FINAL REPORT

EVALUATION OF MICROLON AND TECHNOL-G

by

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Research Scientist

(The opinions, findings, and conclusions expressed in this report are those of the author and not necessarily those of the sponsoring agencies.)

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SUMMARY

An evaluation was made of the cost-effectiveness of the automotive products Microlon, an engine treatment consisting of Teflon suspended in a solvent, and Technol-G, a gasoline-treating additive consisting of a blend of aliphatic and aromatic distillates. Examined in the evaluation were engineering test reports provided by the manufacturers of the products, test results reported by users of the products, and the performance of the products when used in six of the Department's 1/2-ton Dodge pickup trucks. While the results suggest that use of the products can reduce gasoline consumption, more study is needed to conclude that they are cost-effective.

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INTRODUCTION

In the face of soaring gasoline prices and nationwide concern over the supply of gasoline, the automotive market has been flooded with so-called gasoline-saving devices that can be attached to the engine; fuel-extending or fuel-supplementing additives or fuel treatments that are mixed with gasoline; and performance-enhancing, friction-reducing additives or engine treatment additives that are mixed with motor oil.

Accordingly, over the past several years the U. S. Department of Energy (DOE) has sponsored a developmental program for the design and testing of a procedure for evaluating fuel-efficient crankcase lubricants. According to a recent report on this work, there is a good potential for improving the fuel economy of the U. S. automotive fleet using crankcase lubricants and oil supplements.(1) Dynamometer tests of eight products have shown the following improvements in gasoline mileage as compared to an SAE 30 grade mineral oil used as a control: 6.4% for an SAE 10W40 mineral oil containing graphite, 4.6% for an SAE 5W20 synthetic oil, an average of 4.1% for three brands of oil supplements containing polytetrafluoroethylene suspended in a lubricant, an average of 1.1% for two brands of oil supplements containing polytetrafluoroethylene suspended in a solvent, and 0.4% for an SAE 10W40 mineral oil with a friction modifier.(1) However, since only eight vehicles (1980 model front-wheel-drive vehicles with 4-cylinder engines) were involved in the tests of the eight products (one product in each vehicle), it was concluded that a larger fleet test would be required to achieve statistically significant results for any one of the products.(1)

Two commercial products touted to provide fuel economy that have been brought to the attention of the Virginia Department of Highways and Transportation, and subsequently to the attention of the Research Council, are Microlon, which is best described as an engine-treating additive, and Technol-G, which is considered a fuel- and engine-treating additive. Because of the claims made for these products, the Department's Equipment and Purchasing Divisions requested that the Research Council evaluate their performance.

BACKGROUND

Microlon is the trade name for a product consisting of Teflon (polytetrafluoroethylene) suspended in a solvent.[2] It is added to the engine oil and fuel, usually on a one-time basis. The recommended procedure for using it in automobiles and light trucks is as follows:

> At operating temperature, with engine idling, add 32 oz. of Microlon to the crankcase and 4 oz. to the carburetor. Drive the vehicle for 50 miles minimum, or let high idle for one hour. The oil may be changed after 1,000 miles.[3]

According to the manufacturer the Teflon in Microlon impregnates the metal surfaces by filling the pores and thereby reduces friction between the metal parts. The solvent in Microlon is reported to clean the engine by breaking down the rust, scale, and carbon, and to evaporate during the first hour of operation.[2] The end result is reported to be —

1. greater engine efficiency (better gasoline mileage),
2. less engine maintenance, and
3. longer engine life.[2,3]

Technol-G is the trade name for a product that is added to the gasoline storage tank at the recommended dosage of 1 gallon per 1,000 gallons of gasoline.[4] According to the manufacturer, it is a blend of aliphatic and aromatic distillates and various other hydrocarbons that causes a change in the molecular structure of gasoline to improve combustion. Use of the product is also purported to clean the gasoline storage tank and the entire fuel system of the vehicle.[4] The benefits claimed to be derived from the use of Technol include:

1. greater engine efficiency (better gasoline mileage),
2. less engine maintenance,
3. longer engine life, and
4. lower octane requirements for some engines.[4]

The Department would incur a sizeable expense if either of the products were to be used statewide. Microlon costs about $140 per gallon, or about $40 for enough to treat one vehicle,[5] and Technol-G costs $20 per gallon, or 2.0 cents for enough to treat 1 gallon of gasoline.[6] However, significant improvements in vehicle performance resulting from the use of the products could provide a reduction in gasoline purchases that would more than offset their costs.

