing safe and reliable transportation to over 75,000 students that are transferred to and from school each day is, and will continue to be, a paramount goal for DCS. In addition, DCS constantly seeks new means and methods to contribute to a cleaner environment by reducing the amount of pollution in the air through various programs, initiatives, services and products.

DCS received an “Honorable Mention” for the 100 best fleets in North America in 2010 as well as a Certificate of Excellence for Financial Reporting. DCS also received an Environmental Excellence Award from the Mayoral of the City of Dallas (MEEA) in 2009.

FLEET INFORMATION

Number of service centers:	12
Number of diesel buses:	1,434
Number of routes:	1,489
Type of buses:	Chev Vortec V8, Chev 6.6L, Ford 5.4L, Cummins ISB260H, Cummins ISB280H, Cummins ISC, Cummins ISL05, Cummins ISL07, Cummins ISL10, Cummins ISL-G, Cummins ISL, Cummins ISX1DDC S50, DDCS60 and Mercedes Benz.
Average age of fleet:	9 years
Distance travelled per year:	36 million miles

OBJECTIVE OF THE PRACTICAL ON-ROAD TEST

To determine if OCTCT35 treated diesel (a treatment ratio of 1:400, that is one gallon of OCTCET35 with 400 gallons of diesel), will:

- Reduce maintenance cost.
- Bring about mechanical benefits.
- Improve fuel economy.
- Reduce running expenses.

TESTING AND IMPLEMENTATION PHASES

These activities can be divided into three phases:

Phase 1:	Initial Testing Phase
Phase 2:	Initial Implementation Phase
Phase 3:	Additional Testing Phase

Phase 1: Establishing of the baseline (based on historical data)

Period:	May - October 2014
Service centers:	Irving and Carrollton
	Farmers Branch
Number of buses:	450
Baseline (MPG for this fleet):	6.04
Distance travelled during baseline period:	12,093,400 miles
Gallons used during the baseline period:	2,002,219
Cetane number of diesel fuel:	44
Introduction of OCTCET35 treated diesel:	November 2014 -
	December 2015
Service centers:	Irving and Carrollton
Farmers Branch	
Number of buses:	450
Distance travelled with OCTCET35 treated diesel:	
	12,523,500 million miles
Improvement in fuel economy:	7.12%
Gallons used during the testing period:	1,923,725
Savings in diesel gallons for the period:	136,969
MPGs with OCTCET35 treated diesel:	5.49 (Worst result)
	6.91 (Best result)
	6.47 (Average result)








Results measured and tendencies observed:

Varied from bus to bus and were influenced by type, model and age of bus, distance travelled, routes used, climate (daily temperature), and driver behaviour.

Based on the average increase in fuel efficiency achieved during this year long test, supported by the results received from scientific lab tests and independent practical tests, DCS decided to implement OCTCET35 treated diesel into an additional 600+ buses. It was further observed that buses who travelled longer distances, showed a higher percentage in fuel efficiency – the longer the treated diesel was used, the better the fuel economy.

Phase 2: Initial Implementation Phase

Period:	January 2016 onwards
Number of buses:	1,056
Treatment of fuel with OCTCET35:	When fuel is delivered at all service centers.
Distance travelled with OCTCET35 treated diesel (January - October):	21,373,440 miles (From January – October).
Estimated gallons saved for the period:	235,207

Phase 3: Additional Testing Phase

Because of several positive outcomes measured, observed and experienced during the initial implementation phase, DCS decided to do a practical on-road test in one of their pick-up trucks to see if a more sophisticated diesel engine will benefit from OCTCET35 treated diesel.

In September, a 2016 GMC (Chevrolet) 3,500 HD truck, with 4,800 miles on the odometer, that uses the latest direct-injection (DI) technology, was chosen for this purpose. This technology was developed to ensure diesel engines run quieter and more efficient. It also changed the conventional way fuel enters the engine. However, this design facilitates carbon build-up in the engine's intake EGR valves and EGR coolers. When carbon builds up in the engine, it causes several problems, but noticeably, a loss of power. Carbon






build-up also has a negative impact on the ratio of fuel-to-air in the engine.

