Docket #0110 -01 84
Item 3

A-96-01
II-A-959

Helen O. Petrauskas
Vice President
Environmental and Safety Engineering

Ford Motor Company
The American Road
P. O. Box 1899
Dearborn, Michigan 48121-1899

December 15, 1983

The Honorable William D. Ruckelshaus
Administrator
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Dear Mr. Ruckelshaus:

Enclosed is a petition from Ford Motor Company (Ford) requesting deferral of the January 1, 1986, effective date of the 80 dB(A) noise emission standard for medium and heavy trucks [40 CFR 205.52(a)(ii)] so as to make it coincident with the effective date of the more stringent NO_x and particulate standards that may apply to the 1987 or 1988 models. According to EPA pronouncement, these exhaust emission standards are to be proposed early in the 1984 calendar year.

Our reasons for this request include the continued depressed state of the medium and heavy truck industry, the increased burden of the cost of compliance and the fact that anticipated standards mandating reductions in NO_x emissions from heavy duty engines and regulating particulate emissions from such engines no longer are projected to take effect on January 1, 1986.

As the Agency previously recognized, engine modifications needed to comply with these anticipated standards also are likely to affect the level of noise emissions from these heavy truck engines. The decline in demand for heavy trucks coupled with the increased penetration of imports has severely reduced our available product development income. The Agency should defer the effective date of the 80 db(A) standard to coincide with that of the NO_x and particulates standards, to spare Ford (and doubtless other manufacturers) from having to divert scarce engineering personnel, and having to incur substantial additional costs that the consumer may have to absorb because Ford would be required to first engineer regulated trucks (including in some cases their engines) to comply with the 80 dB(A) standard by January 1, 1986, and to later re-engineer those same trucks to comply with the same 80 dB(A) standard after the engines have been modified to comply with the anticipated NO_x and particulates standards.

We are submitting this petition at this time because the orderly development of vehicle noise abatement designs to meet a 1986 production schedule requires the immediate allocation of both engineering resources and tooling money. In addition, to avoid repetitious testing, our engineering practice dictates that we use production level (emissions calibrated) engines for our noise control development. We urge you to give favorable and expeditious consideration to this petition.

If you or your staff would like to discuss any aspect of this petition further, please contact me or Mr. Donald R. Buist, Director, Automotive Emissions and Fuel Economy Office at (313)594-0842.

Sincerely,

H. O. Petrauskas

H. O. Petrauskas

Enclosure

PETITION OF FORD MOTOR COMPANY

FOR AMENDMENT OF EFFECTIVE DATE OF LOW SPEED SOUND EMISSION

STANDARD FOR MEDIUM AND HEAVY TRUCKS -

40 C.F.R. §205.52(a)(ii)

Ford Motor Company (Ford) petitions the U.S. Environmental Protection Agency (EPA) to defer the effective date of the 80 dB(A) noise emission standard (40 C.F.R. §205.52(a)(ii)) so that it becomes coincident with the effective date of the heavy duty engine NO_x and particulate exhaust emission standards* which currently are expected to be promulgated by EPA for the 1987/1988 time period.

I. INTRODUCTION AND SUMMARY

Ford is submitting this petition at this time because lead time considerations for the orderly development of vehicle noise abatement designs to meet a 1986 production schedule requires the immediate allocation of both engineering resources and tooling money, both of which are in short supply.

The heavy truck industry, both manufacturers and users (the motor carriers), continues in the worst depression it has experienced since World War II. U.S. factory sales are running at a rate of only 40% of the recent 1974 peak. These reduced sales increase the impact of Ford's cost of compliance in three ways. First, we have a smaller base over which to allocate our fixed costs (engineering, tooling, facilities and launch expenses). Second, income necessary to finance the development of noise abatement hardware must be diverted from other sources and product progams. Third, price increases necessary to cover the additional hardware costs will further discourage truck purchases.

There is, however, a positive side to reduced sales. In assessing the need for the noise standards EPA assumed continued growth in the number of new trucks sold and total trucks in operation. Because the number of noise generating sources have increased much more slowly than projected by EPA, a deferral of the 80 dB(A) noise standard will not significantly affect the public.

In 1982, the Administrator deferred to January 1, 1986 the 80 dB(A) noise standard. The purpose of the deferral was twofold: First, to provide near-term economic relief and second, to permit manufacturers to align and economize the design requirements of the 80dB(A) noise standard with improved fuel economy designs and Federal air emission standards anticipated in the 1986 timeframe. The pertinent rulemaking notices associated with the more stringent air emissions standards are now anticipated to be issued in early 1984. Lead time constraints could dictate the final rules be effective in the 1987 or 1988 timeframe. Consequently Ford is requesting that the effective date of the 80 dB(A) noise standard be deferred to be coincident with the forthcoming emission standards.

* These are the standards referred to in 48 Fed. Reg. 47864, 47916 (October 17, 1983) at Sequence Numbers 242 and 243.