PURPOSE

This study was a small-scale effort to determine the potential of Microlon and Technol-G as cost-effective additives for use in the Department's gasoline-powered vehicles. A specific objective was to determine if the use of the additives could lead to a reduction in gasoline and oil consumption.

SCOPE

The study was extremely limited since each of the two products was used in only three vehicles. However, it was anticipated that when the results of the vehicle tests were considered in conjunction with an engineering analysis to be provided by the manufacturer and information reported by other agencies, a decision could be made as to whether or not the materials warranted further study. It was recognized that a thorough fleet test would be necessary before valid judgments could be made regarding the use of these products on a wide scale by the Department.

METHOD OF EVALUATION

Microlon and Technol-G were evaluated in three ways as indicated below.

1. Test reports supplied by the manufacturer were studied in detail.

2. Test results reflecting the experiences of other organizations were collected and studied.

3. Vehicle performance evaluations based on road and dynamometer data were conducted on three identical groups of three Dodge 1/2-ton pickup trucks assigned to the Culpeper District.

For the evaluation based on road data, seven months of background mileage and maintenance data collected for a Gasohol study[7] were compared to six months of data collected while the test vehicles were operating on the Technol-G and Microlon. For the evaluation based on the dynamometer tests, each vehicle was placed on the dynamometer three times, and data on fuel consumption and exhaust emissions were collected. The dynamometer tests were conducted at the Culpeper District Shop.

Before it could be recommended that the Department consider the large-scale use of either test product it would be necessary to demonstrate, with a certain degree of statistical significance, that the cost of the product would be more than offset by a reduction in gasoline purchases. Tables 1 and 2 show the percentage improvements in mpg that must be attributed to the use of the test products to offset their costs.

Since Microlon is reported to be a one-time treatment in the life of the vehicle,[2,3] it is necessary to consider the cost of the treatment, (assumed to be $40 at the current cost for 36 ounces[5] in light of the price of gasoline, the baseline fuel consumption of the vehicle, and the useful life of the Microlon treatment. It is obvious from Table 1 that the higher the price of gasoline, the lower the baseline mpg; and the greater the useful life of the Microlon treatment, the less the improvement in mpg required to justify the $40 for the Microlon treatment. Skeptics might view Microlon as being useful until the oil is changed, and, as can be seen in Table 1, a considerable improvement in mpg is required to offset the cost of the treatment in 3,000 miles of use (19.0% for a fuel consumption of 15 mpg and a gasoline price of $1.25). On the other hand, if a vehicle is treated when new, and the treatment lasts for the life of the vehicle, say 100,000 miles, very little improvement in mpg is needed to justify the Microlon treatment (0.5% for a fuel consumption of 15 mpg and a gasoline price of $1.25).

Unlike Microlon, Technol-G is added to the fuel and can be considered as increasing the cost of the fuel a certain percentage depending upon the relation between its price and that of gasoline. Table 2 shows the improvement in mpg that must be attributed to the use of Technol-G for several relationships between these prices. It is obvious from Table 2 that the higher the price of gasoline relative to that of Technol-G, the less the improvement required to justify use of the product. A 1.6% improvement is necessary to justify the use of Technol-G at a price of $20 per gallon[6] when gasoline costs $1.25 per gallon, which is typical of the present situation.

Table 1

Percentage Improvement in Miles Per Gallon Necessary to Offset the Cost of a $40 Microlon Treatment for Various Vehicle Operating Scenarios

Price of gas. $/gal.	Useful Life of Microlon, Miles				
	3,000	10,000	50,000	100,000	mpg
	Needed Percentage Improvement				
1.00	25.0	6.4	1.2	0.6	15
1.25	19.0	5.0	1.0	0.5	15
1.50	15.4	4.2	0.8	0.4	15
1.00	66.7	13.6	2.5	1.2	30
1.25	47.1	10.6	2.0	1.0	30
1.50	36.4	8.7	1.6	0.8	30