The specific purpose of the EGR Valves in these engines, is to regulate how much exhaust gases are re-circulated. Carbon deposits build up in and around the valves and prevent the opening and closing of the valve's operation. Worst case, the valve can become stuck, losing all functionality. If the ratio of fuel-to-air is not in balance, carbon will accumulate more quickly and impact engine performance, reliability, and cause the engine to regenerate more frequently. Carbon build-up also impacts fuel efficiency negatively.

Usually the initial symptoms of the clogging of an EGR Valve is a loss of power and poor fuel economy. Eventually the EGR valve, ERG cooler and DPF will stop functioning properly. It will face-plug the DFP, the carbon build-up saturation will be accelerated, and will cause excessively high emissions and frequent regenerations.

A diesel with a higher cetane number and oxygen content, such as OCTCET35 treated diesel, that combusts quicker and more complete, will limit and reduce carbon build-up in the engine and emissions significantly.

To allow any engine to perform at optimal combustion ranges to provide peak power and reduce heat rejection on engine components, the quality of diesel fuel is very important. When there is reduced or no carbon build-up, the diesel particulate filter (DPF) extends its regeneration intervals or cycles. This will lead to greater reliability, improved durability, lower life cycle and maintenance costs.

The regeneration of diesel filters is characterized by a balance between the soot being captured and the soot being oxidized in the

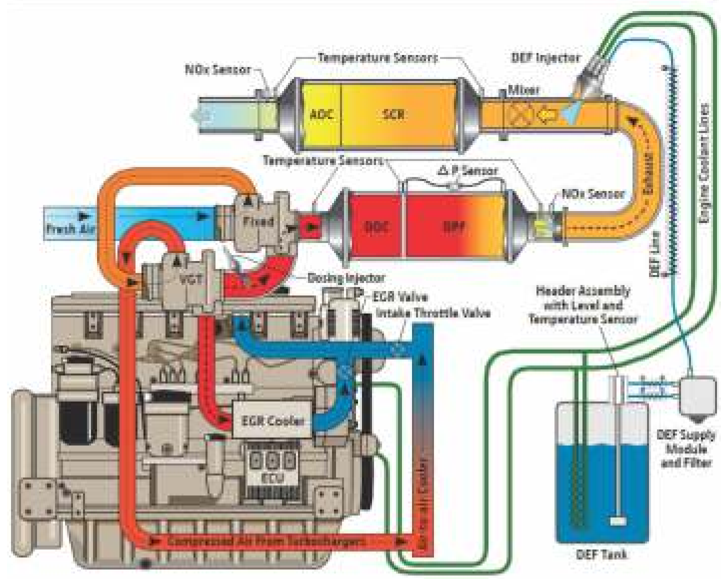
filter. Soot oxidation rates depend on the filter temperature, soot load in the filter, as well as number of other factors.

The purpose of the EGR (Engine Gas Re-circulation) system is to reduce nitrogen oxide (NOx) emissions that primarily form when nitrogen and oxygen is subject to high heat and pressure. All modern diesel engines require EGR, DPF and SCR systems to meet emissions regulations. These systems are designed to re-circulate exhaust gases back into the intake system which reduces O2 in the diesel engine's intake stream. These gases have little or no ability to react to the second combustion cycle they are subjected too, which helps reduce combustion heat and in-cylinder temperatures.

Re-circulated exhaust gases contain carbon, unspent fuel (including varnishes) and oil vapor, which gradually accumulates and bonds as carbon particles inside the inlet and re-circulatory system - especially on and around the valve itself. This leads to numerous engine problems, and worst-case, even engine failure because of the carbon build-up.

Outcomes and results: Reduction in regeneration cycles

Since the introduction of OCTCET35 treated diesel into this pick-up truck, DCS experienced a reduction in regeneration cycles or intervals. Normal intervals were recorded between on average between every 500 – 600 miles. After 1,650 miles with OCTCET35 treated diesel, the intervals were extended to between 2,200 and 2,300 miles. An improvement of more than 400%. This, as per the above explanation, implies a reduction in the carbon build-up that contributes to improved functionality of the EGR valves.

