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ITEM 28

ANALYSIS OF THE HEALTH AND WELFARE AND ECONOMIC IMPACTS OF REVISION OF THE INTERSTATE MOTOR CARRIER NOISE STANDARD COINCIDENT WITH A 2-YEAR DELAY IN THE 80dB MEDIUM AND HEAVY TRUCK NOISE STANDARD

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OFFICE OF AIR AND RADIATION
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ANALYSIS OF THE HEALTH AND WELFARE AND ECONOMIC IMPACTS OF REVISION OF THE INTERSTATE MOTOR CARRIER NOISE STANDARD COINCIDENT WITH A 2-YEAR DELAY IN THE 80 dB MEDIUM AND HEAVY TRUCK NOISE STANDARD

INTRODUCTION

Under the authority of the Noise Control Act of 1972 (Public Law 92-574) (amended by the Quiet Communities Act of 1978) the Environmental Protection Agency promulgated two key noise regulations for trucks:

The Noise Emission Standards for Motor Carriers Engaged in Interstate Commerce (40 CFR Part 202) effective October 15, 1975; and the Noise Emission Standards for Medium and Heavy Trucks (40 CFR Part 205, Subparts A and B) effective January 1, 1978. For brevity, these regulations are referred to in this document as respectively, the IMC (for Interstate Motor Carrier) and the MHT (for Medium and Heavy Trucks) regulations.

The IMC regulation set two noise standards for trucks used in interstate Commerce: a low-speed limit of 86 decibels and a high-speed limit of 90 decibels. The MHT regulation set a not-to-exceed noise standard of 83 decibels (measured in a low-speed acceleration test) effective January 1, 1978, and a reduced limit of 80 decibels, effective January 1, 1982.

As a result of various economic developments and associated industry comments submitted in response to President Carter's initiatives to minimize the burden of regulations, in 1980, the EPA Administrator made a decision to defer the effective date of the MHT 80 dB standard to January 1, 1983.

Subsequent contentions by the industry that economic efficiences would be achieved by making the 80 dB MHT standard coincident in time with updated exhaust emission standards for trucks led to further deferral of the 80 dB standard to June 1, 1986.

Recently it has become apparent that the revised exhaust emission standards originally scheduled for 1986 would not be promulgated in time for 1986 effectivity. Instead, current projections are for a January 1, 1988 effective date for the updated exhaust emission standards. Accordingly, the industry has petitioned for further deferral of the 80 dB MHT standard to retain coincidence with the exhaust emission standards.

Recognizing the logical consistency of this petition, the Agency is proposing to defer the 80 dB standard further, to January 1, 1988. In reviewing the Health and Welfare impact of this further deferral of the MHT standard, the Agency finds that there is a modest, but significant loss of benefits. At the same time, the Agency has experienced a renewed awareness of its obligation under the Noise Control Act to update the IMC noise standard to reflect "best available (noise control) technology." Available data on the noise levels of in-use trucks suggests that lowering the IMC noise limits to achieve consistency with the MHT 83 dB standard would provide some improvement in the noisiest portion of the truck fleet. Such improvement in turn is expected to provide health and welfare benefit gains that would compensate at least in part for the benefit losses expected from the MHT deferral.

This analysis examines both the economic and the health and welfare impacts of the proposed regulatory actions. It presents the economic effects of these changes in reducing industry costs and the changes in health and welfare benefits resulting from the revised regulations.

SUMMARY OF PROPOSED REGULATORY ACTIONS

The proposed regulatory changes are as follows:

- Medium and Heavy Truck Noise Regulation
- The 80 dB (low speed acceleration test) standard originally scheduled to become effective on January 1, 1986 is deferred to January 1, 1988 (coincident with the new exhaust emission standards)
- Interstate Motor Carrier Noise Regulation

  The standards, for trucks manufactured in 1978 or later, are revised as shown:

  Low-speed test - reduced from 86 dB to 83 dB
  Stationary test - reduced from 90 dB to 87 dB
  High-speed test - reduced from 90 dB to 87 dB

BACKGROUND

During consideration of the Noise Control Act of 1972, the truck industry lobbied Congress very heavily to obtain relief from an increasing proliferation of differing noise emission standards by States and local governments. These local regulations affected both manufacturers of new trucks and users of these trucks.

The intent and ultimate effect of regulations promulgated by the Agency under Section 17 of the Noise Control Act was to provide preemption of State and local noise limits for trucks engaged in interstate commerce and afford interstate motor carriers uniformity of treatment on a nationwide scale while giving some protection to citizens from the noise of these vehicles. However, the establishment of not-to-exceed noise emission levels for in-use trucks engaged in interstate commerce was necessarily restricted because of the age range of the trucks (from new to approximately 25 years) which are typically used in interstate transport. Therefore, this "in-use" regulation (Section 17) served primarily as a cap on their maximum noise emissions by basically eliminating the use of pocket retread tires which were a major source of truck noise, and ensured that the trucks did not operate on the Nation's highways with defective exhaust systems. EPA studies showed that further reductions for interstate motor carriers would require costly noise abatement retrofits to in-use vehicles, even though many of these vehicles had limited remaining useful lives.

It was evident from EPA's studies that the most cost-effective way to provide the Nation's population with the protection they desired and sought through State and local ordinances, and yet avoid unreasonable cost burdens on the Nation's interstate motor carriers and consumers, was to insure that noise abatement features were designed into trucks rather than added on at some later date. Congress had recognized the need for such an approach to noise abatement in writing Section 6 of the Noise Control Act. Section 6 directs the Administrator of EPA to issue not-to-exceed noise emission regulations for newly-manfactured products entering commerce; surface transportation vehicles are specifically identified. Thus, in promulgating noise emission limits for newly-manufactured medium and heavy trucks, the Agency intended to provide protection to the Nation's population from the single most pervasive noise source that could jeopardize their health and welfare while at the same time affording the trucking industry (manufacturers and users) the protection of uniform regulatory treatment across State lines.

Section 6 of the Noise Control Act directs the Administrator to set noise emission standards protective of public health and welfare, based on best available technology, taking cost into consideration. The Agency determined that the most cost-effective reductions in the noise emissions of newly-manufactured trucks would be achieved through incremental reductions scheduled to match the four year design cycle typical of most manufacturers. Although noise abatement technology was available in 1975 to produce a 75 decibel truck, the Administrator elected to defer the establishment of this stringent level until the Agency could assess the attendant costs with a higher level of confidence based on the industry's experience in reducing the noise level of trucks to the less stringent intermediate levels. Consequently, the Administrator required the first step of noise reduction by setting the noise limit* at 83 decibels, to

*This was a not-to-exceed limit of truck noise level measured by a specified procedure based on a low-speed acceleration test.

be effective January 1, 1978. This level was approximately 2 dB below the average noise level of the trucks in operation in 1974. Essentially, the 83 dB regulation did little more than induce all manufacturers to use moderately improved mufflers in their new production trucks.

The second level of stringency was set at 80 decibels to become effective January 1, 1982. The 3 dB reduction in emission levels from 83 dB to 80 dB is equivalent to reducing truck traffic by 50 percent (if all trucks in operation were so quieted). The industry was generally supportive of the regulation since it was less stringent than the noise emission levels being imposed by many State and local governments. The Agency indicated in the regulation that a more stringent level (such as 75 dB) would be promulgated in time for the 1985 model trucks based on a reassessment by the Agency of available technology and attendant costs.