Table 2

Percentage Improvement in Miles Per Gallon Necessary to Offset the Cost of Technol-G for Various Combinations of Price for Gasoline and Technol-G

Price of gas. $/gal.	Price of Technol-G, $/gal.		
	15	20	25
	Needed Percentage Improvement		
1.00	1.5	2.0	2.5
1.25	1.2	1.6	2.0
1.50	1.0	1.3	1.7
2.00	0.8	1.0	1.3

RESULTS

Test Reports Provided by Manufacturers

The manufacturers of the two products were requested to provide detailed engineering reports on the effectiveness of the products. Neither supplied reports showing the statistically significant results necessary to conclusively support the use of their products in vehicles such as those operated by the Department, but they did furnish considerable literature as noted below.

Microlon

The manufacturers of Microlon provided the information noted in references 2, 3, 8, and 9 which included a large number of endorsements from persons who had used the product in a variety of applications. The reports noted in references 2 and 3 describe how Microlon works and give instructions for using it. The report noted in reference 8 provides engineering data on some successful applications of Microlon to treat bits in various machining operations; a laboratory analysis which showed that Microlon does not corrode metal parts and does not react with Viton and Nitrile; the results of a bench test which showed that a Microlon treatment reduced the level of noise emitted by helicopter gears; a description of a vehicle being driven 500 miles without oil after being treated with Microlon; and a number of reports from individuals who had used Microlon. While the report strongly supports the theory that Microlon can reduce friction and therefore should extend the service life of metal components subjected to friction, it does not provide conclusive evidence that benefits can be achieved from treating the engine of a typical vehicle with Microlon. The most convincing document provided by the manufacturers of Microlon was the one noted in reference 9, which was a condensed version of the work reported in reference 10. According to reference 9, the use of Microlon in a 1976 Chevrolet 305 cu.in. V-8 engine reduced fuel consumption by 3.4%. The report also showed that Microlon reduced engine friction by as much as 13% and reduced exhaust emissions. Unfortunately, according to reference 10 the results shown in reference 9 were not statistically significant and therefore were inconclusive.

Technol-G

In response to the request for a detailed engineering report on Technol-G, the manufacturer supplied the miscellaneous compilation of literature noted in reference 4. The literature included a test report showing that the metals content of Exxon no-lead gasoline containing Technol-G was the same as that of gasoline without the additive; a statement of the physical properties of Technol-G; a product liability policy for Technol-G; a general service administration number for Technol-G; a list of three laboratories that have tested Technol-G (one indicating that the flash point of Technol-G is 142^{o}F, and two indicating that exhaust emissions are reduced substantially with Technol-G); and a number of product endorsements from persons who had used Technol-G in a variety of vehicles. It's interesting that an analysis of Technol-G by the Chrysler Corporation has indicated that the product contains approximately 50% organic phosphate, which is a catalyst poison. Given the validity of this finding, continued use of the product should result in an increase in the rate of the degradation of the catalyst.(11)

Test Results From Other Organizations

The data obtained from the literature furnished by the manufacturers which reflect individual user experiences with the test products are summarized in Tables 3, 4, and 5.[3,4,9,10,12] Personal contact was made by phone to discuss the experiences with some of the users. Successful phone contacts are noted with a ✓ in the tables. In every case, data had been collected prior to using the test product and again after initiating the use.

It is obvious that the experience of the Microlon users, reported in Table 3, was extremely good, with each user reporting a greater than 10% increase in mpg after treating the engine with Microlon.[3] Giving equal weight to each user, the average increase in mpg was 18%, with a standard deviation of 7.4%. Based on these data, it can be concluded that an increase in mpg of 3.2% (2 standard deviations from average) can be expected at the 95% confidence level. Based on the data in Table 1, for a fuel consumption of 15 mpg and a gasoline price of $1.25/gal., the $40 treatment cost can be justified if the useful life of the treatment is greater than 16,000 miles.

