AFD-6550 X-1R Diesel System Treatment

MULTI-FUNCTIONAL PREMIUM DIESEL CONCENTRATE

PERFORMANCE FEATURES

- KEEPS INJECTORS CLEAN
- SUPERIOR PERFORMANCE IN THE CUMMINS L-10 INJECTOR DEPOSIT TEST. CRC RATING < 10
- REMOVES DEPOSITS THAT DETERIORATE FUEL ECONOMY AND EMISSIONS
- PASSES CLASS 8 TRUCK FUEL FILTER PLUGGING TEST
- ENHANCES THERMAL STABILITY
- ENHANCES FUEL STABILITY DURING STORAGE
- INCREASES CETANE BY 2 OR MORE NUMBERS
- INREASES LUBRICITY TO PROTECT AGAINST PUMP & INJECTOR WEAR
- CONTAINS DEMULSIFIERS FOR WATER INTERACTION CONTROL
- MEETS OR EXCEEDS THE JOINT EMA/TMC PUMP GRADE SPECIFICATION FOR DETERGENCY AND ACCELERATED THERMAL STABILITY
- MEETS OR EXCEEDS THE NCWM PREMIUM DIESEL FUEL SPECIFICATIONS FOR INJECTOR CLANLINESS AND THERMAL STABILITY
- MEETS OR EXCEEDS CUMMINS CES 60032 REQUIREMENTS

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CUMMINS L-10 TEST PROCEDURE:

- Using a 1990 Cummins L-10 engine, the procedure was designed to simulate the severe injector carbonizing problems that were first experienced in 1988 L-10 and NT engines. This field problem caused engines to lose as much as 15% of their maximum power in as little as 40,000 miles. The test cycle is as follows:

Step	Time	RPM	Load
1	15 sec.	2300	55-65 FHP
2	15 sec.	2300	Closed throttle motoring
3	Repeat steps 1 and 2 for a total of 125 hours		

- To pass the L-10 test requires a CRC rating of the plunger of less than 10 and an average injector flow loss of less than 6%.

L-10 TEST ENGINE

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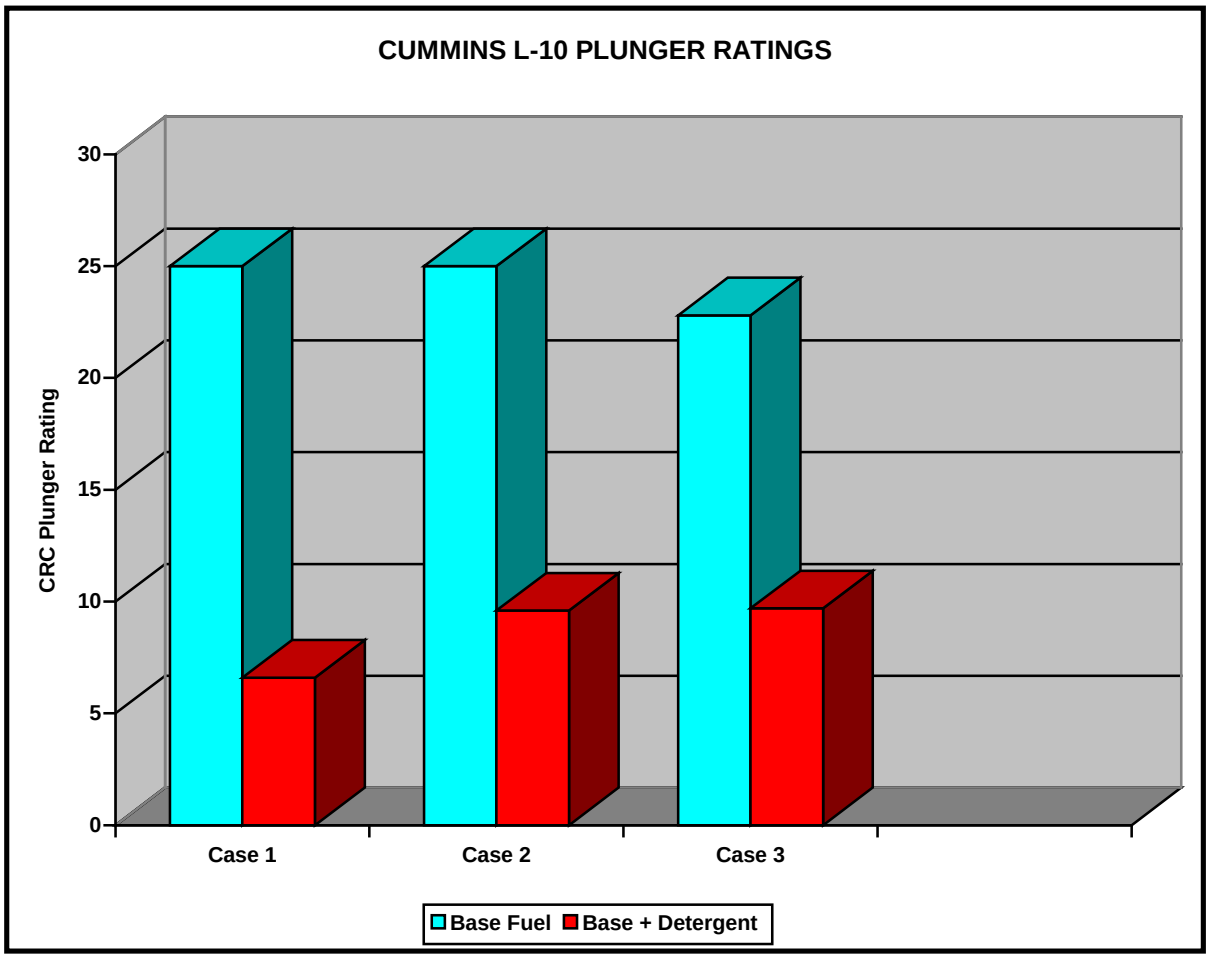
CUMMINS L-10 TEST RESULTS