The promulgation of the Interstate Motor Carrier Noise Emission Regulation (40 CFR 202, Subparts A & B) has preempted State and local governments from enacting or enforcing in-use noise emission levels on interstate motor carriers that are different from the Federal levels. Similarly, the Federal noise emission regulation for newly-manufactured medium and heavy trucks (40 CFR 205, Subpart A & B) preempts all State and local regulations (for new trucks) that are not identical to the Federal rule.

In the summer of 1980, former President Carter invited the automotive and truck industry to identify those Federal regulations which they believed would have an adverse economic effect on their industries. The 80 dB noise emission standard for medium and heavy trucks, which was to become effective January 1, 1982, was identified by several truck manufacturers as being potentially burdensome. Truck manufacturers were already complying with the 83 dB limit which had become effective in 1978.

By November 1980 the Agency had received three requests to defer the effective date of the 80 dB regulation by two to three years. The Agency also received two formal petitions requesting that the 80 dB regulation be rescinded. Such action would permit the noise level of new trucks to remain essentially at the 83 dB level, not far below the pre-regulation level of 1974. After careful review of the data submitted by the manufacturers in support of their requests, former Administrator Costle determined that:

- The costs attendant to the 80 dB regulation were commensurate with the anticipated benefits to public health and welfare.
- The industry had not made an adequate case for rescission of the regulation.
- Economic forecasts and market projections based on truck industry statistics did not dictate a need for extensive delays in the effective date of the 80 dB regulation.

However, in light of the depressed economic condition of the automotive industry as a whole and the reduction in truck sales during the 1979-1980 time frame, a decision was made to defer the effective date of the 80 dB regulation by one year until January 1, 1983. In light of economic forecasts that predicted a significant gain in truck sales in 1983, it was believed that this additional year would provide time to the industry to recover and ease possible cash-flow problems that several manufacturers might encounter in gearing up in 1981 to meet the January 1, 1982 effective date.

The one-year deferral was accompanied by a 90-day public comment period which closed on April 24. On March 19, in conformity with commitments made to Secretary Lewis' Task Force, a second notice was published in the Federal Register that expanded the solicitation for comments to the deferral notice to include comments concerning the possible rescission of the 80 dB standard.

The comments received in response to the Federal Register solicitation break neatly into two opposing groups:

(1) Manufacturers generally contend that the 80 dB standard should be rescinded on the basis that the regulation is not cost-effective. However, the majority of manufacturers support the existing 83 dB truck noise emission regulation because of the preemption that the Federal regulation provides over 10 State and local jurisdictions which, prior to issuance of the Federal rule, had differing noise emission standards for trucks.

(2) State and local governments strongly supported the 80 dB standard and, in some cases, recommended even more stringent regulatory levels. Two States recommended that, in the event of rescission of the 80 dB standard, the entire Federal truck noise regulation should be rescinded, thereby returning to the States the authority to set their own noise standards for trucks.

After thorough review of the various contentions, the Administrator found insufficient basis to rescind the 80 dB MHT standard, but concluded that the cost and economic factors justified deferral of this standard to January 1, 1983.

In early 1981, EPA received a request from the Vice President's Task Force on Regulatory Relief to consider further deferral or rescission of the 80 dB MHT standard. The Agency again found insufficient basis to rescind. However, the Agency concluded that there was merit in deferring the 80 dB noise standard to coincide in time with the effective date of the expected new exhaust emission standards. The rationale was that significant cost savings to both industry and the public would be realized by allowing a coordinated design, engineering and testing effort to incorporate changes needed to meet both the new noise and exhaust emission standards at the same time.

Consequently, in February 1982, EPA published a new revision to the MHT regulation, deferring the 80 dB standard to January 1, 1986. Several States and local jurisidictions opposed further deferral. They argued that the combination of deferral of the MHT 80 dB standard for new trucks and the lenient IMC standards for in-use trucks would have an adverse impact on public health and welfare.

In late 1983 several truck manufacturers submitted petitions for further deferral of the 80 dB MHT standard. These petitions centered on EPA's slippage in issuing the revised standards for exhaust emissions (NO_x and particulates) previously scheduled for 1986. Since the Agency had based its February 1982 deferral of the 80 dB standard to 1986 at least partly on the projected 1986 effectivity of the exhaust emission standards, the petitioners argued that the Agency, to be consistent, should accordingly postpone the MHT 80 dB standard as well.

The petitioners contended that in-use noise levels of trucks built to conform to the 83 dB standard of 1978 range from 77 to 82 dB, and that therefore an additional postponement "would not impose an undue risk to the public's health and welfare." This contention is subjected to a somewhat more quantitative review in the section that follows, on health and welfare impact.

The health and welfare impact analysis also considers the effects of a 3 dB reduction of the IMC limits in 1986, with a view toward assessing the compensatory noise benefits associated with such regulatory action.

AGENCY ANALYSIS

Prior to the promulgation of the Federal medium and heavy truck noise emission regulation in January 1976, the Agency carried out, over a period of two years, an extensive analytical prediction of the Nation's population that is adversely affected by medium and heavy truck noise. Investigations and analyses were also completed on the levels of technology attendant to noise reductions that are requisite to the protection of public health and welfare, the costs associated with various levels of reduction, and the potential economic effects on the industry and the general public.

In response to initial industry requests for deferral and rescission of the 80 dB standard, the Agency's 1974-75 analyses were updated in December of 1980. After the Administrator's decision to defer the effective date of the standard by one year, further updates of the anticipated costs and potential economic effects of the 80 dB standard were carried out incorporating new information from industry and from the Agency's on-going Quiet Heavy Truck Demonstration Program. In response to the most recent industry petitions, the analyses have been updated once again. The details of these updated analyses and the assessment of the cost-effectiveness of the revisions of the MHT and IMC regulations are presented in the following sections.

Health and Welfare Benefits Analysis

Rationale and Model for Health and Welfare Analysis

Through the use of an extensive computer model* that permits assessment of traffic noise impacts by considering the Nation's roadway system and

* This model, known as the "National Roadway Traffic Noise Exposure Model "(NRTNEM) was developed with assistance from the Department of Transportation and the Federal Highway Administration

attendant population distribution, the Agency estimates that in the absence of any regulations or controls, in excess of 95 million persons would currently be exposed to levels of noise from traffic that can jeopardize their health and welfare, and that in the year 2000, in excess of 157 million would be so exposed.

In order to quantitatively assess the potentially adverse impact of truck noise and the effectiveness of possible noise emission regulations, the Agency employs two descriptors as measures of noise impact. One is the Level-Weighted Population (LWP) and the other is the Population Exposed (PE) to a day-night average sound level equal to or greater than 55 decibels ($L_{dn} \geq 55$ dB). These descriptors are explained in subsequent paragraphs.

LWP expresses in a single number both the extent and severity of noise impact. The extent of impact refers to the number of people who are adversely affected, while the severity represents the degree to which each person is affected. Therefore, LWP provides a simple method to compare benefits of different noise reduction options. This method is recommended by the National Academy of Sciences for use in noise impact assessment [1].

In 1973, pursuant to a directive from Congress [2] and based on a large body of evidence, the Agency determined [3] that a day-night average sound level (L_{dn}) value of 55 dB represents the lower threshold of noise that can jeopardize the health and welfare of people. Above this level, noise may be a cause of adverse physiological and psychological effects. These effects also often result in personal annoyance and community reaction. Thus, the PE represents the total number of persons exposed to such noise levels.