The results of dynamometer tests of Microlon are shown in Table 4. The U. S. DOE found a 3.5% improvement in mpg resulted from the treatment of a 1976 Chevrolet engine with Microlon,[9] but later tests on a 1980 Pontiac showed only a 1.9% improvement.[10] The DOE results are certainly encouraging, but their study concluded that more tests are required to produce conclusive results.[10]

In a thesis project, a Ford engine treated with Microlon showed a 5.5% improvement in mpg and an 8% to 20% reduction in engine friction.[12] Again the results are encouraging, but the conclusion was that more tests were needed to produce conclusive results and evaluate the long-term effects of the Microlon treatment.

Based on the results of the three tests reported in Table 4, it can be concluded that the results were encouraging but not conclusive, since at the 95% confidence level (2 standard deviations from average) the Microlon treatment produced no improvement.

It is obvious that the experience of the Technol-G users reported in Table 5 is extremely good, with all but two users reporting a greater than 10% improvement in mpg.[4] Treating each user equally, the average improvement was 15% with a standard deviation of 7.3%. At the 95% confidence level, an improvement of 0.4% can be expected with Technol-G, which, based on the price relationship shown in Table 2, is not enough to justify the use of Technol-G.

Table 3

Experiences of Others With Microlon

Type Vehicle	Owner	Improvement mpg
✓ Truck fleet	J. E. Hodnett, Cedartown, Ga.	13.5%
✓ Truck & car fleet	Bonanza Equip. Co., Youngstown, Ohio	16.0%
✓ 1976 Ford Granada	J. Keyzer, Ansonville, N.C.	11.0%
✓ Tractor trailer & Dodge Pickup	H. P. Racing Enter., Van Nuys, Cal.	25.0%
1979 Chevrolet Impala	Sheriff's Dept., Bristol, Va.	24.0%
1979 Ford truck	Standard Beef Co., New Haven, Conn.	44.0%
Trucks & cars (fleet)	Pacific Tel. & Tel., San Jose, Cal.	13.0%
Trucks & cars (fleet)	Plane & Pilot News, Inc., Ravenna, Ohio	15.0%
Pickup truck	Don Brennecke, Chicago, Ill.	18.0%
✓ Ford LTD	Lawton H. Nisbet, Greenville, N.C.	14.0%
Company car	J. B. Baylor, Houston, Tex.	13.0%
1973 Olds. & 1972 Pickup	J. C. Caskey, Prichard, Ala.	17.0%
	Avg.	18.0%
	SD =	7.4%

Table 4

Dynomometer Tests of Microlon

Type Engine	Tested By	Friction Reduction	Improvement mpg
✓ 1976 Chevrolet V-8	U. S. DOE, Bartlesville, Okla.	0-13%	3.5%
✓ 1980 Pontiac 4-Cyl.	U. S. DOE, Bartlesville, Okla.	-	1.9%
✓ Ford 6-Cyl.	Edward L. Kyte, U.Va., Charlottesville, Va.	8-20%	5.5%
		Avg.	3.6%
		SD =	1.8%

Table 5

Experiences of Others with Technol-G

Type Vehicle	Owner	Improvement in mpg
3 school buses	Richmond Pub. Sch., Richmond, Va.	14.5%
✓ School bus fleet	Newport News Pub. Sch., Newport News, Va.	4.0%
✓ School buses	George Westover Motors, Belleville, Pa.	19.2%
✓ Vans and cars	Harder Service, Inc., Hempstead, N. Y.	15.6%
✓ Mac trucks	Riteway Express Co., North Bergen, N. J.	6.0%
3 buses and 1 car	Newport News Pub. Sch., Newport News, Va.	11.2%
33 cars, vans, and buses	Allied Aviation Co., Washington, D. C.	31.2%
Police vehicles	Baton Rouge, Baton Rouge, La.	13.0%
School buses	State College Sch. State College, Pa.	21.7%
	Avg.	15.0%
	SD =	7.3%

Performance Evaluations Based on Road and Dynamometer Data

Three identical groups of three Dodge 1/2-ton pickup trucks located in the Culpeper District were selected for the road and dynamometer evaluations. Six were 1978 models and three 1979 models. The average odometer readings for the three groups were as follows: Group A — 31,500; Group B — 58,500; Group C — 28,500. All nine vehicles were equipped with 318 cu. in. V-8 engines having a compression ratio of 8.5 to 1.