- BASE FUEL WAS CAT 1K REFERENCE FUEL
- CASE 1: FRONT ENGINE: ADDITIVE CONCENTRATION WAS 126 PPMV
- CASE 2: FRONT ENGINE: ADDITIVE CONCENTRATION WAS 113 PPMV
- CASE 3: REAR ENGINE: ADDITIVE CONCENTRATION WAS 333 PPMV
- A PLUNGER RATING OF LESS THAN 10 IS A “PASS”

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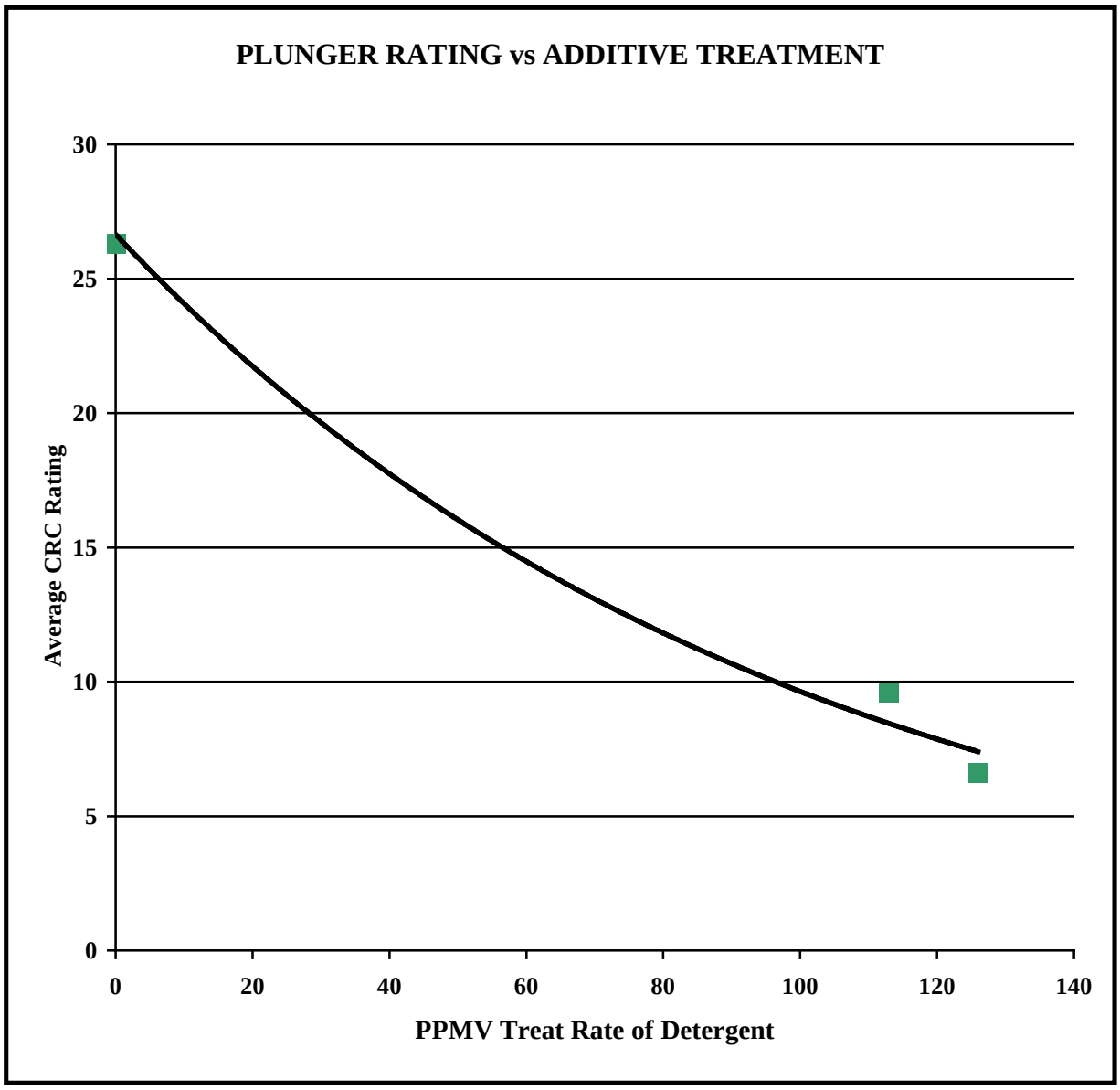
CUMMINS L-10 RESPONSE TO TREAT RATE



