# Diesel Fuel Component Contribution to Engine Emissions and Performance


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## Objective

To determine the relationships between the fuel feedstock source, processing, properties, and composition, and the resulting combustion and emission characteristics in a diesel engine.

## Approach

The method of fractional distillation was used to produce narrow-boiling cuts for detailed study. Properties of six to eight cuts each from the feedstocks and the hydrotreated products of straightrun diesel, light cycle oil, light coker gas oil, and Fischer-Tropsch liquids were measured by laboratory tests and engine evaluation with measured emissions. The overall approach is shown in Figure 1.

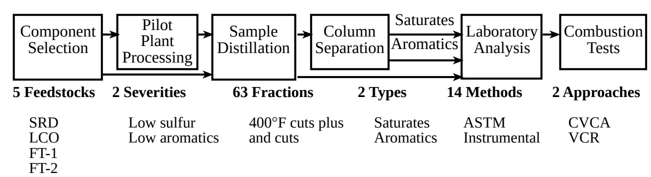


Figure 1

## Accomplishments

The correlations of emissions of carbon monoxide (CO), hydrocarbon (HC), oxides of nitrogen ($NO_x$), and Bosch Smoke were used in a proof-of-concept formulation of 10 minimum emission test fuels. The emissions were expressed as an emissions parameter whose value was equal to a dimensionless value of 4 when each test fuel emission met a target value a little more severe than current regulations.

**Low-Emissions Fuels Descriptions**

| No. | Blending Concepts |
|---|---|
| 1 | Minimum overall emissions |
| 2 | Maximum low aromatics light-cycle oil |
| 3 | Minimum aromatics with CN 55 to 56 |
| 4 | Maximum aromatics with CN 55 to 56 |
| 5 | Maximum cetane no., aromatics 15%–16% |
| 6 | Minimum cetane no., aromatics 15%–16% |
| 7 | 50:50 mixture of blends 3 and 4 |
| 8 | 50:50 mixture of blends 5 and 6 |
| 9 | Minimum emissions with typical LCO and LCGO %s |
| 10 | Minimum emissions, F-T products excluded |

The results of this effort are shown in Figure 2. The trend of emissions below the target value and the agreement of the predicted and actual values characterizes the figure.

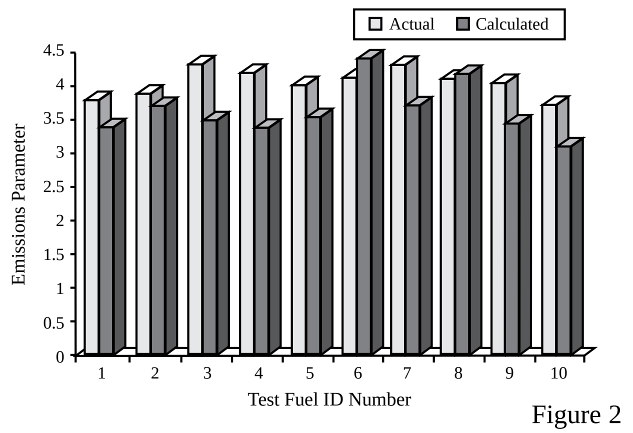


Figure 2

## Publications


Ryan, T.W., III, J. Erwin, R. L. Mason, and D.S. Moulton. 1994. "Relationships between Fuel Properties and Composition and Diesel Engine Performance and Emissions," International Congress and Exposition, SAE Paper No. 941018, February 28–March 3, Detroit, MI.

Erwin, J. and T.W. Ryan, III. 1993. "The Standing of Fischer-Tropsch Diesel in an Assay of Fuel Performance and Emissions," presented at the Contractors Coordinators Meeting, September 29, Detroit, MI.

Ryan, T.W., III and J. Erwin. 1993. "Diesel Fuel Composition Effects on Ignition and Emissions," Society of Automotive Engineers, International Fuels & Lubricants Meeting and Exposition, SAE Paper No. 932735, October 18–21, Philadelphia, PA.

Ryan, T.W., III, and J. Erwin 1992. "Effects of Fuel Properties and Composition on the Temperature Dependent Autoignition of Diesel Fuel Fractions," Society of Automotive Engineers, International Fuels & Lubricants Meeting and Exposition, SAE Paper No. 922229, October 19–22, San Francisco, CA.

Ryan, T.W. III and J. Erwin. 1992. "Effects of Fuel Properties and Composition on the Temperature Dependent Autoignition of Diesel Fuel Fractions," also Volume 101 of SAE Transactions, October.

Erwin, J. 1992. "Assay of Diesel Fuel Components, Properties, and Performance," prepared for the ACS Symposium on Synthetic Fuels, August 23–28, Washington, D.C.