Three of the vehicles served as controls (one each from groups A, B, and C), three were treated with Microlon (one each from groups A, B, and C) and three were operated on fuel containing the recommended dosage of Technol-G. All the vehicles were operated in the usual manner on no-lead gasoline.

Fuel Consumption Based on Road Records

Monthly gasoline, oil, and maintenance records were kept over the six-month test period from May 1 to October 31, 1980, and the seven-month background period of August through October 1979 and January through April 1980 by each of the drivers of the vehicles in the study. Over these thirteen months no significant maintenance other than routine oil changes was performed on the vehicles and their oil consumption was negligible.

A linear regression analysis was made of the ratio of gallons of fuel used in the test vehicle to the gallons of fuel used in the control vehicle as a function of the ratio of miles traveled by the test vehicle to the miles traveled by the control vehicle for each of the 6 pairs of vehicles. The results of the analyses are shown in Table 6. For example, during the seven-month background period, the Microlon test vehicle in group A achieved 6.1% less mpg than the control vehicle, and during the 6-month test period it achieved 4.1% less. Therefore, the data indicate that the Microlon treatment of this vehicle resulted in a 2.1% improvement in mpg. On the average, the three vehicles that received the Microlon treatment achieved 0.6% better mpg than the control vehicles prior to the Microlon treatment and 0.7% after the treatment, for a relative improvement of 0.2% attributable to Microlon. Similarly, the vehicles using Technol-G exhibited 9.0% better mpg than the control vehicles prior to the use of Technol-G and 9.1% better mpg during the use of Technol-G, for a relative improvement of 0.1%. Although there were some statistically significant differences between the test vehicle and the control vehicle in some of the pairs and in the case of Technol-G for the average of the three pairs, there was no statistically significant difference in fuel consumption that could be attributed to the use of the test products. Although both products produced a minor improvement in mpg based on the average results obtained from three pairs of vehicles, the improvements were not statistically significant.

Table 6

Percentage Differences in mpg Based on Road Data —
Test Vehicles vs. Control Vehicles

Study Period	Microlon Vehicle Group				Technol-G Vehicle Group			
	A	B	C	Avg.	A	B	C	Avg.
7 mos. before use of product	-6.1	+12.5**	-3.7**	+0.6	+10.4	+17.1***	+0.2 **	+9.0***
6 mos. during use of product	-4.1**	+17.2***	-9.0***	+0.7	+6.4	+24.2***	-1.6	+9.1*
Relative change	+2.1	+ 4.2	-5.5	+0.2	-3.7	+ 6.0	-1.7	+0.1

Significant difference based on Wilcoxon signed ranks test at significance level of: *0.100, **0.050, ***0.025.

Fuel Consumption Based on Dynamometer Tests

Since some people consider fuel consumption records maintained for everyday operations to be unreliable because of the many factors that can affect fuel consumption, additional data were obtained by placing the vehicles on a dynamometer and measuring fuel consumption for different controlled operating conditions. The basic procedure involved (1) placing a vehicle on the dynamometer, (2) disconnecting the fuel line between the carburetor and the fuel pump, (3) connecting a fuel line to the carburetor from a fuel pump fed from external containers, (4) operating the vehicle on the dynamometer until the temperature gage on the dashboard indicated that the vehicle had reached normal operating temperature, and (5) operating the vehicle for a prescribed period of time at prescribed speeds and loads on preweighed 1-liter containers of fuel.

The vehicles were subjected to four loading conditions: an idle condition comparable to operating at a stop light, a light load condition comparable to operating on a level road, a medium load condition comparable to climbing a 2% grade, and a heavy load condition comparable to climbing a 3% to 4% grade. A threaded rod was connected to the accelerator linkage on the carburetor so that a constant speed could be maintained, and a stop watch was used to

time the operation at each speed. The procedure was to operate the vehicle under heavy load at 25 and 40 mph; adjust the dynamometer to a medium load condition and operate the vehicle at 25, 40, and 47 mph; adjust the dynamometer to the light load condition and operate the vehicle at 25, 40, and 55 mph; and complete the test by operating the vehicle while in gear but with the emergency brake applied. The test was designed to subject the vehicle to the variety of driving conditions encountered in everyday driving while eliminating the effects of driving habits, weather, and other factors.