- THE FUEL USED IN THESE TESTS WAS THE CATERPILLAR 1K REFERENCE FUEL

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MULTI-FUNCTIONAL PREMIUM DIESEL CONCENTRATE

CUMMINS L-10 INJECTOR PLUNGER

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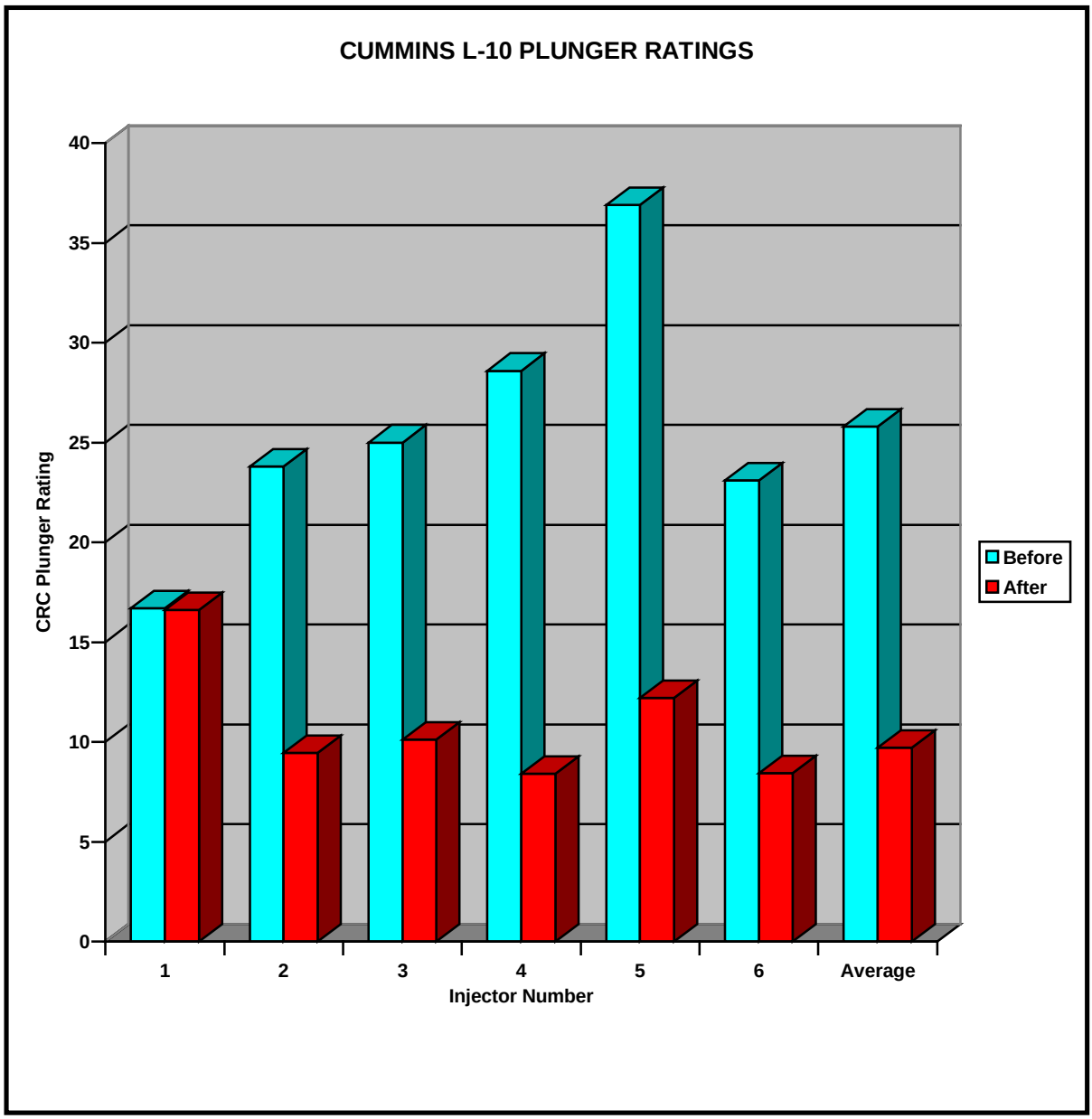
CUMMINS L-10 DETERGENCY – 125-HOUR CLEAN UP RESULTS



- TREATMENT RATE OF DETERGENT WAS 400 PPMV

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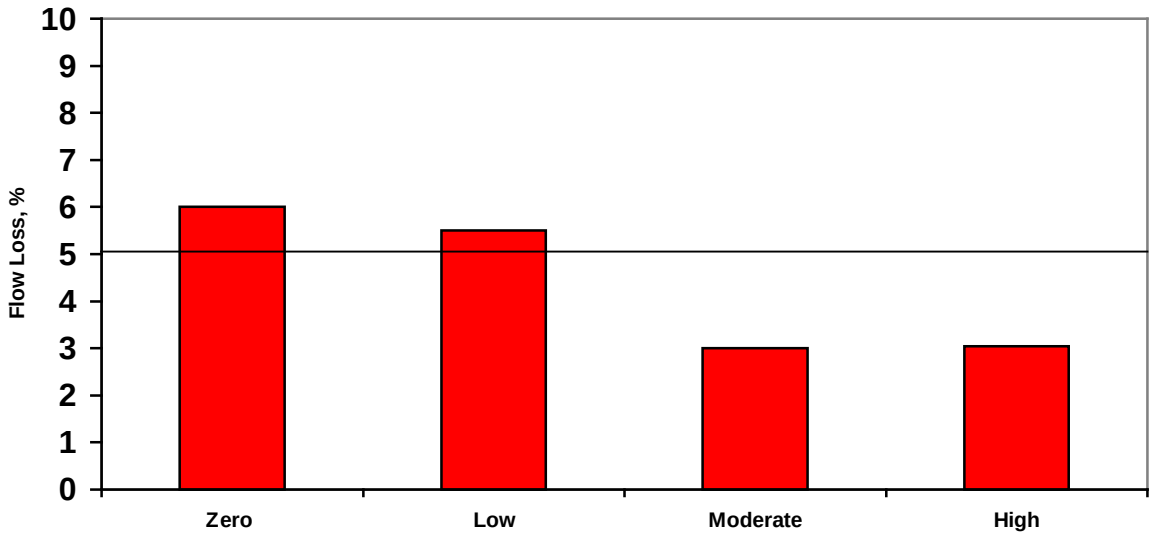
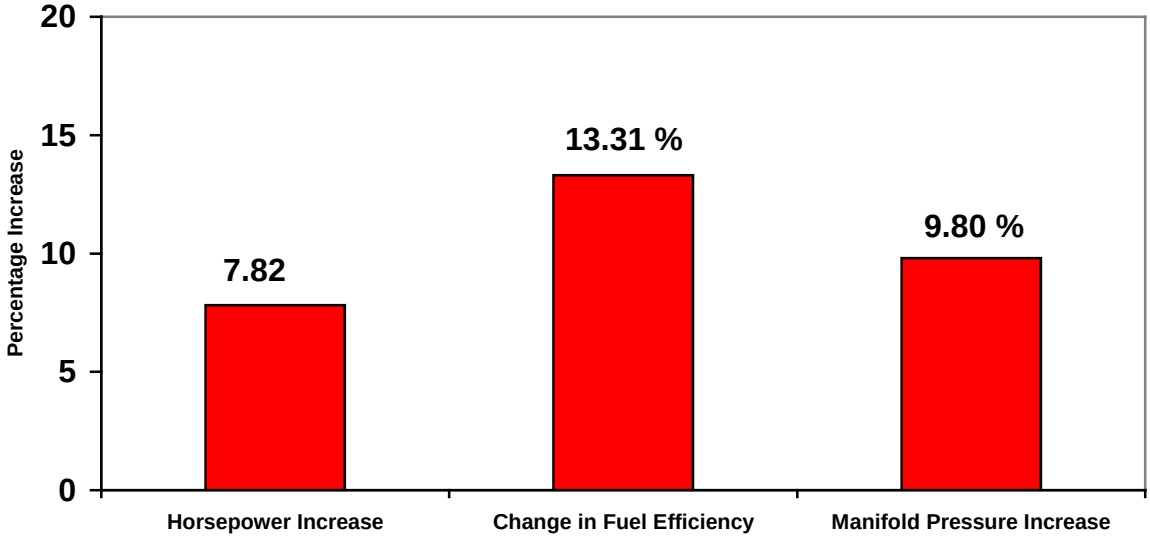
FUEL ECONOMY – INJECTOR FLOW LOSS IN CUMMINS L-10 ENGINE TESTS