II. Depressed State of the Medium and Heavy Truck Industry

The heavy truck industry continues in the worst depression it has experienced since World War II. U.S. factory sales have declined from the recent peak in 1974 of 450,000 to 184,000 in 1982 (Attachment A). The industry sales rate for the first seven months of this year supports Ford's projection of less than 180,000 sales for the full 1983 calendar year (a 60% reduction from 1974 levels).

The motor carrier industry has just suffered its worst financial results in history, with over 43 percent of ICC-regulated carriers showing an operating loss in 1982. In addition, over 300 major carriers have gone out of business altogether, are in Chapter II bankruptcy, or have reduced or altered service since July of 1980 (See American Trucking Association, Inc., publication entitled "What Is The Industry's Financial Condition?", Attachment B).

In addition to the decline of the total demand for heavy trucks, the threat of the imports has never been so great. Three major heavy truck manufacturers have been acquired by foreign manufacturers in the past two years--Freightliner, White and Mack. Imports have continued to capture an ever-increasing share of the market despite declining volumes in U.S. retail deliveries of medium-heavy (Group 4-7) trucks. As indicated in Attachment C, U.S. retail deliveries of Group 4-7 medium-heavy trucks have declined from 291,000 units in 1973 to 104,000 units projected for 1983--a 65% reduction. In the same period, import share has steadily grown from 0.1% in 1973 to a projected 7.6% of the medium-heavy market projected for 1983 (Attachment D). In the near term we expect import sales to continue to increase.

The results of this decline in total demand and in the market share of domestic manufacturers have been reductions in the domestic work force and "belt tightening" to reduce fixed costs. At Ford this has translated into a 27% reduction of heavy truck engineering manpower since 1978. Industry production facilities are presently operating at 40% of their potential normal output. On August 4, 1980 production at Ford's heavy truck plant in Louisville, Kentucky was reduced from two shifts, producing 28 units per hour, to one shift, producing 23 units per hour--a 60% reduction.

The most dangerous threat facing the U.S. heavy truck manufacturers today is the incursion of the imports. With the limited engineering resources available, new product programs need to be implemented to assure a viable U.S. heavy truck industry. This nation's experience with imports in the passenger car and light truck markets should serve as examples of what can happen if the U.S. heavy truck industry is not adequately prepared with products demanded by the marketplace. Consequently, whenever possible, programs should be planned to assure maximum utilization of the limited engineering resources.

Ford currently offers diesel engines from four suppliers (Caterpillar, Cummins, Detroit Diesel Allison (DDA), and International Harvester) in its trucks above 10,000 pounds GVW. Beginning in the 1986 model year, Ford also will offer mid-range diesel engines designed and manufactured by Ford (Tractor Operations). Due to this engine design and supplier diversity, a very detailed coordination effort is required between Ford and each of its engine suppliers to assure compliance with the noise standard in every configuration. If the effective date of the 80dB(A) noise standard remains at January 1, 1986, two major coordinated design programs will be required. The first program will have to assure that 1986 model year trucks with "interim level" engines meet the 80dB(A) standard. These "interim level" engines will be a combination of carry-over engines and engines with improved fuel economy aimed at increasing sales. The second major effort will involve meeting the noise standard while integrating a new generation of engines designed to meet new NO_x and particulate standards in the 1987 or 1988 model year.

Ford has surveyed its engine suppliers; these state unanimously that compliance with the more stringent NO_x and particulate standards will affect the noise levels of their engines. It appears, however, that the effect will vary--both directionally and in magnitude--from manufacturer to manufacturer and by engine configuration. This will make the task for the truck manufacturer (Ford) extremely complex as it tries to accommodate, on a given truck model, engines which emit more or less noise, than in the previous model year. Compliance with the 80dB(A) noise standard in conjunction with the more stringent emission standards will entail a difficult and expensive program regardless of whether the effective date of the 80dB(A) noise standard is deferred to coincide with that of the new emission standards. The reduced burden resulting from such a deferral would be derived from not having to reduce the noise levels of the interim level engines (either through engine or truck design changes).

The following is a discussion of the various strategies that Ford's engine suppliers are considering as means of complying with the post-1986 (as-yet-to-be-determined) emission standards while minimizing fuel consumption penalties. The directional impacts of these changes on engine noise are also discussed.

Turbocharging

Some engines will be converted from naturally aspirated to turbocharged. Turbocharging can be used effectively to reduce fuel consumption and particulate emissions at an equivalent performance (power) level. It also tends to increase NO_x emissions, which must be offset by some other strategy. Turbocharging tends to reduce engine noise throughout the speed range by increasing the charge air temperature, which increases the end-of-compression temperature and results in a shorter ignition delay. Less fuel is injected into the cylinder during a shorter ignition delay and the spontaneous combustion of this smaller amount of fuel causes a lower initial pressure rise rate, which results in a reduction in noise.