Above a daily sound level (L_{eq}) of 70 dB, noise can cause hearing loss. Although studies indicate a link between noise and cardiovascular disease, research has not yet reached the point where we can determine a quantitative dose-response relationship, i.e., what cardiovascular effects occur at what levels of noise. Consequently, these effects are not considered in this analysis.

Computation of the LWP is based on combining the number of people exposed to noise levels above L_{dn} of 55 dB with the degree of impact at different noise levels. For day-night sound levels below 55 dB, it is assumed that no adverse impact occurs. "Full" impact is assumed to occur at a 75 dB day-night sound level. Figure 1 is a pictorial representation of the LWP principle. The circle represents a source which emits noise to a populated area represented by the figures. The partial shading represents degrees of partial impact from the noise source. Those people closest to the noise source are more severely impacted than those at greater distances. The partial impacts are then summed to give the equivalent population that is fully impacted by noise. In this example, six real people are adversely affected to varying degrees (partially shaded) by the noise. The sum of these partial impacts is equated to a Level-Weighted Population that is represented by the two totally shaded figures.

Health and Welfare Benefits of the MHT Noise Regulation

The potentially adverse impacts of surface transportation noise and the potential benefits from noise emission regulations are assessed through the use of the computer model mentioned earlier, known as the "National Roadway Traffic Exposure Model" (NRTNEM). The model allows the determination of noise impacts (in terms of PE and LWP) by vehicle type (i.e., automobiles, medium and heavy trucks, buses, and motorcycles) as a

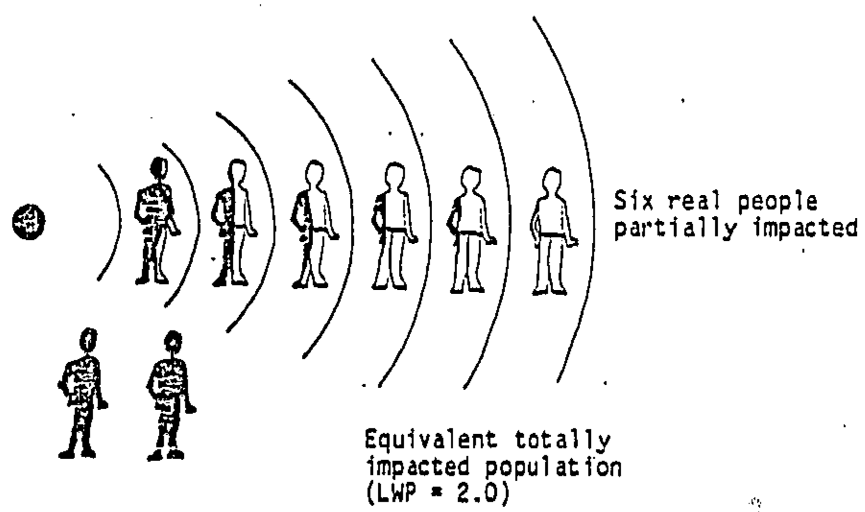


Figure 1. LEVEL-WEIGHTED POPULATION: A METHOD TO ACCOUNT FOR THE EXTENT AND SEVERITY OF NOISE IMPACT

function of time, taking into account the location of people in the vicinity of these roads, and the anticipated growth in both the Nation's population and new vehicle sales. Computations based on this model enable us to determine the potential reductions in LWP and PE (the benefits) for selected regulatory options.

In the absence of noise emission regulations to control surface transportation noise, the number of people exposed to day-night sound levels above L_{dn} of 55 dB (the level above which people are adversely affected by noise) is expected to grow dramatically with time. By the year 2000, the Nation's population is anticipated to increase by 22.5%. Because of the concurrent expected growth in traffic, the population exposed to levels in excess of 55 dB (i.e., the PE) would be expected to increase by 65% over those similarly exposed in 1980; the corresponding increase in LWP would be 73.1%. Thus, without controls on the noise emission of vehicles or an increased application of noise attenuating devices, i.e., highway noise barriers and improved noise insulation of personal dwellings, it is clearly evident that the surface transportation noise impact would worsen continually.

Within the fleet of vehicles operating on the Nation's roadways, medium and heavy trucks (trucks over 10,000 lbs. Gross Vehicle Weight Rating, GVWR) constitute the primary source of traffic noise. Today, noise impacts from trucks account for approximately 73 percent of those people exposed to day-night sound levels above 55 dB. The large contribution that trucks make to the national noise impact results from their high noise emissions compared to those of other vehicles. For example, Federal Highway Administration data [4] show that, under cruising conditions, a medium truck is equivalent in noise intensity to approximately 10 automobiles, while a heavy truck is equivalent to roughly 32 automobiles. Under low-speed acceleration conditions, a medium truck can be equivalent in noise intensity to 35 automobiles, while a heavy truck can be equivalent to 200 automobiles.

To control the growth of the surface transportation noise problem, the Agency, in 1975, promulgated a two-phase noise emission regulation for medium and heavy trucks. The first phase limited truck noise emissions to 83 dB and became effective January 1, 1978. The second phase, originally scheduled to become effective January 1, 1982, but subsequently deferred to January 1, 1986, limits truck noise emissions to 80 dB. Because decibels are logarithmic in nature, a seemingly small decrease of 3 dB actually is equivalent to a halving of the total sound intensity from the noise source.

In the year 2000, we estimate that 157.5 million people would have been exposed to day-night average sound levels (L_{dn}) above 55 decibels in the absence of regulation. The 83 dB standard is expected to reduce the number of people so exposed by 21.6 million to 135.9 million, a reduction of 13.7%. With an 80 dB standard in place effective in 1982, the number of people exposed to L_{dn} above 55 dB is estimated to be 126.7 million, a reduction of an additional 9.3 million impacted people, or 43 percent additional reduction as compared with the 83 dB standard. These results are summarized in Table Ia.