The dynamometer tests were conducted prior to initiating the use of the test products, two weeks after the initiation of their use, and six months afterwards. All three vehicles in each group were tested on the same day so that a total of nine days were required to collect the data. Figure 1 shows the data collected for the control vehicle and the Technol-G vehicle in Group A.

The fuel consumption data collected during the dynamometer tests are shown in Table 7. The percentage differences in mpg reported in Table 7 are based on the ratio of the fuel used in the test vehicle to the fuel used in the control vehicle at the time of the test after correcting the ratio based on the ratio between the vehicle pairs prior to the use of the test product. The fuel consumption of each vehicle is based on the average fuel consumption for nine operating conditions.

From Table 7 it can be seen that both products produced a statistically significant increase in mpg based on the tests conducted two weeks after initiation of the use of the products. There was a 3.8% average increase in mpg for Microlon and a 4.9% increase for Technol-G. Unfortunately, the improvements were not duplicated when the vehicles were tested six months later, at which time no significant difference was found between the control vehicles and the test vehicles. On the average there was a 1.7% improvement in mpg for the Microlon vehicles, which was significant, and a 1.9% improvement for the Technol-G vehicles, which was not significant. It may be theorized that in the case of the Microlon treatment the benefits noted at two weeks were lost when the oil was changed and did not show up six months afterwards. In the case of Technol-G, the results were generally not extremely favorable, and it may be theorized that the average improvements were due to the large improvement noted for vehicle pair B. This 15.5% improvement was similar to that reported by other users of Technol-G, but since it did not show up in the tests six months later it is possible it was due to some gross testing error.