Charge Air Cooling

Charge air cooling is expected to become widely used with the implementation of the revised emission standards. Cooling the charge air after it leaves the turbocharger tends to offset the adverse effect of turbocharging on NO_x. Alternatively, when applied in conjunction with injection timing changes (advance), it can reduce fuel consumption at a given NO_x level. Thus it provides a means of optimizing emissions and fuel economy. Various manufacturers are pursuing the following methods of charge air cooling, listed in order of temperature reduction capability (from lowest to highest):

- Jacket water intercooling
- Low temperature (water) intercooling
- Air-to-air intercooling

Unfortunately, the complexity, expense, and packaging difficulty generally increase in correspondence with the relative effectiveness of the three types of systems.

Charge air cooling generally tends to increase engine noise by increasing ignition delay (the opposite of the effect of turbocharging) which results in steeper initial pressure rise rates. In addition, depending on the configuration and location of the intercooler, it may adversely affect engine cooling (either by adding heat to the coolant or restricting the flow of cooling air from the fan to the radiator. In this case, a larger, deeper-pitched, fan or higher-speed fan may be required, which would tend to increase noise.

Injection Timing

Injection timing retard is very effective at reducing NO_x levels. However, the significant tradeoff with particulates and fuel consumption make it necessary to combine it with other strategies to meet emission standards while maintaining competitive fuel economy. Because of its effect of reducing peak combustion pressure, timing retard generally is expected to reduce engine noise.

Exhaust Gas Recirculation

There has been a general reluctance among heavy-duty diesel engine manufacturers to use EGR to control NO_x due to the potential adverse effects on particulate emissions, lubricant breakdown, and engine durability, and its limited effectiveness at reducing NO_x under conditions close to full load due its tendency to cause excessive smoke. Nevertheless, EGR may see at least limited use in California and possibly in 49 states depending on the NO_x standard and its effective date. Like retarded injection timing, EGR is expected to reduce engine noise through its effect on peak combustion pressure.

Combustion Chamber Improvements

All of Ford's diesel engine suppliers have identified combustion chamber modification as an area they are working on to achieve reductions in emissions and improved engine performance. However, these changes are in early stages of development and have not been tested to determine noise impacts.

Speed Reductions

Ford's suppliers are considering reductions in rated speed over the next several years, primarily as a means of reducing fuel consumption, and offsetting the fuel penalty of reduced NO_x. Speed reduction generally will reduce engine noise; however, this action may require upgrading of driveline components in order to not adversely affect durability.

Electronic Controls

Some heavy-duty diesel engines are likely to employ electronic control of fuel injection to meet the post-1986 reduced NO_x and particulate standards. The opinions of Ford's suppliers are mixed as to the directional effect of electronics on engine noise. If the net effect of electronic control is to provide more overall advance in injection timing than the mechanical system it replaces, then combustion noise may tend to increase. Likewise, if improved fuel control during acceleration allows higher transient fuel rates, transient engine noise may be increased. On the other hand, if noise objectives are integrated into the calibration of the control module, electronic control may provide the capability for scheduling injection timing to reduce noise at critical operating conditions and to rapidly change timing during transients to reduce acceleration noise.

Particulate Trap-Oxidizer Systems

Although EPA had originally proposed a "trap-forcing" particulate standard for heavy-duty diesel engines beginning in the 1986 model year, we now believe the Agency will propose a particulate standard that can be met on an "engine-out" basis, because trap-oxidizer systems are not feasible for heavy-duty engines in the 1987/88 time frame. If and when these systems come into use, they may tend to reduce exhaust noise when they are in a collection mode. Noise levels during regeneration have not been assessed and would depend on the mechanism used for regeneration.

Based on the above, the net effect on noise of the changes made to engines in order to meet the revised emission standards will differ from engine model to engine model. We expect that some engines will tend to emit less noise than their predecessors, while others will emit more. The latter engines will require additional noise abatement features such as cylinder block side covers, isolated oil pans, etc., or additional vehicle shielding. A deferral of the effective date of the 80dB(A) standard to coincide with the revised emission standards would save Ford and its customers significant costs in either case. In the case of an engine

where revised emission control will reduce noise, the deferral will result in savings of noise abatement equipment and design costs in both the near term and the longer term by permitting the beneficial impact of the emission-related changes to be integrated with the design of the vehicle. In the case of an engine where the emission-related changes will have a net adverse effect on engine noise, the deferral of the noise standard would result mainly in near-term savings by enabling engine and truck manufacturers to forego the design and installation of additional noise reduction equipment on (and around) the "interim level" engine. This would free up resources to concentrate on reducing the noise level of the post-1986 low-emission engine.

V. PUBLIC INTEREST CONSIDERATIONS

Ford believes that the public will not be harmed by deferral of the 80 dB(A) standard. An EPA analysis (detailed below) shows that truck noise passby levels would drop by only 1.2 dB(A) in going from the 83 dB(A) standard to the 80 dB(A) standard. The following table, taken from EPA background document 550/9-76-008, shows the minimal incremental benefit which would be gained by enforcement of the 80 dB(A) standard.