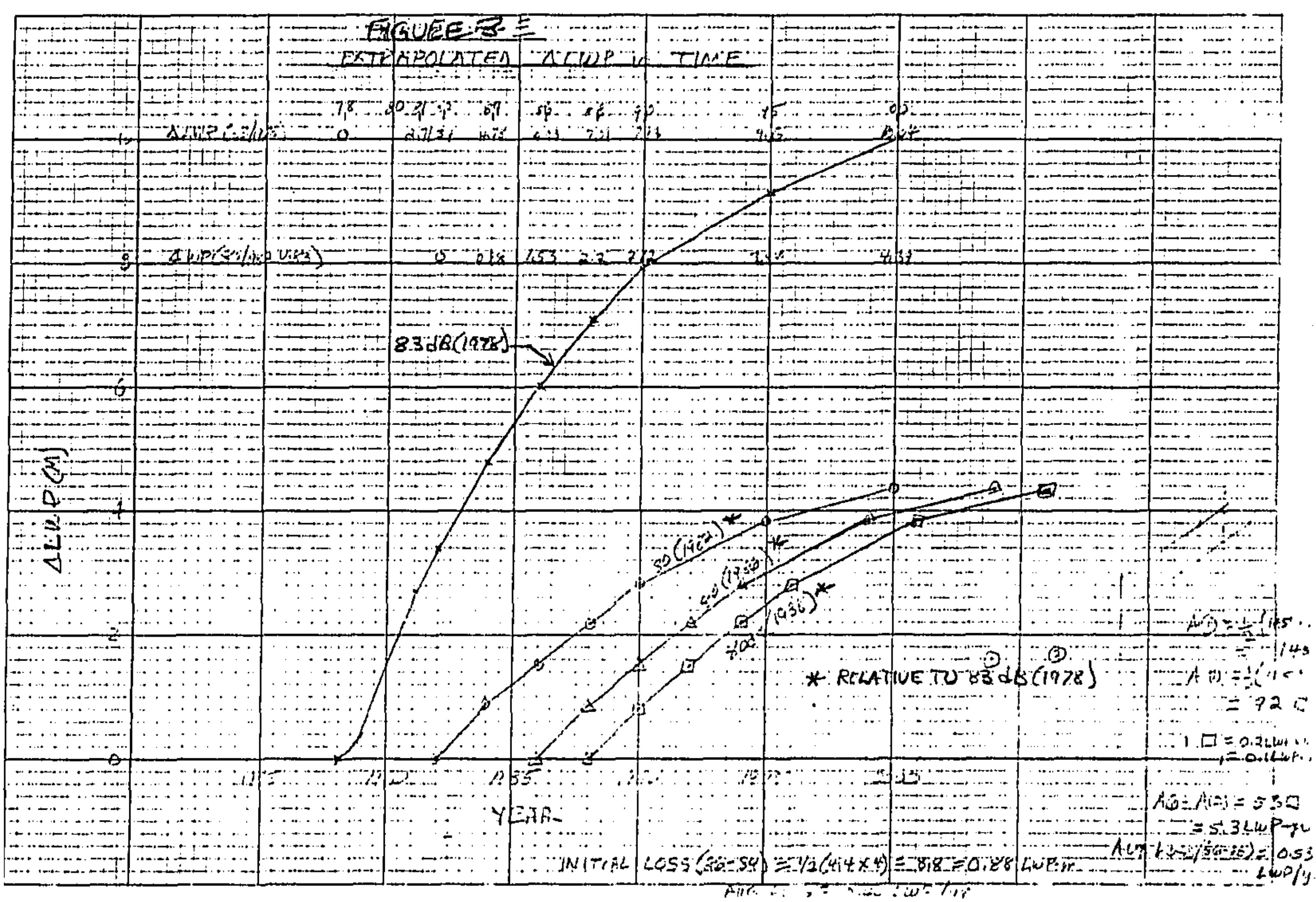
In terms of Level-Weighted Population, the baseline LWP in 2000 in the absence of regulation is estimated to be 52 million. The 83 dB standard is expected to reduce the LWP in 2000 by 10.0 million, a reduction of 19.0 percent. With an 80 dB standard in 1982, the Level-Weighted Population is expected to decrease an additional 4.4 million, or 44 percent of the reduction in LWP obtained with the 83 dB standard; see Table Ib.

Figure 2 show how the effectiveness of the truck noise regulation will increase with time. The area between the 83/80 dB and 83 dB benefit curves represents the incremental benefits that would accrue from the 80 dB standard.

The same data are displayed in a slightly different form in the upper two curves of Figure 3 (for LWP) and the upper curve of Figure 4 (for PE) relative to the 83 dB standard.

A simple way to visualize the effects of delaying the onset of the 80 dB standard is to shift the LWP (or PE) curves in Figures 3 and 4 on the time scale. As a baseline we use the computed results for the 83 dB standard effective in 1978 and the 80 dB standard assumed effective in 1982. These results are summarized in Tables 2 and 3, for PE and LWP, respectively. The curve for "80 dB (1982)" is shifted four years to "80 dB (1986)" by replotting the LWP (or PE) points to the right a distance equal to four years on the time scale, and to "80 dB (1988)" by shifting an additional two years. This procedure introduces a small error, as the LWP (or PE) in 1986 for the same regulatory scenario is slightly different from that in 1982; this difference arises from the differences in both the size of the truck fleet and the U.S. population in those years. Similarly, there are differences between 1986 and 1988. Since the rate of population growth is expected to be rather small, the errors in estimated values of LWP and PE also are expected to be small.

The concern here is to estimate the effect of a two-year delay in the 80 dB standard, from 1986 to 1988. Consequently, the pertinent region to consider is that between the 80 dB (1986) and 80 dB (1988) curves.



EXTRAPOLATED
83dB(1978)
* RELATIVE TO 83 dB(1978)
YEAR

CORRECTION!

THE PREVIOUS DOCUMENT(S) MAY HAVE BEEN FILMED INCORRECTLY . . .

RESHOOT FOLLOWS!