FUEL ECONOMY – BRAKE SPECIFIC FUEL CONSUMPTION



- TREAT RATE OF DETERGENT WAS 400 PPMV

MULTI-FUNCTIONAL PREMIUM DIESEL CONCENTRATE

LONG TERM ADDITIVE TREATMENT EFFECTS

- A 3-YEAR PROGRAM INVOLVING NINE DIESEL VEHICLES WAS CONDUCTED TO QUANTIFY VEHICLE EMSSION PERFORMANCES.

- THE OBJECTIVE WAS TO EVALUATE THE ABILITY OF THE PRODUCT TO:

    - CONTROL EXAUST EMISSIONS
    - IMPROVE FUEL CONSUMPTION

- A FLEET OF FOUR SMALL DIESEL PASSENGER CARS AND FOUR HEAVY DUTY TRUCKS WAS SELECTED

- TEST PROTOCOL:

A. HEAVY DUTY DI VEHICLES: FOUR TRUCKS WITH CUMMINS ENGINES WERE DRIVEN ON ROAD. TWO OF THEM WERE OPERATED WITH EUROPEAN COMMERCIAL DIESEL FUEL AND OTHERS WITH SAME FUEL BUT INCLUDING THE DETERGENT ADDITIVE AT THE SELECTED CONCENTRATION. THE TYPE ONE TRUCKS WERE BRAND NEW AND TYPE-II TRUCKS WERE TWO YEARS OLD WITH NEW REPLACEMENT INJECTORS. THE TRUCKS TRAVELLED A COMBINED DISTANCE OF 450,000 KM.

B. LIGHT DUTY PEUGEOT: TWO NEW MATCHED PEUGEOT 306 1.9 LITRE IDI DIESEL PAASENGER VEHICLES WERE RUN FOR 1000 KM USING A STANDARD DIESEL FUEL. THE CARS WERE THEN TRACK TESTED TO ENABLE A ROA LOAD POWER CURVE TO BE OBTAINED FROM THE COAST-DOWN TIMES TO ENSURE ACCURATE SETTING OF TEST DYNAMOMETERS. THIS PROCEDURE WAS REPEATED WITH THE VEHICLES FULLY LADEN. NEW FLOWED AND MATCHED INJECTORS WERE INTRODUCED TO BOTH ENGINES AND THESE REMAINED WITH THE SAME VEHICLE THROUGH ALL TESTING. FROM THIS PONT THE VEHICLES WERE DESIGNATED AS A BASE OR AN ADDITIZED CAR AND A STRICT FUELLING REGIME WAS FOLLOWED DURING TESTING.

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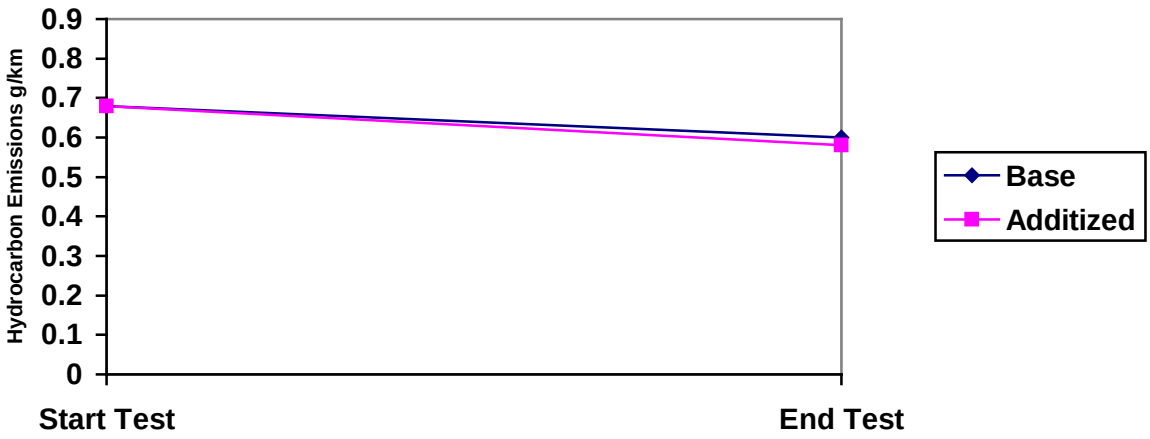
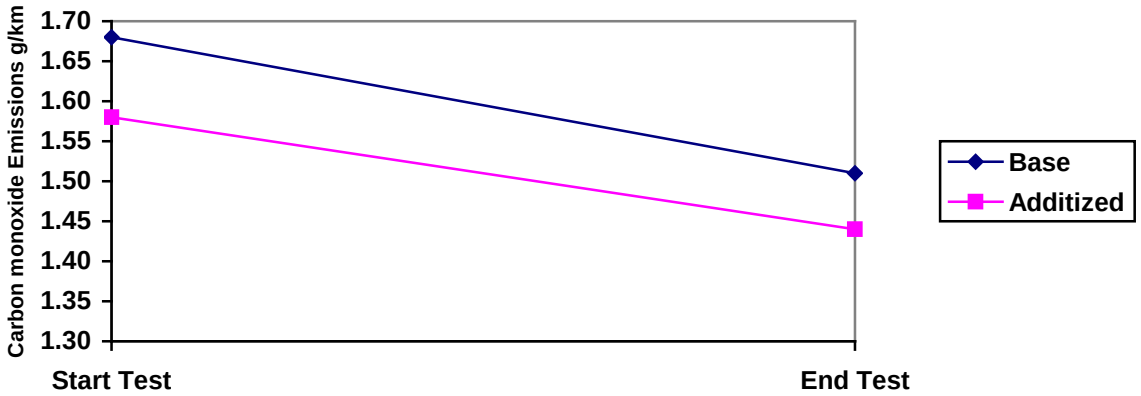
HEAVY DUTY DI VEHICLES – HYDROCARBON EMISSIONS