Percentile Noise Levels for Individual Truck Passbys
(Ref: Page 4-37, Table 4-20)

	Percentile Passby Noise Levels			
Truck Type	L50	L10	L1	L0.1
Existing Trucks	83.5 dBA	88.2 dBA	91.8 dBA	94.9 dBA
83 db(A) Regulated Trucks	77.2 dBA	79.1 dBA	80.5 dBA	81.8 dBA
80 dB(A) Regulated Trucks	76.0 dBA	77.9 dBA	79.3 dBA	80.6 dBA

It should be noted that going from the unregulated environment to 83 dB(A) regulated trucks dropped the L10, L1, and L0.1 (10%, 1%, and 0.1% percentile trucks) noise levels 9.1 dB(A), 11.3 dB(A), and 13.1 dB(A) respectively. Additional regulation to 80 dB(A) drops each of the L10, L1, L0.1 levels only an additional 1.2 dB(A).

In setting the standards, EPA assumed continual growth in the number of new trucks sold and in the number of total trucks in operation. Modeling projections in the original rulemaking background document used a growth rate which ranged from 1.5% for medium trucks to 5.0% for heavy diesels. More recent studies (National Exposure to Highway Noise Through the Year 2000, Wyle Research July 1979) used an average growth rate of 2.4%. Although showing a continual decline in the overall market, EPA's market projections (published as Figures A-5, A-6 and A-7, 46 Fed. Reg. 8510-8512, January 27, 1981) in the first deferral of effective dates were still more optimistic than the present trend.

Attachment E is a summary of the most recent Automobile Manufacturers Research Council compilation of manufacturer and supplier forecasts of the U.S. domestic industry sales of heavy trucks in 1983 through 1985 calendar years. Truck manufacturers are more "bullish" in their forecast of an industry recovery than are suppliers and Ford is the most optimistic. U.S. domestic industry sales through August 1983 are running at a seasonally adjusted rate of 186,000 units which is slightly more than the average of the truck manufacturers forecast of 180,000 and right on Ford's 185,000 projection. Industry forecasts beyond 1985 are not available. Ford's projection beyond 1985 indicates a small increase of about 0.6% in each of calendar years 1986, 1987 and 1988.

Consequently, the magnitude and conditions of use of medium and heavy trucks are likely to not achieve the levels projected by EPA in their benefit analysis until a much later time.

V. COST OF COMPLIANCE

The cost of compliance impacts both truck manufacturers and the truck users. The manufacturer must allocate engineering manpower and development budget which could better be utilized on more functional product programs as well as absorb the lost sales and profit potential associated with price increases necessary to recover the added cost of the noise abatement hardware. The truck user must contend with higher initial cost as well as continuing higher maintenance costs imposed as a result of the installation of sound barriers. Ford does not have any new estimates of incremental maintenance costs which have not already been supplied to the Agency in responses to Docket 81-02 (particularly the Motor Vehicle Manufacturers Association of the United States (MVMA) response, Document 81-02-25 dated 4-22-81 and incorporated herein by reference).

Ford's estimates of the incremental cost impact of implementing the 80 dB(A) standard compared to the 83 dB(A) standard are shown below in terms of the cost penalty per truck.

Truck Category	Cost per Truck (Retail Price Equivalent) 1986 (Dollars)
Gasoline	$ 135
Mid-Range Diesel	$ 416
Premium Diesel	$1100
Average Heavy Truck	$ 416

These estimates are somewhat lower than those provided to EPA in our response to Docket 81-02 on April 24, 1981 due to the following revisions:

Gas Engine - Some of the major cooling and exhaust system revisions are currently assumed not to be required.

Mid-Range Diesel - The naturally aspirated Caterpillar 3208 engine will continue to be available and the cooling system will not require revisions. In addition, double wall exhaust pipes have been incorporated into current production, and therefore the cost increase for such incorporation no longer appears in our estimate.

Premium Diesel - Variable costs reflect current quotes. Intake system revisions will not be required. The transmission modifications to reduce gear noise and the improvements in exhaust system mounting have been incorporated into current vehicles, and therefore the cost increases for these changes do not appear in our estimate.

Additionally, the investment required to implement the 80 dB(A) hardware changes is approximately $10 million (1983 dollars). This investment does not include $1.4 million which represents the net additional engineering expense that would be incurred to redo the 80 dB(A) noise program in conjunction with the 1987/88 diesel emissions program.

VI. STATUTORY AUTHORITY

The Noise Control Act requires that the Administrator set noise emission standards ..."requisite to protect the public health and welfare taking into account the magnitude and conditions of use of such product (alone or in combination with other noise sources), the degree of noise reduction achievable through the application of the best available technology, and the cost of compliance." The Administrator is also required to give appropriate consideration to standards under other laws designed to safeguard the health and welfare of persons, including pertinently any standards under the Clean Air Act. 42 U.S.C. §4905(c)(1). The Administrator is authorized to revise any regulation containing such a standard. 42 U.S.C. §4905(c)(3).