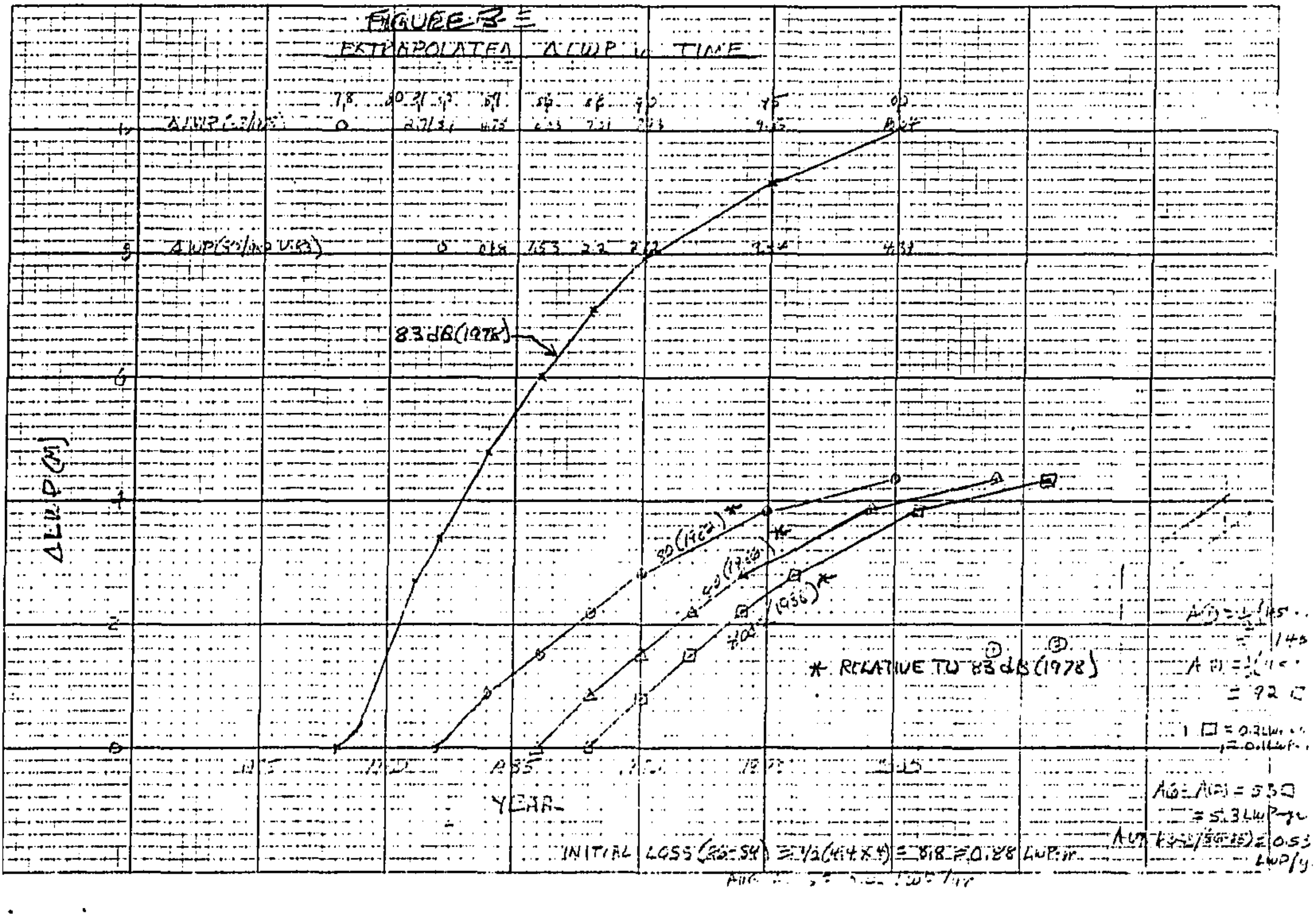


FIGURE 3
EXTRAPOLATED ΔLWP vs TIME
83 dB (1978)
ΔLWP (dB)
YEAR
* RELATIVE TO 83 dB (1978)
INITIAL LOSS

POOR COPY

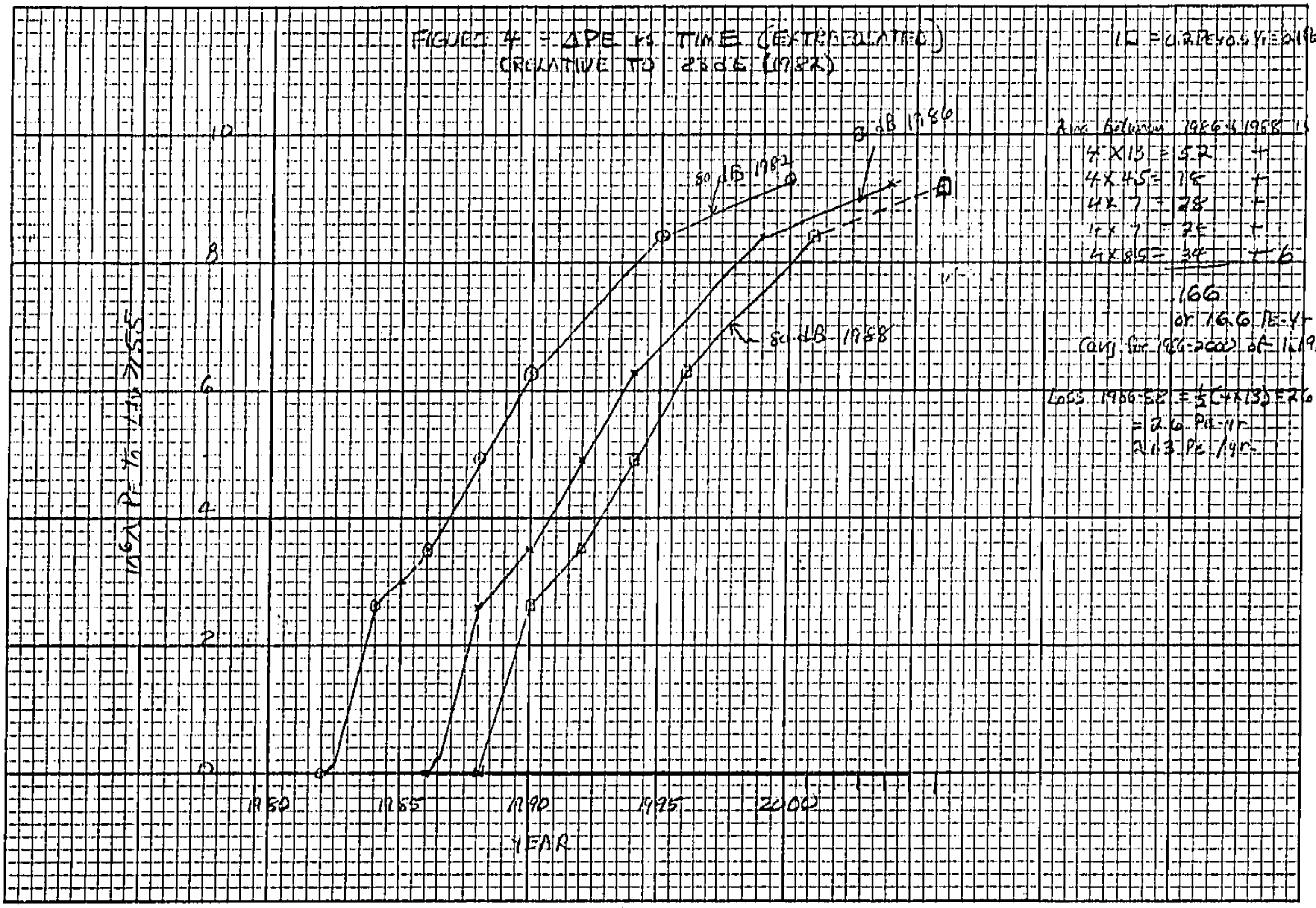


FIGURE 4 – ΔPE vs TIME (EXTRAPOLATED)
(RELATIVE TO 2ΔE (1982)
80 dB 1982
dB 1986
80 dB 1988
4X13 = 52
4X45 = 18
166
or 16.6 PE-yr
= 2.6 PE-yr
10
8
6
4
2
0
1980
1985
1990
1995
2000
YEAR

TABLE Ia AND Ib
BENEFITS OF THE 83 AND 80 dB
TRUCK NOISE EMISSION REGULATIONS

Ia. Population Exposed to $L_{dn} \geq 55$ dB

Regulation	Population Exposed $L_{dn} > 55$, Millions in year 2000	Reduction in Population Exposed, Millions from No Regulation	% Reduction	Incremental % Reduction in Population Exposed
Unregulated	157.48	-	-	-
83 dB	135.93	21.55	13.7%	-
80 dB	126.68	30.80	19.6%	42.9%

Ib. Level-Weighted Population

Regulation	LWP, Millions in year 2000	Reduction in LWP, Millions	% Reduction from no regulation	Incremental % Reduction in LWP
Unregulated	52.76	-	-	-
83 dB	42.76	10.04	19.0%	-
80 dB	38.37	14.43	27.3%	43.7%

FIGURE 2. COMPARISON OF THE BENEFITS, MEASURED IN TERMS OF REDUCTION IN THE LEVEL-WEIGHTED POPULATION FOR THE 83 AND 80 dB TRUCK NOISE EMISSION REGULATIONS