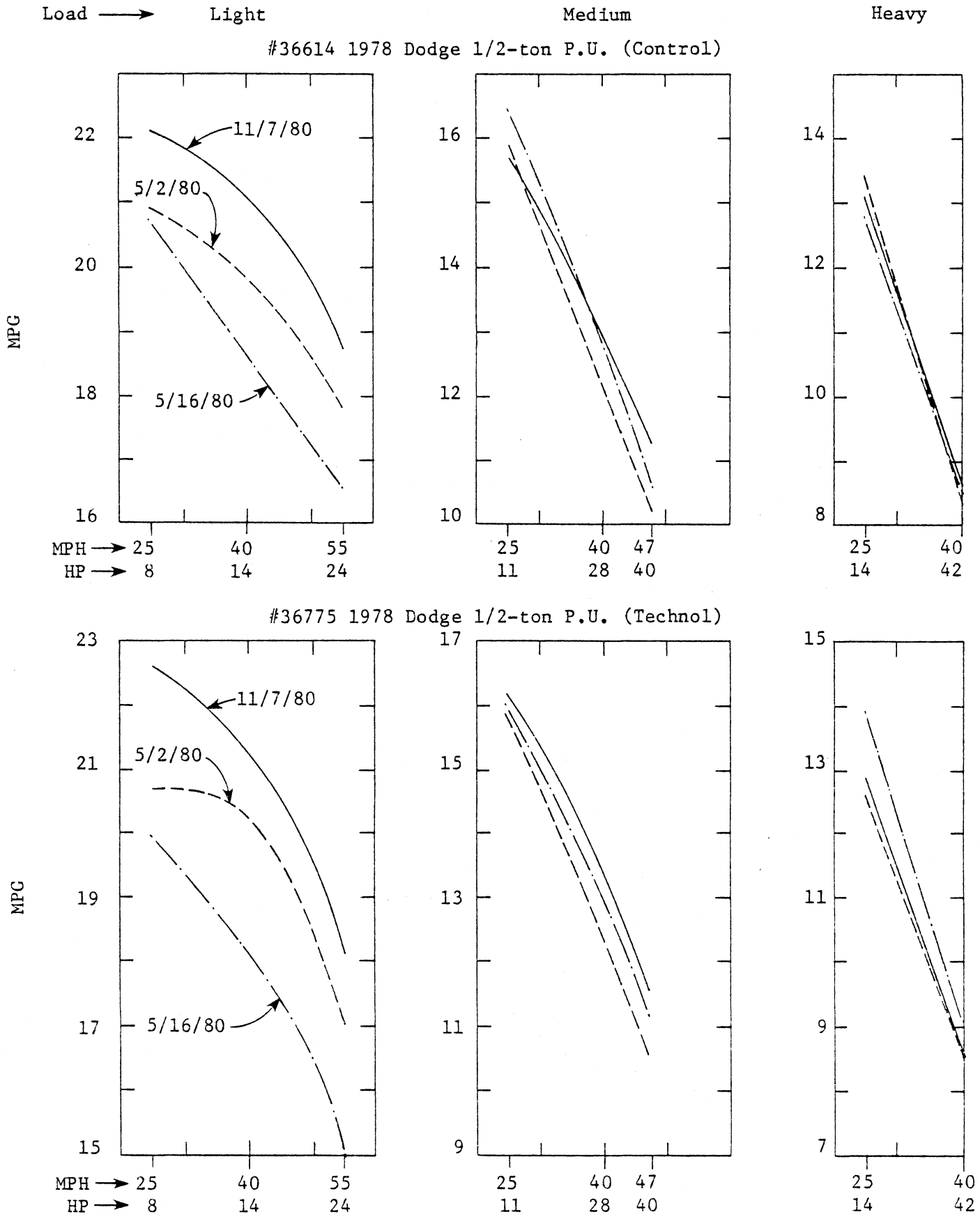

Figure 1. Example of data obtained from dynamometer tests.

Table 7

Percentage Differences in mpg Based on Dynomometer Tests

Time of Test	Vehicle Group	Microlon	Technol-G
2 wks. after initiation of use	A	+0.4	+ 1.0
	B	+6.7	+15.5***
	C	+4.5**	- 1.1
	Avg.	+3.8***	+ 4.9***
26 wks. after initiation of use	A	-5.2	+ 1.1
	B	+6.7*	- 2.2
	C	-2.4	- 2.6
	Avg.	-0.4	- 1.2
Avg.	A	-2.4	+ 1.1
	B	+6.7**	+ 6.5*
	C	+1.1	- 1.8
	Avg.	+1.7*	+ 1.9

Significant differences between product and control based on Wilcoxon signed ranks test at a significance level of *0.100, **0.050, *** 0.025.

A comparison of the road and dynomometer data for fuel consumption is shown in Table 8. Based on these data, it appears that the products tested produced the greatest improvement in mpg when used in the vehicles in group B, which incidentally had the highest odometer readings. However, neither product can be considered to be cost-effective based on the average results. In the case of the 1.7% improvement for Microlon found from the dynomometer tests, a useful life of 40,000 miles would be required to offset the cost of the $40 treatment with the cost of gasoline $1.25/gal. and the average fuel consumption 15 mpg. More tests are needed to establish a useful life of 40,000 miles, since the dynomometer tests suggest that the effects of the treatment are lost within the first six months. The 0.2% improvement found for Microlon based on the road data will not offset the cost of the treatment, even if the effects last for 100,000 miles (see Table 1). The 1.9% improvement found for Technol-G in the dynomometer tests is enough to justify its cost (see Table 2). However, this result must be questioned since it includes a large improvement found for one vehicle which was not duplicated in later tests. Of course the 0.1% improvement found for Technol-G based on the road data is not adequate to justify the added cost (see Table 2).

Table 8

Comparison of Percentage Change in mpg
Based on Dynomemeter and Road Data

Vehicle Group	Percentage Change in mpg			
	Microlon		Technol-G	
	Dynomometer	Road	Dynometer	Road
A	-2.4	+2.1	+1.1	-3.7
B	+6.7	+4.2	+6.5	+6.0
C	+1.1	-5.5	-1.8	-1.7
Avg.	+1.7	+0.2	+1.9	+0.1

Other Data

The exhaust emissions of the nine vehicles were measured with a Pulsar infrared exhaust gas analyzer while the vehicles were being operated on the dynamometer. The analyzer is designed to measure carbon monoxide (CO) in percent and hydrocarbons (HCs) in parts per million of a sample of exhaust gas. Based on the results obtained with the analyzer, which are shown in Table 9, the CO emissions were significantly reduced for the vehicles with the Microlon treatment and the HCs were significantly higher for the vehicles using Technol-G.