HEAVY DUTY DI VEHICLES – CARBON MONOXIDE EMISSIONS



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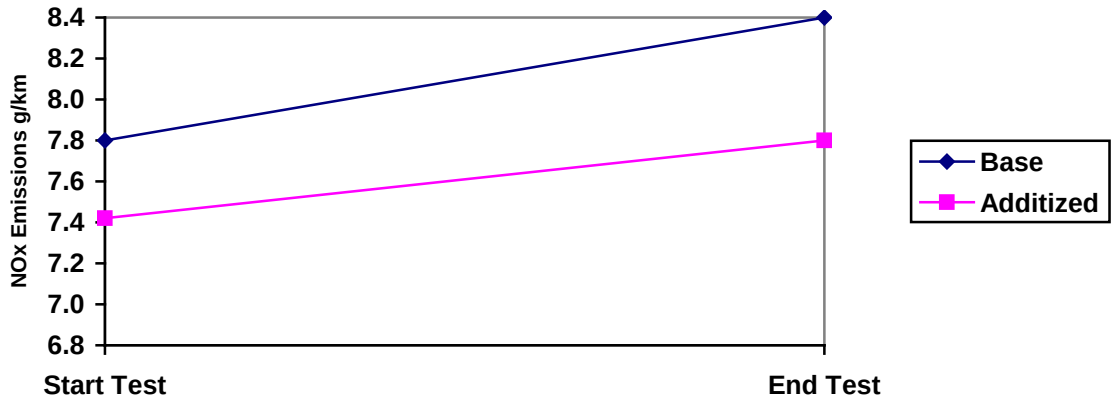
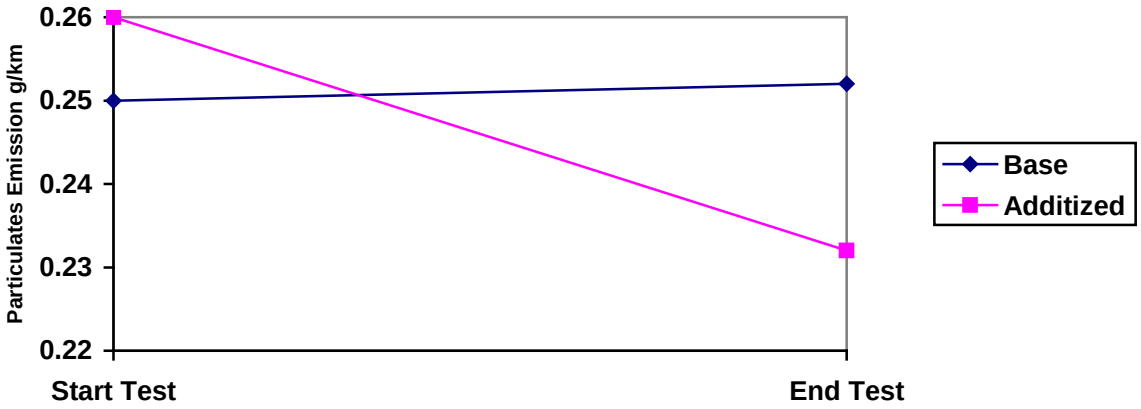
HEAVY DUTY DI VEHICLES – NO_X EMISSIONS



HEAVY DUTY DI VEHICLES – PARTICULATES EMISSIONS



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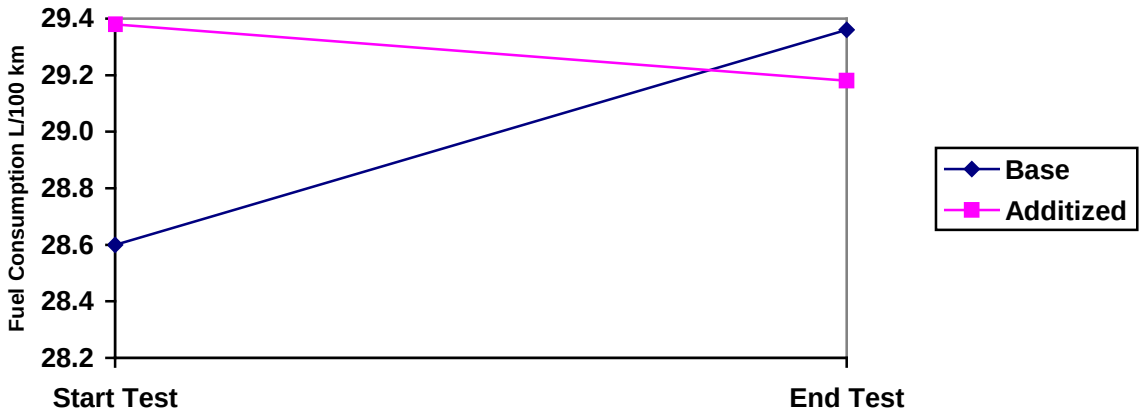
HEAVY DUTY DI VEHICLES – FUEL CONSUMPTION