In 1982, the Administrator granted under this statutory authority a three year deferral to January 1, 1986 of the 80 dB(A) noise standard. In doing so, the Administrator stated in pertinent part:

> "In consideration of the present economic state of the truck industry and the potential interrelationship of design changes that may be required to meet the 80 dB standard with technological innovations now being considered to reduce exhaust emissions and improve fuel economy, the Administrator has concluded that an additional three-year deferral of the 80 dB standard for medium and heavy trucks to 1986 is appropriate. Thus, the purpose of this deferral is twofold: First, to provide near-term economic relief to the truck industry by allowing them to temporarily divert those resources that would otherwise by used to comply with the 1983 80 dB standard to help meet their near-term economic recovery needs, and second, to permit manufacturers to align and economize the design requirements attendant to the 80 dB standard with improved fuel economy designs and Federal air emission standards anticipated in the 1986 timeframe. (47 Fed. Reg. 7186 (February 17, 1982)).

In view of the increasingly depressed economic conditions of the medium and heavy truck industry and the anticipated changes to heavy-duty exhaust emissions standards, Ford believes an additional delay in the effective date of the 80 dB(A) standard is warranted at this time.

VII. CONCLUSION

Ford submits that the foregoing facts and reasons demonstrate conclusively that the effective date of the 80 dB(A) standard ought to be deferred to coincide with the effective date of the forthcoming heavy truck NO_x and particulate emission standards. Such action is therefore respectfully requested. We also respectfully request expeditious action on this petition. As shown in Attachment F, unless the current effective date of January 1, 1986 is promptly deferred, we shall have to allocate engineering resouces and tooling money in order to meet that date, regardless of the ultimate ruling on our petition.

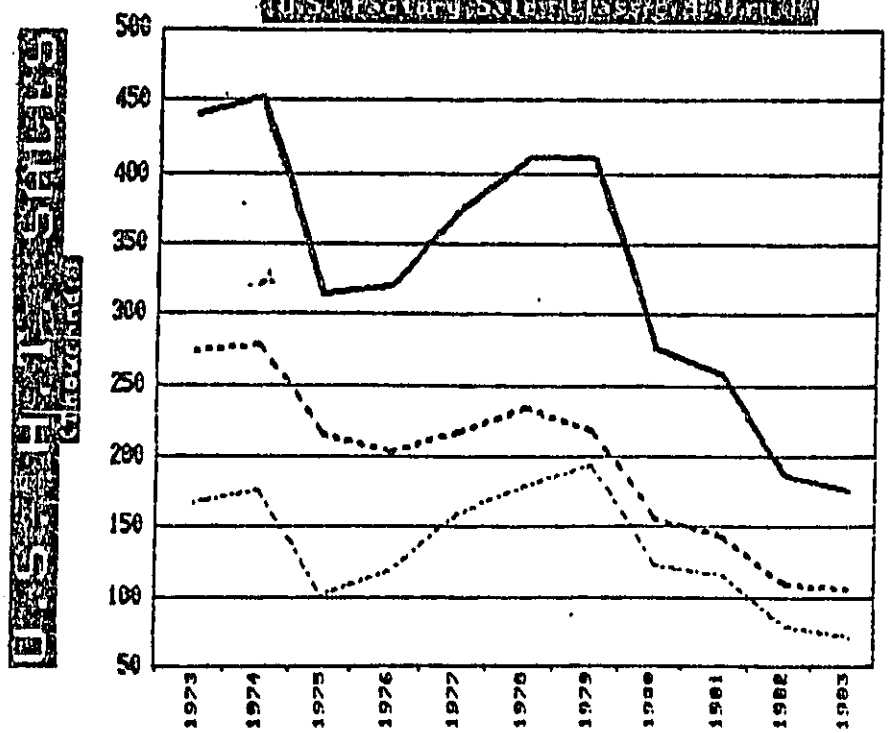
4/310/j

Attachment A

9/6/83

H.D.T. INDUSTRY VOLUME

U.S. Factory Sales (Thousands)



LEGEND:

US TOTAL SALES

MED. HUY. (4-7)

EXT. HUY. (8)

NOTES:

1. SOURCE: MVMA FACTS AND FIGURES '83 (Page 12)

What is the industry's financial condition?

• CONTINUED FINANCIAL AND BUSINESS DECLINES FOR ICC REGULATED MOTOR CARRIERS OF PROPERTY IN 1982 PRODUCE WORST YEAR IN HISTORY

The motor carrier industry in 1982 suffered its worst financial results in history, seeing its composite operating ratio (operating expenses as a percent of gross revenues) rise to 98.29 and its income after tax margin fall to one-half of one percent (50 cents per $100.00 of revenues). The 1982 results reflect a trend in deteriorated earnings and financial health that has been unending since 1977, and the present dismal results eclipse those of 1960, the previous low point in industry earnings.

With declines experienced in all quarters of 1982 from the comparable quarters of 1981, the 1982 results show a significantly deteriorated industry position. Based on 497 Class I and II carrier submissions to the ICC, tonnage of 292.88 million in 1982 was off 10.79 percent from 328.30 million tons in 1981. Vehicle miles declined 7.17 percent to 9.19 billion from 9.90 billion miles.