The compression of three of the cylinders in each vehicle was determined at the completion of each of the tests on the dynomometer. The percentage differences in compression for the test vehicles as compared to the control vehicles are shown in Table 10. It can be concluded from these data that a significant reduction in engine compression resulted from the use of both products. It is interesting to note that the reduction was greater after twenty weeks than after two weeks, which might suggest a continuing reduction in compression. However, it is believed that the reductions in compression were due to the cleaning action of the solvents in the two products. Since the reductions are only 2% to 3% they are not an indication of premature engine wear.

Clearly, neither product seems to deteriorate performance, and both seem to improve performance to some degree. Unfortunately, another study involving a larger number of vehicles would be required to allow a statistically significant conclusion.

Table 9

Percentage Differences in CO and HC Emissions
Based on Dynomometer Tests

Time of Test	Group	Microlon		Technol-G	
		CO	HC	CO	HC
2 wks.	A	+48	+20	+87	+15
after	B	-84	+21	+25	+48
initiation	C	-81	-43	-39	+25
of use	Avg.	-64	- 6	+13	+29
26 wks.	A	-18	+ 1	-38	-16
after	B	-97	+33	-80	+98
initiation	C	-69	- 5	+ 1	+ 6
of use	Avg.	-80	+ 8	-50	+21
Avg.	A	+10	+10	+ 8	- 2
Avg.	B	-93	+27	-50	+71
Avg.	C	-76	-26	-22	+15
	Avg.	-74**	+ 1	-25	+24*

Significant difference at significance of: *0.10.
Significant difference at significance of: **0.05.

Table 10

Percentage Differences in Engine Compression

Time of Test	Microlon	Technol-G
2 wks.	-1.3	-2.3
26 wks.	-2.8	-3.3
Avg.	-2.1*	-2.8**

Significant difference at significance of: *0.10.
Significant difference at significance of: **0.05.

Discussion of Results

At best the results are encouraging for both products, since the data generally show improvements in mpg. Unfortunately, the results are inconclusive. Neither of the manufacturers provided engineering test reports that conclusively showed that improvements in mpg will result from the use of their product. The test results reported by others show that Microlon is cost-effective at the 95% confidence level, if its useful life is greater than 16,000 miles. Unfortunately no reports have surfaced that conclusively show the effective life of the Microlon treatment. The test results reported by others do not show an improvement in mpg at the 95% confidence level for fuel treated with Technol-G. The performance evaluation showed significant improvements in performance for the Microlon treatment, but did not show that the effects were lasting. In the case of Technol-G, no significant improvement in performance was found. Further evaluation is needed to conclusively show that either product is cost-effective.

Further efforts to evaluate Microlon should be directed at determining the useful life of the treatment. Essentially, all the test data were for performance immediately following the treatment. Further efforts to evaluate Technol-G should be directed at sampling a much larger fleet. It is believed that the products may improve the performance of some vehicles more than that of others, and further study should be directed at determining the performance of the products as a function of the operating characteristics of the vehicles. The performance of the least efficient vehicles would probably be improved the most.

Because so many factors can influence vehicle performance, it is extremely difficult to obtain statistically significant results for products that provide only a marginal improvement. Whereas the use of either product could be justified if it provided a 2% improvement in performance, a considerable amount of care, time, effort, and money would be required to statistically demonstrate that a 2% improvement at the 95% confidence level would result from the use of a product.

It may well be that there are cost-effective engine treatments or fuel or oil additives on the market. It is hoped that in the quest for greater gasoline mileage the automotive manufacturers would perform the necessary engine treatments at the production level and, further, that they would recommend the use of the fuel and oil additives in the vehicle operating manuals and cover the use of the additives under the vehicle warranties. Unless a manufacturer can clearly show that the use of his particular engine treatment or oil and fuel supplement or additive is cost-effective, he should not expect a state agency such as the Department to purchase it.

CONCLUSION

The use of Microlon and Technol-G appears to provide marginal reductions in gasoline consumption. However, a much larger fleet test is required to conclude that the products are cost-effective.

RECOMMENDATIONS

The administration of the Department should establish a policy on the use of engine treatments and oil and fuel additives or supplements. Where there is an interest in pursuing the use of such products, a standard procedure for evaluating them should be established, with recognition that considerable care, time, effort, and money are required for a conclusive evaluation of any one of them.

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