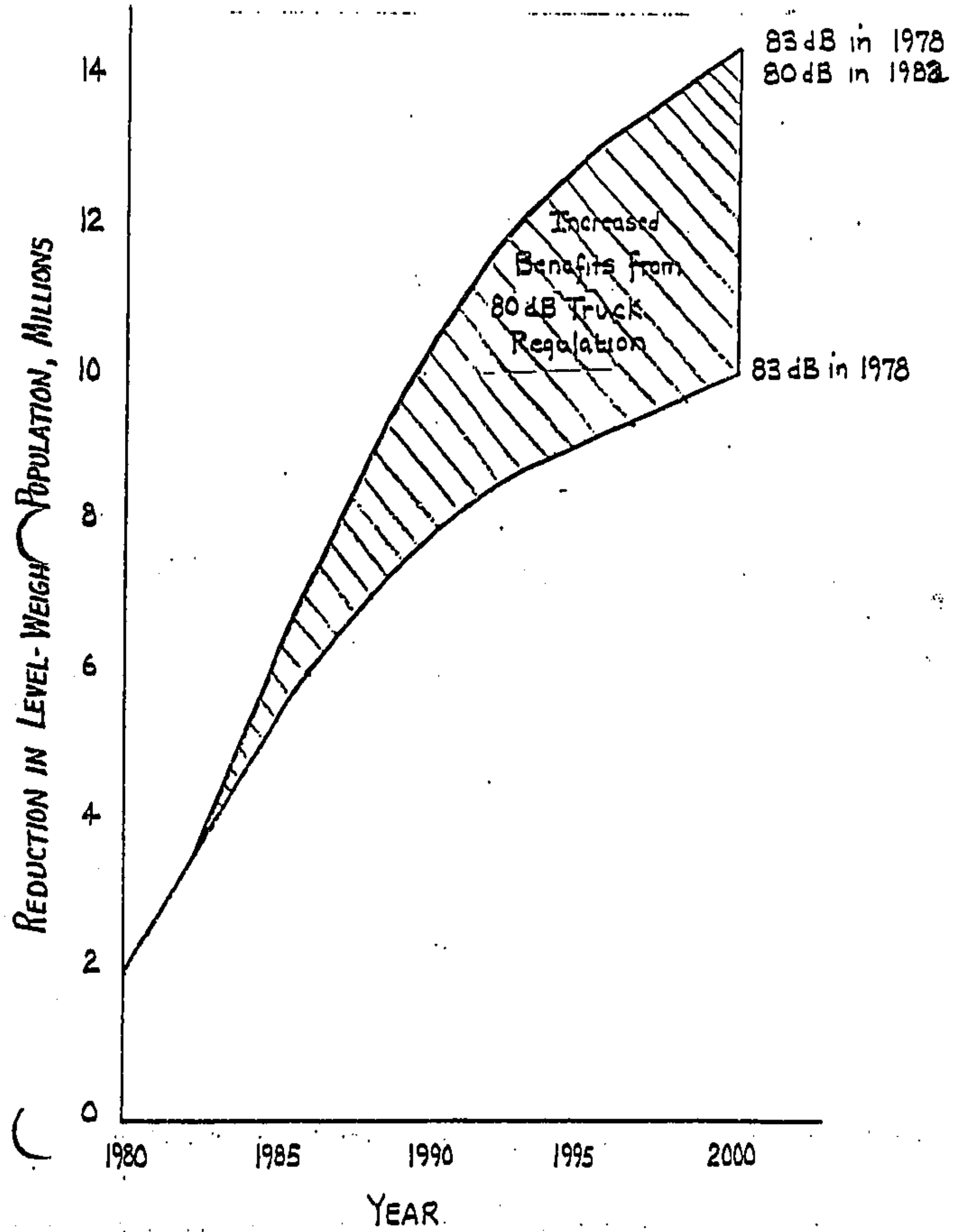


Table 2

Reductions in Population Exposed to Ldn≥ 55 dB (PE) (Millions)
due to MHT standards of 83 dB (1978) and 80 dB (1982)

Year / Standard	1974	1981	1984	1986	1988	1990	1995	2000
83 dB (1978)	--	6.21	10.2	13.5	15.8	17.5	20	21.6
*80 dB (1982)	--	0	2.62	3.49	4.95	6.3	8.4	9.26

Table 3

Year / Standard	1974	1981	1984	1986	1988	1990	1995	2000
83 dB (1978)	--	2.71	4.78	6.03	7.09	7.93	9.19	10.04
*80 dB (1982)	--	0	0.88	1.53	2.2	2.82	3.88	4.39

* relative to an 83 dB standard only.

The area between these curves represents the lost benefits due to the two-year deferral. To the year 2000, the area between the curves is calculated as 16.6 million PE-years, or an average for the period 1986 to 2000 of 1.19 million PE per year. This represents a loss of about 21 percent of the benefit expected from the 80 dB standard if effective in 1986. In the near term, the lost benefit for the two-year period 1986-1988 is calculated as 2.6 million PE-years or an average of 1.3 million PE in each year.

Similarly, we estimate that the loss of LWP due to the two-year deferral is 8.46 million LWP-years, or an average of 604,000 LWP per year over the period 1986 to 2000. This represents a loss of 24 percent of the benefits of 35.54 million LWP-years, averaging 2.54 million LWP per year, expected in that period for a 1986 effectivity of the 80 dB standard.

Health and Welfare Benefit Gains from Revision of the IMC Regulation

From the NRTNEM runs of March 31, 1981, we find the following:

Assumed Noise Levels for the Heavy Truck portion of the fleet (which controls the Noise Exposure) are as follows, for baseline (B/L), 83 dB standard and 80 dB standard.

Condition	H/S	L/S	Fleet Noise Level*(FNL)	Change in FNL
B/L	85.7dB	82.8dB	84.25dB	B/L
83dB std.	83.7	79.4	81.55	2.7dB
80dB std.	82.6	76.7	79.65	1.9dB

(*average of High-Speed and Low-Speed levels)

In the year 2000 (in which we can assume a fleet of completely regulated trucks) the PE (population exposed to Ldn $\geq$ 55dB) is as follows:

Condition	Fleet NL	NL	PE	PE	PE(%)
B/L	84.3dB	B/L	157M	B/L	B/L
83dB std.	81.6	2.7dB	136M	21M	13.4%
80dB std.	79.7	1.9dB	127M	9M	6.6%

Thus, for the 83dB standard a change in fleet noise level of 2.7dB yields a reduction in PE of 13.4%, or about 5% per dB. The 80dB standard, resulting in a NL of 1.9 dB, yields a PE of 6.6%, or 3.5% per dB.

(As the fleet noise level for Heavy Trucks decreases, the other traffic sources become relatively more important, thus decreasing the effectiveness of incremental reductions of Heavy Truck noise levels).

The 1980-81 noise data from BMCS and EPA measurements show a mean Noise Level for Heavy Trucks of 84.7 dB at High Speed and an estimated 81.5 dB at low speed, for an estimated Fleet Noise level of 83.1 dB (compared to a baseline, or 1974, fleet noise level of about 88.1 dB). Approximately 3 percent of trucks were above the IMC low speed standard of 86 dB and 7 percent were above the IMC high speed standard of 90 dB.

If the IMC standards were reduced by 3 dB to 83 dB (low speed) and 87 dB (high speed) respectively, then compliance of the noisy trucks would bring their levels down about 4 dB. Thus, for the non-conforming average 5 percent of the fleet, the 4 dB drop in level (ignoring possible changes in the conforming portion of the fleet) would represent a drop in fleet noise level of 0.2 dB. Then, conservatively assuming a 4 percent decrease in PE per dB decrease in fleet NL, the PE in 1986-1988 would be reduced by about 0.8 percent, or approximately 800,000 in each year.

Comparison of this figure to the estimated average increase in PE of 1.3 million resulting from the two-year deferral of the 80 dB MHT standard shows that adoption of the revised IMC standard in 1986 would recover about

62 percent of the near-term loss of health and welfare benefits caused by the two-year MHT deferral.

In the longer term, the salutary effect of the reduced IMC standard in preventing loss of the anticipated benefits of the MHT regulations (26-30 million PE reduction) would far outweigh the modest reduction of benefits (averaging about 1.2 million PE per year) resulting from the two-year deferral of the 80 dB MHT standard.

