

ETHYL CORPORATION

HIGHER TEL CONCENTRATIONS

Since 1956 Ethyl Corporation has reported to refiners from time to time on its efforts to obtain an increase in the maximum allowable TEL concentration in motor gasoline. An increase has now been allowed--raising the maximum from 3 to 4 ml per gallon. The long-term Ethyl studies completed in this connection are briefly summarized in this report.

These studies show that higher TEL concentrations:

1. Are entirely safe in respect to public health.
2. Raise no engine application problems of real significance.
3. Provide economically attractive gains in anti-knock quality--especially in terms of Motor and Road octane response.

Hygienic Evaluation

Since the 1920's Ethyl Corporation has required refiners to limit the concentration of TEL in motor gasoline to 3 ml per gallon. This was based on a recommendation of a Committee appointed by the Surgeon General. This arbitrary limit was entirely safe from a toxicity standpoint.

Evaluations of the medical aspects of higher TEL concentrations began in 1950. The continuous studies initiated by Ethyl's Medical department in the 1920's, centered at the Kettering Laboratory at the University of Cincinnati, were essential background for this evaluation.

These comprehensive studies indicate that the large safety margin with the 3 ml limit will not be altered significantly at the 4 ml level.

Ethyl engaged the Midwest Research Institute to study the possible relation of TEL in gasoline to the "smog" problem. The studies indicated that TEL has no significant affect on any of the factors commonly associated with the "smog" problem.

Engine Durability

In 1954 Ethyl initiated studies comparing 3 versus 4 ml per gallon in all aspects of engine durability and deposit effects in passenger cars, trucks, farm tractors, and engine dynamometer operation. Since then, a total of 4,000,000 miles of road tests, 12,000 hours of tractor tests, and 2,000 hours of engine dynamometer tests have been completed. The results show no durability or deposit problems that should prevent increases in TEL concentration.

Refinery Economics

Response studies of higher TEL concentrations have been in progress since 1946. The 1959 Ethyl survey of premium gasoline road behavior provides up-to-date information on the response of the 4th ml in current premiums and super-premiums. This survey included laboratory octane response (Research and Motor) up to 4 ml per gallon in 132 fuels. Thirty of these were rated at both 3 and 4 ml per gallon in cars in Ethyl's all-weather rooms. The data on these 30 fuels are summarized in Table I along with the cost of the octane gains in terms of cents per octane-barrel. The cost data are based on TEL at 0.22 cent per milliliter.

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TABLE I

RESPONSE TO THE 4TH ML TEL
(In 30 Current Fuels)

	Octane Gain		Cost	
	4th ML TEL		¢/ON-Barrel	
	Average	Maximum	Average	Minimum
Research	0.8	1.2	11.6	7.7
Motor	0.9	1.7	10.3	5.4
Road	1.1	1.8	8.4	5.1

The octane response and cost data indicate that these gains would be attractive to a large segment of the industry. The Motor octane gains and costs are particularly attractive because of the greater importance of Motor rating, due to the increased tendency of current engines to knock at high speed and part-throttle, and the high cost of Motor improvement by processing. The gains on the road are greater than the Research or Motor increases. This is in line with many earlier data observed at lower TEL concentrations. This enhanced Road octane increment, for added TEL is applicable to regular grades as well as premiums. Road octanes are the octanes that really count in the final analysis. Thus, higher TEL concentrations can save many refiners money in current operations and may enable refiners to avoid or delay capital investments which otherwise might be required for process equipment.

Deposit Effects

Another aspect of the data in Table I relates to fuel composition. Where severe reforming must be used to obtain improved octane quality, the Research gain is greater than the Motor gain. Also, high severity operations increase the aromatic concentration in motor fuel. Fuels of high aromaticity produce combustion chamber deposits which are prone to

surface ignition and rumble. The availability of higher TEL concentrations therefore permits a reduction in aromatics or the inclusion of more paraffins, either of which will reduce a fuel's tendency toward surface ignition or rumble.

Conclusion

The antiknock gains from increased TEL concentrations are economically attractive, especially in terms of Motor and Road octane. This can apply at either low or high lead levels, depending on competitive process costs. Further, the use of higher concentrations may permit the blending of fuels to minimize surface ignition and rumble. The extension of TEL usefulness can help to reduce current operating costs and can delay capital investments which may ultimately prove unnecessary.

NOTE: Technical reports of the Economics, Engine Durability, and Deposit Effects are available.

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