Revenues for the 497 carriers totalled $19.34 billion, a decline of 5.76 percent from $20.52 billion in 1981. Expenses declined to $19.01 billion from $19.78 billion. Since the expense decline of 3.88 percent was less than the revenue slippage, net carrier operating income fell -- to $329.84 million from $745.64 million, or by 55.76 percent. Ordinary income before taxes fell by 64.84 percent to $227.11 million from $646.22 million. With income taxes taking over 57 percent of these earnings, ordinary income after taxes was $97.56 million in 1982, 75 percent lower than the 1981 earnings of $393.83 million. The full year

(over)

1982 operating ratio was 98.29, compared to 96.37 in 1981, and the profit margin was 0.50 percent (50 cents for every $100.00 of revenues) compared to 1.92 percent in 1981.

For the year as a whole, 40 percent of the individual carriers had operating ratios of 100 or above, indicating operating losses. Based on final net, almost 43 percent of the carriers ended 1982 with a net loss. In the fourth quarter of 1982 specifically, 59 percent of all carriers experienced losses in operating their trucking business. This is in addition to the 300 major carriers (employing 55,800) which have gone out of business altogether, are in Chapter 11 bankruptcy or have reduced or altered service since July of 1980.

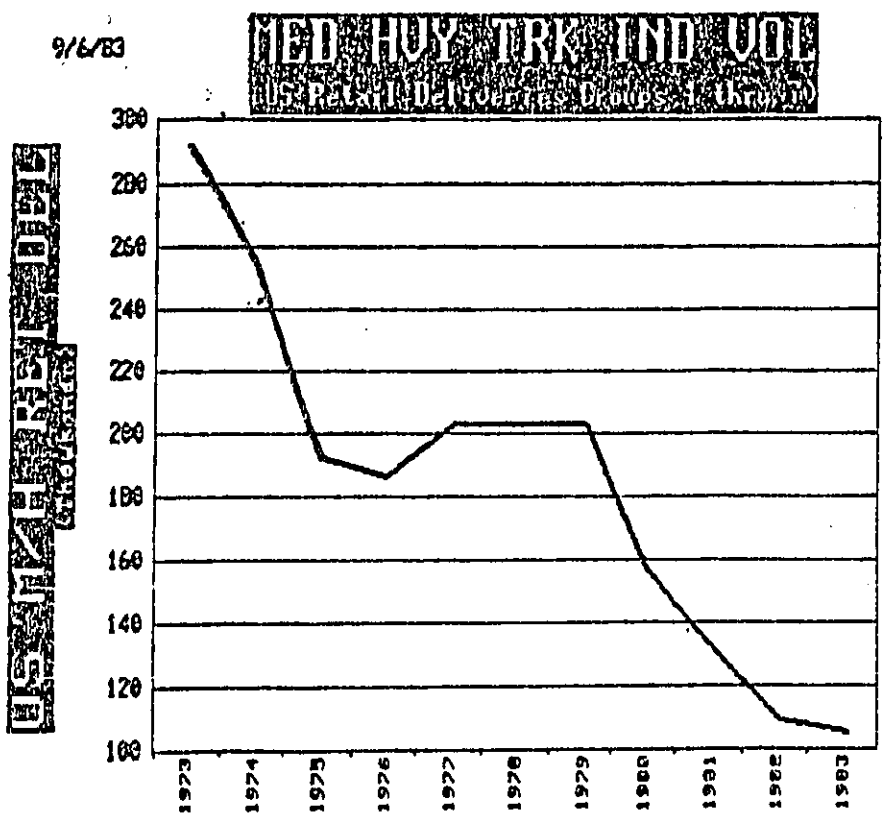
Of the top 100 carriers by revenue, 45 had net losses in 1982. The profit margin of these firms was 0.42 percent and their return on equity was 2.19 percent in 1982 compared to 11.10 percent in 1981.

April 1983

American Trucking Associations, Inc.

Attachment 6

9/6/83



LEGEND:

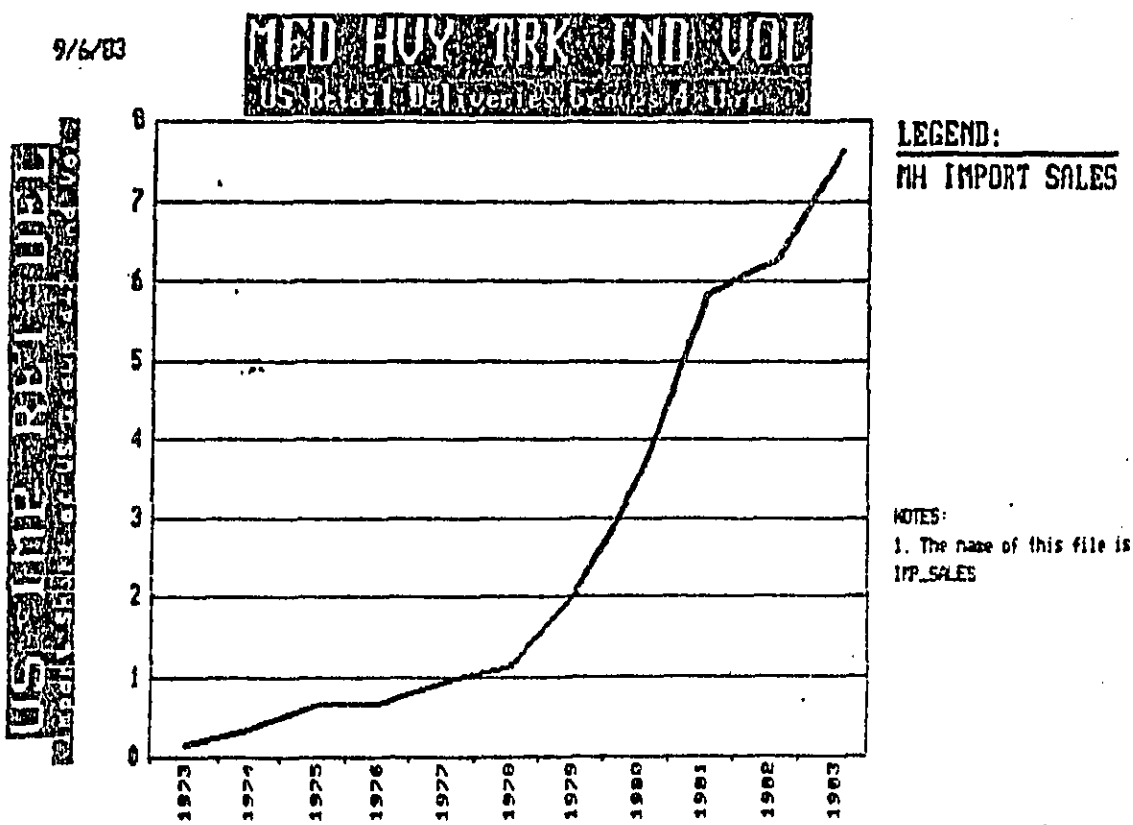
TOTAL M/H SALES

NOTES:

1. The name of this file is MHL_SALES

Attachment D

9/6/83



LEGEND:

MH IMPORT SALES

NOTES:

1. The name of this file is IMP_SALES

Attachment E

TOTAL HEAVY TRUCK INDUSTRY VOLUME FORECASTS

JULY 1983

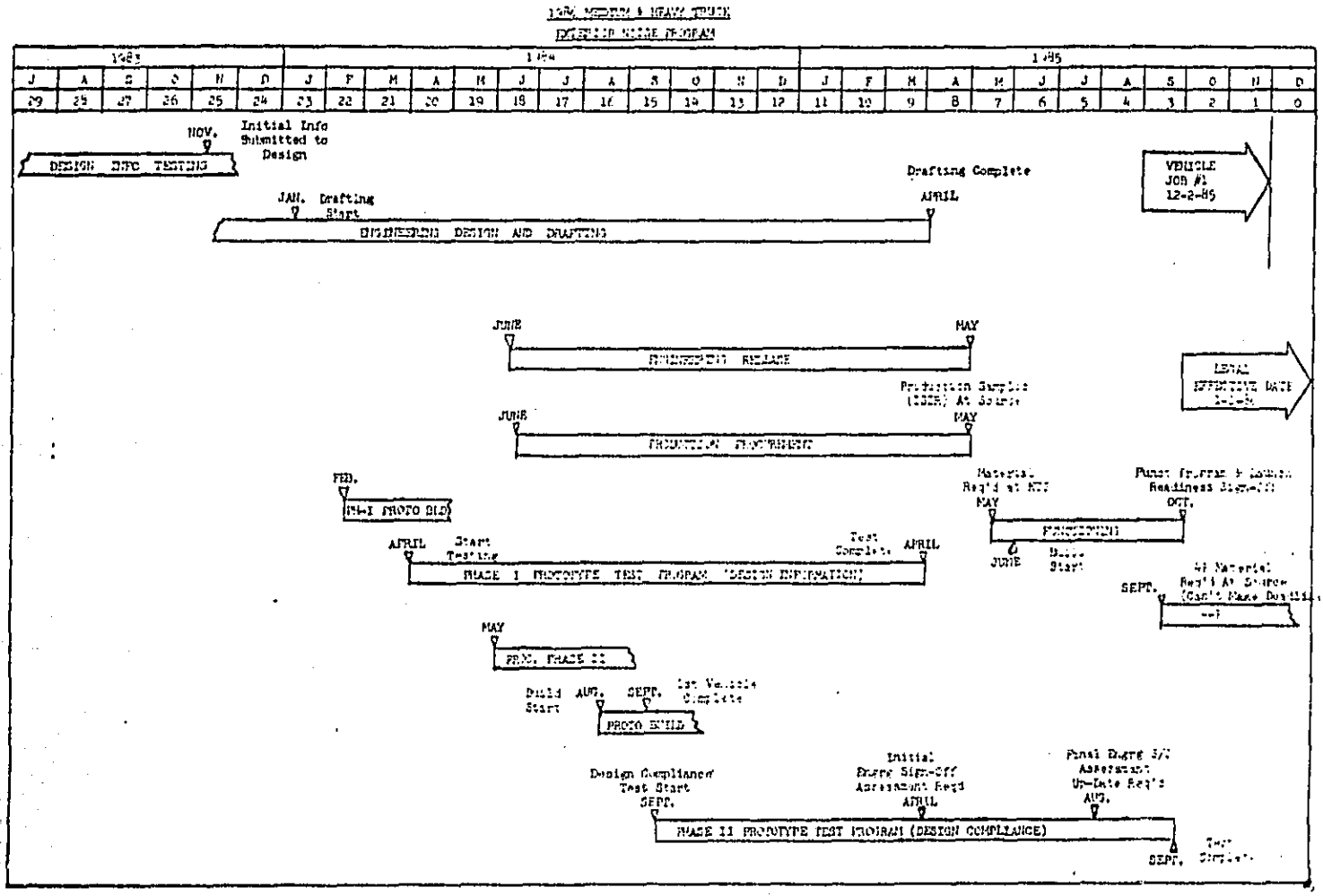
	U.S. Domestic Industry Sales (000)								
	Group 5-7 Medium/Heavy			Group 8 Extra-Heavy			Total Heavy		
	1983	1984	1985	1983	1984	1985	1983	1984	1985
Manufacturer									
Ford	110.0	150.0	198.0	75.0	90.0	122.0	185.0	240.0	320.0
GMC	114.7	122.4	149.4	74.3	102.7	140.0	189.0	225.1	289.4
IHC	102.3	126.1	136.4	80.8	111.6	132.4	183.1	237.7	268.8
Mack	103.2	119.1	129.3	69.7	97.9	126.3	172.9	217.0	255.6
White	95.5	115.0	133.0	71.0	105.0	125.0	166.5	220.0	258.0
Freightliner	101.0	116.0	140.0	81.0	98.0	128.0	182.0	214.0	268.0
Average	105.0	125.0	145.0	75.0	100.0	130.0	180.0	225.0	275.0
Ford Over Other Manufacturers							5.0	20.0	50.0
Supplier									
Bendix	96.7	101.5	106.6	77.0	96.2	110.7	173.7	197.7	217.3
Federal Mogul	96.3	124.0	137.5	71.0	80.8	101.3	167.3	204.8	238.8
Eaton	106.1	123.5	136.0	76.0	110.5	130.0	182.1	234.0	266.0
Rockwell	94.0	105.8	143.1	73.6	93.7	127.7	167.6	199.5	270.8
TRW	97.8	110.5	136.0	72.3	102.0	140.3	170.1	212.5	276.3
Clark	-	-	-	-	-	-	175.0	211.0	262.0
Caterpillar	96.9	101.7	106.8	69.0	89.3	110.5	165.9	191.0	217.3
DDA	107.5	125.7	147.2	71.0	89.8	105.9	178.5	215.5	253.1
Average	100.0	115.0	130.0	75.0	95.0	120.0	175.0	210.0	250.0

TVCAP - 9/13/83
CEW/hmb/37c

Federal Exterior Noise Program
(Legal Effective Date - January 1, 1986)

PROGRAM TIMING ELEMENTS

Mos. Before Job #1	Calendar Date	Element
0	Dec - 85	Job #1
		. First unit off production line . Staged one month ahead of legal effective date
6	Jun - 85	Manufacturing Proveout
		. Training unit builds . Verify process description/sequence and bills of material . Develop manufacturing aids . Test production tooling and facility revisions . Procure production supply . Determine incoming parts quality and supplier process capability
8	Apr - 85	Engineering Sign-Off
		. Establish compliance to legal req'mts and internal objectives . Test and develop attenuation capability of noise abatement hardware . Confirm durability/reliability of noise hardware and associated subsyster and component changes . Assure appropriate function, service-ability and heat protection for affected vehicle systems
16	Aug - 84	Prototype Build
		. Build engineering test units to production release design level using components produced on experimental tools
19	May - 84	Prototype Procurement
		. Issue procurements for prototype material and tools based on engineering detail drawings and system layouts
23	Jan - 84	Drafting/Design Start


1984
1985
NOV.
Initial Info Submitted to Design
DESIGN INFO TESTING
JAN. Drafting Start
Drafting Complete
APRIL
ENGINEERING DESIGN AND DRAFTING
VEHICLE JOB #1 12-2-85
JUNE
MAY
Production Samples (USER) At Source
FEB.
PHASE I PROTO BLD
APRIL
Start Testing
Test Complete
PHASE I PROTOTYPE TEST PROGRAM (DESIGN DEFINITION)
Material Req'd at MTC
MAY
JUNE
Build Start
OCT.
SEPT.
MAY
PROD. PHASE II
Build Start
AUG.
SEPT.
1st Vehicle Complete
PROTO BUILD
Design Compliance Test Start
SEPT.
Initial Prove Sign-Off Assessment Reqd
APRIL
Final Prove S/O Assessment Un-Late Req'ts
AUG.
PHASE II PROTOTYPE TEST PROGRAM (DESIGN COMPLIANCE)
SEPT.