ECONOMIC IMPACT OF THE MHT AND IMC REGULATIONS

Technology Requirements for the 80 dB Regulation

The availability of noise control technology for manufacturers to comply with the 80 dB noise emission regulation is not at issue. That manufacturers are capable of producing trucks that comply with the 80 dB regulation has been supported in written submittals to the Agency by all of the major truck manufacturers [5] and has been verified by the Agency in its Quiet Truck Demonstration Program [6].

In general, the quieting treatments that we expect to be applied to comply with the 80 dB regulation consist of one or more of the following treatments: higher performance mufflers, engine shields transmission covers, and air intake modifications. The exact treatment or combination of treatments depends on the type of truck and its specific engine and drive-train configuration.

Updated Vehicle Quieting Costs for Compliance with the 80 dB Regulation

For the purpose of determining quieting costs and performing economic impact assessments for truck emission regulations, the Agency groups trucks by gross vehicle weight rating (GVWR) into medium trucks (10,000 - 26,000 lbs. GVWR) and heavy trucks (>26,000 lbs GVWR). Each weight group is then further subdivided by engine type into either gasoline or dieselpowered trucks. The objective of classifying trucks by weight and engine type is to form truck groups that perform similar in-use functions, require similar noise control technology and thus have similar quieting costs.

Table 4 presents truck price increases that manufacturers have stated they expect to result from compliance with the 80 dB regulation [5]. Based on these costs and 1979 new vehicle sales for each manufacturer, a sales-weighted price increase was determined for each truck category except heavy gasoline. Lacking specific data from manufacturers on quieting costs for heavy gasoline trucks, the $269 cost figure reported in Table 4 was developed by updating the 1975 Agency cost estimate as reported in the Agency's Background Document [7] which presents the regulatory analysis attendant to the regulation.

In computing the sales-weighted price increase from the manufacturer's data, the Ford estimate of $1130 for the heavy diesel was not included. The Ford estimate is clearly out-of-line with other industry data. Ford has communicated to the Agency that these costs represent an absolute worst-case estimate and are not representative of their anticipated typical price increase across their full line of heavy disesel trucks.

The Agency estimates a sales-weighted price increase of $345 per heavy diesel truck to meet an 80 dB regulation. This estimate is derived from the costs required to quiet the four heavy diesel trucks in our Quiet Truck Demonstration Program. These trucks were selected for their diverse configurations. The techniques used to quiet these trucks to their target level of 72 dB (to meet a 75 dB regulation) are similar to, but more extensive than, those needed for the truck that will meet the 80 dB regulation. We have used a straight-line interpolation of dollars per decibel reduction and have sales-weighted these costs to estimate the 80 dB quieting costs. We believe this is an appropriate and conservative approach since it apportions higher costs to quiet across all trucks, not just a select few; nor does it take credit for the relatively large number of heavy diesel trucks that can meet the 80 dB level with very minor changes. Our $345 estimate includes both manufacturer and dealer mark-ups but does not include any reductions that could be anticipated as the result of production efficiencies. We believe the EPA revised estimate for heavy diesel trucks to be an accurate representation of the price increase that can be anticipated due to the 80 dB regulation since it is based on our "hands-on" experience. We view the industry estimates as more representative of their upper price limit and thus not typical of the fleet average. In estimating the potential economic effects of the 80 dB regulation, we have used our estimated price increases as presented in the last column of Table 4.

Table 5 presents the estimated new truck price increase in relation to the average truck sales price for each of the truck categories. Potential price increases range from 0.6 percent for heavy diesels to 2.5 percent for the medium diesel truck. For all trucks, compliance with the 80 dB regulation could result in an average increase in truck prices of less than 0.9 percent.

Changes in Truck Operating Costs Expected to Result from the 80 dB Regulation

Compliance with the 80 dB noise emission standard may affect truck operating costs through changes in performance and increases in vehicle maintenance costs. Although the Agency's experience in the Quiet Truck Demonstration Program indicates no identifiable changes in truck performance, we have taken a conservative approach by including fuel cost increases

TABLE 4. COMPARISON OF MANUFACTURER'S [5] AND EPA TRUCK PRICE INCREASES TO COMPLY WITH THE 80 dB NOISE EMISSION REGULATION

Estimated Price Increases for New Trucks: Data Submitted to EPA by Truck Manufacturers

Truck ategory	International Harvester	Mack	GMC	Freightliner	Peterbilt	Ford	Volvo	Sales-Weighted Average Based on Manufacturer's Data	EPA Revise Estimates $1980
edium Gasoline	$142	-	$ 50	-	-	$ 166	-	$105	$105
eavy Gasoline	-	-	-	-	-	-	-	-	$269
edium Diesel	$387	-	$300	-	-	$ 517	$240	$405	$405
avy Diesel	$379	$400 to $500	$415	$546 to $563	$540	$1130	$150	$437	$345
les-Weighted ice Increase, l trucks	-	-	$365	-	-	-	-	$322	$279

Note: A blank space (-) indicates that information was not supplied by the manufacturer that potentially could result from minor changes in vehicle weight from the application of noise treatments, and from potential changes in exhaust system back pressure associated with the use of higher performance mufflers. Increases in maintenance costs are expected to occur as a result of additional labor time needed to remove and replace noise treatments during normal maintenance and from the higher replacement cost of an acoustically superior muffler over the cost of a normal muffler.

The additional labor for panel removal and reinstallment has been estimated from the detailed service records of private carriers using EPA's demonstration quiet trucks in actual road service. These very quiet trucks are fitted with flow-through enclosures consisting of side and bottom panels in order to meet the 72 dB design target. Although some trucks will need shielding to meet an 80 dB regulaiton, they will not need a complete flow-through enclosure, and many will not need shields at all. Therefore, the service time estimate of one hour and 15 minutes per year for the EPA quiet truck has been adjusted to 15 minutes to reflected the much reduced use of this level of quieting technology to meet the 80 dB level. Accordingly, the service cost increase, using an industry labor rate of $25/hour, is considered conservative.

The incremental increases in muffler costs were obtained from muffler manufacturers' pricing information [5], as was the muffler useful life of 4 years for diesel and 2 years for gasoline engines. These useful life figures were used to prorate the incremental costs of the quieter mufflers.

It should be noted that the truck manufacturers submitted significantly higher estimates of maintenance cost increases, but provided no substantiating data. One manufacturer indicated that estimates were based on the maintenance costs associated with a "quieted" truck operated by United Parcel Service

(UPS). The acoustical treatment used in that truck relied on considerable use of glass fiber "sound insulation" blankets which have the serious disadvantage of absorbing flammable fluids inevitably present in the engine compartment. The maintenance costs for this treatment would bear no relation to the maintenance costs associated with the more practical and cost-efficient treatment used in the Agency's demonstration program and considered in this analysis. The technical availability and production feasibility of this noise abatement treatment to meet a 72 dB design target is attested to by industry's continuing engineering critique of and participation in EPA's Quiet Truck Demonstration Program. The industry's trade press* has stated that EPA's quiet truck program "represented relatively little in the way of new technology," and an official of one major truck manufacturer stated that EPA's noise abatement techniques were "nothing we didn't do five to seven years ago."

Table 6 presents our estimates of the average annual increase in operating costs by truck category as computed over the economic life of the truck (10 yrs.). On the average, the 80 dB regulation is expected to increase average annual operating costs by 0.07% (les than one tenth of one percent).