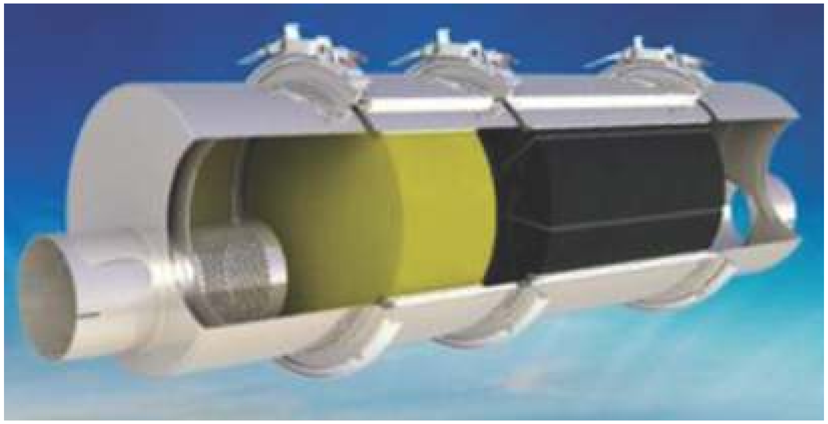


Outcomes and results: Fuel economy

OCTCET35 treated diesel fuel also positively impacted the fuel to air intake ratio, as DCS measured a significant improvement in fuel economy, and experienced improved engine performance.

A baseline, using untreated ULSD diesel available at any gas station, was established over a distance of 384 miles traveling a specific route and time of day. At an average speed of 68 miles per hour, the MPG for this trip was 9.4 miles per gallon as 40.9 gallons of diesel were used.

When OCTCET35 treated diesel was used, the truck travelled the same distance at the same speed, followed the same route, at the same time of day. The same person drove the truck when the baseline was established and when OCTCET35 treated diesel was used. The MPG for this trip with the treated fuel was 10.9 miles as only 35.2 gallons of diesel was used. This measures a savings of 15.96% over this short distance.



Outcomes and results: SCR Systems and Particulate Screen Filters

Several buses and other vehicles in the DCS fleet are fitted with Selective Catalytic Reduction (SCR) systems. The SCRs installed include the 2010 ISB, and ISC/L CM2250 SCR systems.

The SCR converts Nitrogen Oxides (NOx) with the aid of a catalyst into Diatomic Nitrogen (N2), and water (H2O). SCR systems are sensitive to contamination and plugging resulting from normal operation or abnormal events. Many SCRs fail prematurely due to known amounts of contaminants in the untreated diesel. According to DCS, SCR failures and/or repairs, are caused by an over dosage of urea or DEF fluid that is dosed into to the reactor. This is the last after treatment stage before the exhaust goes out the tail pipe).

DEF will crystalize in the SCR when the reactor over doses because of poor fuel combustion and high NOx output. A quicker, more complete and cleaner combustion fuel means less NOx is introduced into the SCR system. Literally, SCR failures have stopped all together since the introduction of OCTCET35 into our diesel, as it facilitates a cleaner and improved combustion.

DCS also uses Particulate Screen Filters from DURAFIT CDTi, and have not experienced any failures.

SYNOPSIS

The following benefits and positive outcomes were experienced by DCS:

- Improvement in efficiency and reliability.
- Reduction in failures.
- Extension of maintenance intervals and cycles.
- Increase in performance.
- Reduction in cost and expenses.

Dr. Rick D. Sorrells
Superintendent

Paul Jacobs
Senior Fleet Manager

"Our buses have traveled a distance of more than 34 million miles with OCTCET35 treated diesel fuel. We have experienced an improvement in efficiency, a reduction in failures,a decrease in maintenance cycles as well as an improvement in performance. We observed no side effects and all these benefits contribute to reduced operational expenses and financial savings."