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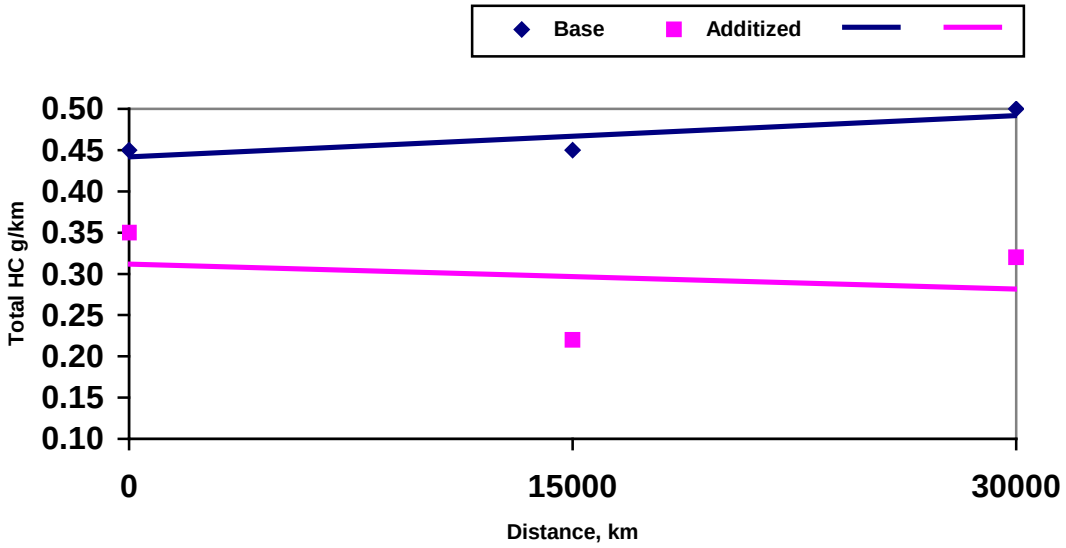
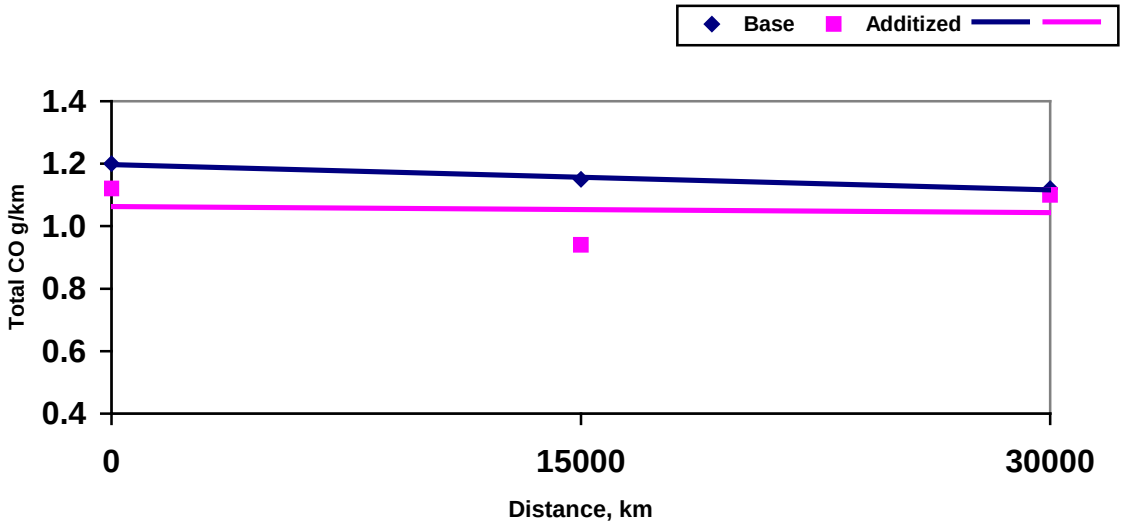
PASSENGER VEHICLES – HYDROCARBON EMISSIONS (PEUGEOT 306)



PASSENGER VEHICLES – CARBON MONOXIDE EMISSIONS (PEUGEOT 306)



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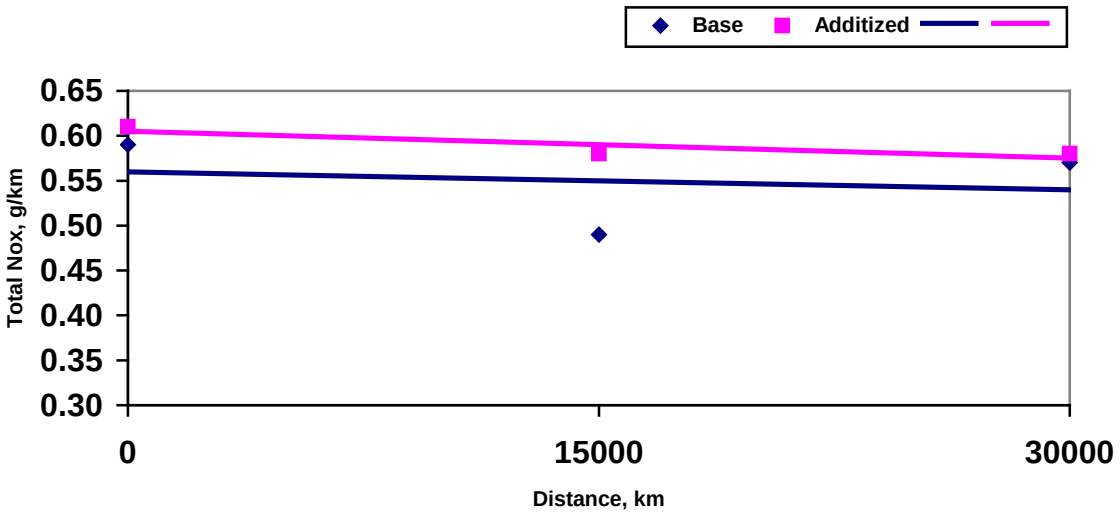
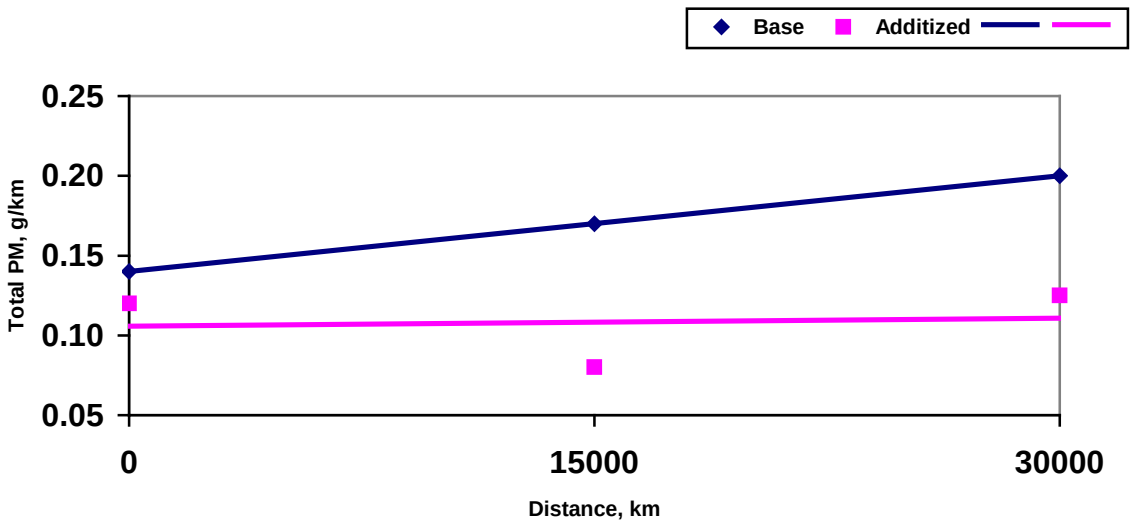
MULTI-FUNCTIONAL PREMIUM DIESEL CONCENTRATE

PASSENGER VEHICLES – NO_X EMISSIONS (PEUGEOT 306)



PASSENGER VEHICLES –PARTICULATE EMISSIONS (PEUGEOT 306)



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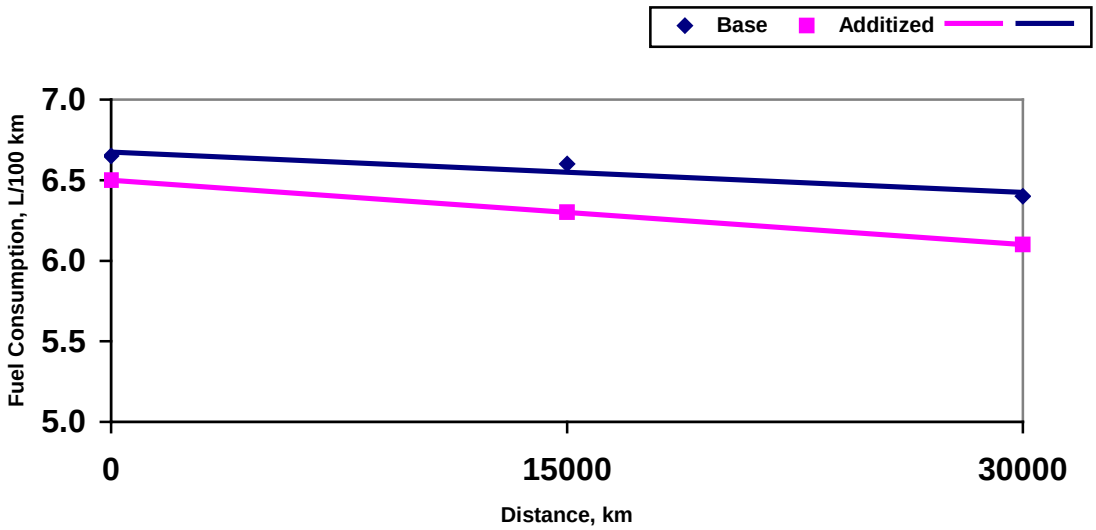
MULTI-FUNCTIONAL PREMIUM DIESEL CONCENTRATE

PASSENGER VEHICLES –FUEL CONSUMPTION (PEUGEOT 306)



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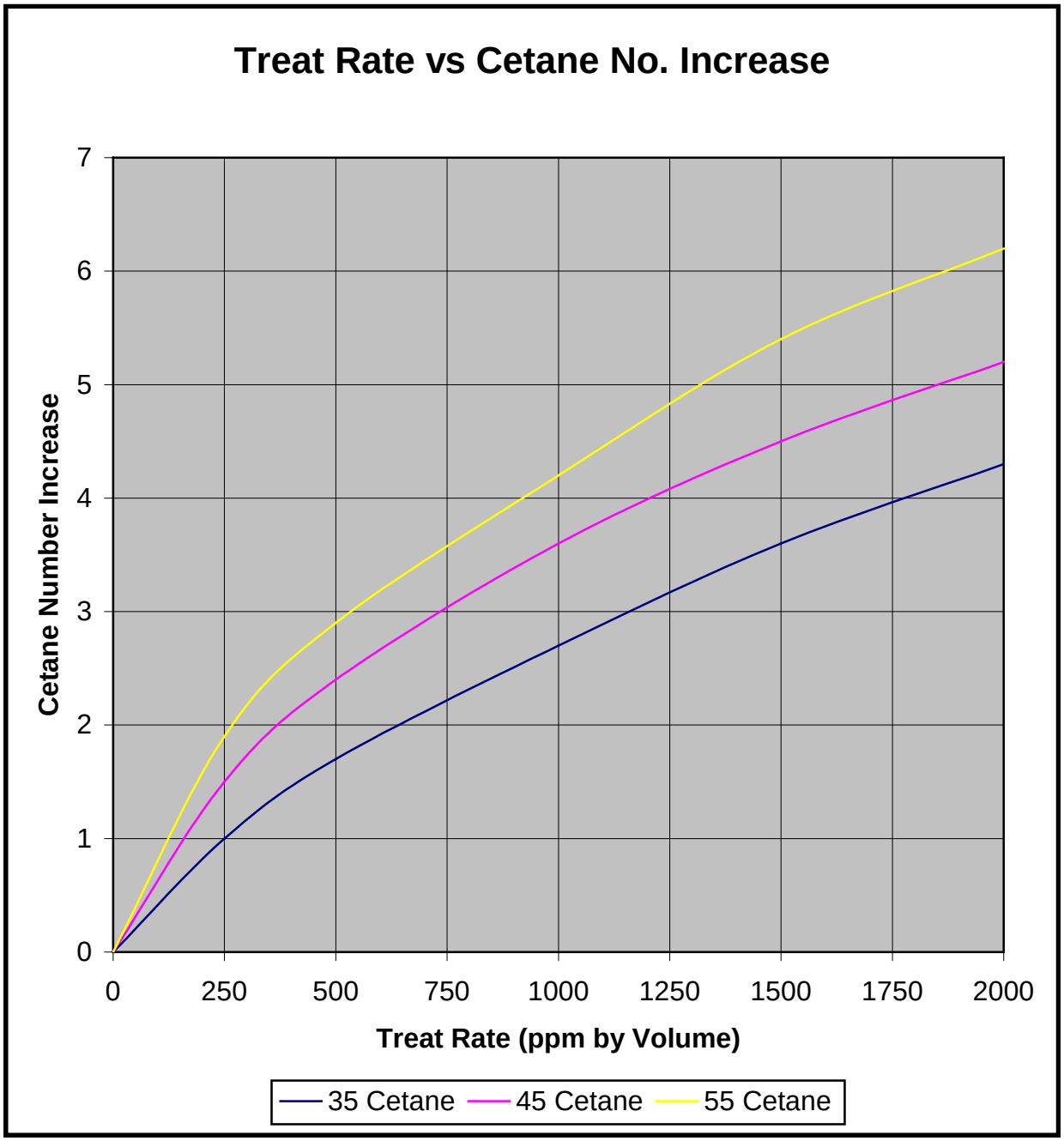
CETANE INCREASE RESPONSE CURVES



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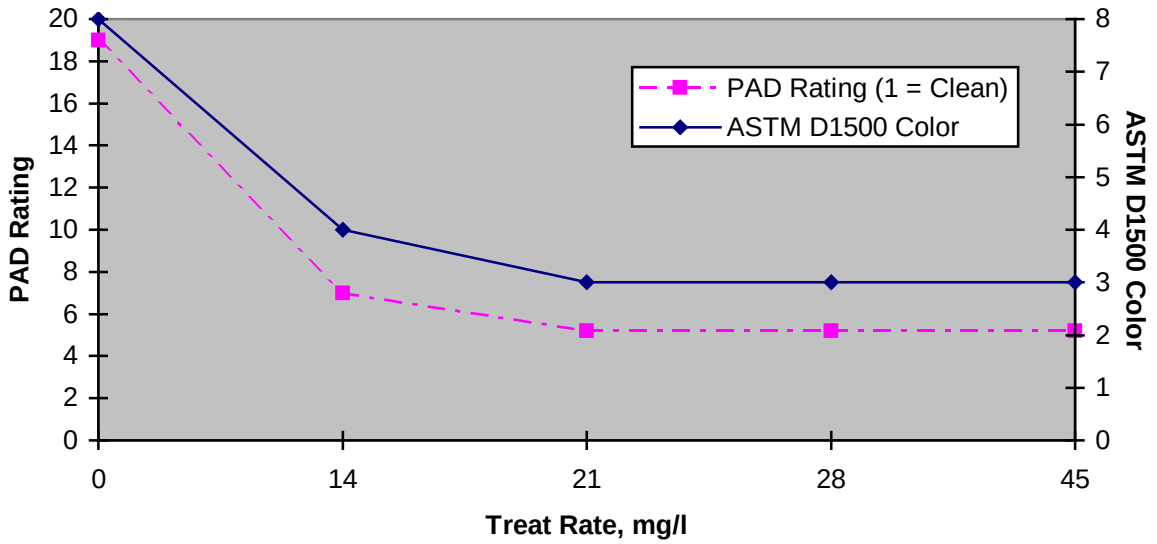
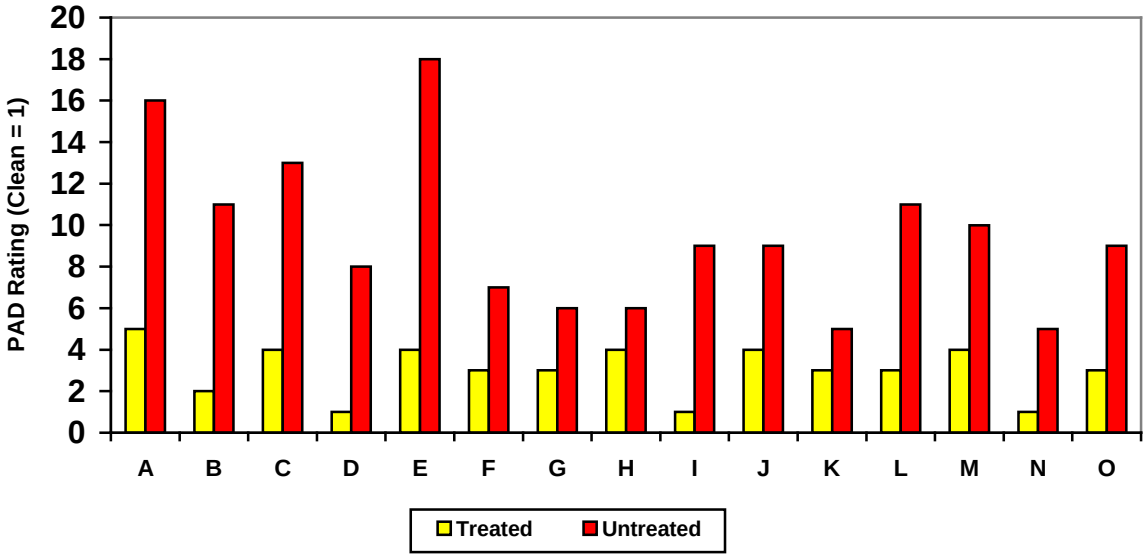
FUEL STABILITY – F-21 HIGH TEMPERATURE TEST



FUEL STABILITY – D6864 THERMAL STABILITY



A – Dallas, TX; B – Atlanta, GA; C – Nashville, TN; D – Lowell, AR; E – Baton Rouge, LA; F – Springfield, MO; G – Columbia, MO; H – Harrison, AR; I – Jackson, MS; J – Memphis, TN; K – Tulsa, OK; L – Ft. Smith, AR; M – Chicago, IL; N – Wichita, KS; O – Oklahoma City, OK.

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MULTI-FUNCTIONAL PREMIUM DIESEL CONCENTRATE

FUEL STABILITY – OXIDATION STABILITY

Additive Treat Rate	Total Insolubles, mg/100 ml	Improvement, %
Zero	0.757	-
Moderate	0.599	21

FUEL STABILITY – CORROSION RESISTANCE

Additive Treat Rate	NACE Scale Rating	Pass/Fail
Zero	E	Fail
Moderate	A	Pass