Economic Impact of the 80 dB Truck Noise Emission Regulation

The economic impact of the 80 dB truck noise emission regulation, as measured by the uniform annualized costs for the period 1980 to 2000, has been updated to include our most recent estimates of noise treatment and operating costs. Included in the uniform annualized costs are capital costs for quieting treatments, depreciation, interest payments (the cost of capital) and operating costs. While our uniform annualized cost

* "Heavy Duty Trucking," March 1981, page 35.

TABLE ~~III.~~ 5 ESTIMATED INCREASE IN TRUCK PRICES DUE TO COMPLIANCE WITH 80 dB NOISE EMISSION REGULATION (1980 dollars)

Vehicle Category	Average Price	Price Increase due to 80 dB Regulation	Percentage Price Increase
Medium Gasoline	$12,083	$105	0.87%
Heavy Gasoline	$24,157	$269	1.11%
Medium Diesel	$16,024	$405	2.53%
Heavy Diesel	$53,434	$345	0.61%
Sales-Weighted Average, all Trucks	$32,343	$279	0.86%

Changes in Truck Operating Costs Expected to Result from the 80 dB Regulation

Compliance with the 80 dB noise emission standard may affect truck operating costs through changes in performance and increases in vehicle maintenance costs. Although the Agency's experience in the Quiet Truck Demonstration Program indicates no identifiable changes in truck performance, we have taken a conservative approach by including fuel cost increases that potentially could result from minor changes in vehicle weight from the application of noise treatments, and from potential changes in exhaust system back pressure associated with the use of higher performance mufflers. Increases in maintenance costs are expected to occur as a result of additional labor time needed to remove and replace noise treatments during normal maintenance and from the higher replacement cost of an acoustically superior muffler over the cost of a normal muffler.

The additional labor for panel removal and reinstallment has been estimated from the detailed service records of private carriers using EPA's demonstration quiet trucks in actual road service. These very quiet trucks are fitted with flow-through enclosures consisting of side and bottom panels in order to meet the 72 dB design target. Although some trucks will need shielding to meet an 80 dB regulaiton, they will not need a complete flow-through enclosure, and many will not need shields at all. Therefore, the service time estimate of one hour and 15 minutes per year for the EPA quiet truck has been adjusted to 15 minutes to reflected the much reduced use of this level of quieting technology to meet the 80 dB level. Accordingly, the service cost increase, using an industry labor rate of $25/hour, is considered conservative.

The incremental increases in muffler costs were obtained from muffler manufacturers' pricing information [5], as was the muffler useful life of estimate does not reflect actual costs to manufacturers, dealers, users, or consumers (since the ability to pass through price increases, investment credits, and taxing schemes is not taken into account), it may be roughly interpreted as the annual "societal" cost of the regulation. Thus, uniform annualized costs are useful for comparing the relative costs of selected regulatory options.

To assess the relative costs and effectiveness of the 80 dB regulation, uniform annualized costs and benefits have been determined for 83 dB, 80 dB, and 75 dB truck noise emission regulations. A 75 dB regulation was included for the purpose of this analysis as representing current available technology (equivalent to a design limit of 72 dB, the level achieved by the Quiet Truck Demonstration Program) and was assumed to go into effect in 1987 to permit one full truck design cycle beyond the current 1983 effective date of the 80 dB regulation.

Costs for the 83 dB and 75 dB regulation are based in part on original data reported in the Background Document for the Truck Noise Emission Regulation. We have updated these costs from 1975 dollars to 1980 dollars by the application of appropriate economic indices [8] as supplied to the Agency by the Bureau of Labor Statistics. We have adjusted estimates of attendant quieting and operating costs to reflect industry data and our experience in the Quiet Truck Demonstration Program. Market share by vehicle category and overall fleet growth are based on industry sources and independent econometric projections.

Using the current 83 dB regulation (which the industry has praised for its cost-effectiveness) as a base for comparison, Table V presents the relative cost-effectiveness of the 83, 80 and 75 dB noise regulations. The data in Table V was computed by determining the incremental costs of each option and the incremental benefits over the time period 1980 to 2000.

Economic Impact of Revision of IMC Regulation

The economic impact of reducing the IMC levels by 3 dB - which corresponds to a Medium and Heavy Truck standard of 83 dB - resides almost entirely in the increased operating costs. No capital cost increases are entailed because the MHT trucks as bought are in compliance with the reduced IMC standard.

Based on the MHT background document, the only significant increment in operating costs of the 83 dB truck is that due to the increase in replacement cost of the mufflers. In 1974, this increase was estimated at, 14 per year, based on 3 muffler replacements in 8 years.

In several phone calls made to truck parts suppliers, data was obtained indicating that the average cost of a "heavy-duty" replacement muffler for a heavy truck engine is about $110. It appears that the after-market no longer supplies cheaper, less effective mufflers. Thus, although one might estimate that the "incremental cost" of the heavy duty muffler over a less effective one could be $40 to $60, there really is no satisfactory alternative to purchasing the effective muffler.

The estimated incremental cost in 1974 of replacing 3 mufflers in 8 years-for an 83 dB truck muffler as compared to the less-effective ones then available was $14 annually. At an average annual mileage of 50,000 per year for a long-hual truck, the increment in maintenance cost would hypothetically be about five-hundredths of a cent per mile.

From the macro point of view, the imputed increment in annual maintenance cost for the entire fleet could be considered as $56 million due to the reduction of the IMC limits. As pointed out above, however, that figure is purely hypothetical, since for practical purposes no alternative cheaper, less-effective mufflers are available. The only requirement is that the users follow proper maintenance practices, and replace the mufflers as necessary-this incurring costs which are generally considered a normal business expense.

Economic Benefits of 2 year Deferral of 80 dB MHT Standard

Deferral of the 80 dB MHT standard for two years generates savings based on several factors, as detailed in the following:

1. Assuming that the 2-year delay is based on coincident timing of the 80 dB noise standard and the new air emission standards, there is a saving of development costs due to coordination of the engineering engineering effort entailed.
2. Since the deferral allows the manufacturers to delay the bulk of the engineering development effect for noise control, there is a savings of the opportunity cost associated with the projected expenditures.
3. Since the added noise control features for the 80 dB standard are expected to increase the price of each truck the user industry will save on each as the trucks expected to be sold in in each year of delay.
4. The higher price of the 80 dB trucks is expected to cause about a 5 per cent decrease in total truck sales in the first year of the standard. (One manufacturer projects a 15 per cent decrease) The two-year deferral will delay the economic impact of such a sales drop until the industry has had additional time to recover from the recent slump.

The estimated dollar savings for each of the factors described are summarized below:

1. For the manufacturers, the estimated industry cost savings for coordinated engineering is about $10 million.

2. The opportunity cost savings due to a 2-year delay in implementing the 80 dB standard is estimated at about $5 million.

3. The savings to the customer industry, based on an estimate of 500,00 trucks sold in the 2-year delay period at about $400 per truck, is about $200 million.

4. The dollar cost of a drop in sales is difficult to estimate, but the delay of two-years would give the manufacturers additional time to bolster their financial position to be able to absorb the impact of such a drop.

It can be seen therefore that the 2-year delay in the 80 dB standard will have a significant beneficial economic impact for the manufacturers and the carriers. As pointed out elsewhere, the revision of the IMC standard is expected to have a minimal economic impact on the industry, as compliance only requires the users to perform the maintenance activities recommended by the manufacturers. The bulk of the user industry is already performing the required maintenance, and the associated costs already have been taken into account in connection with the existing regulations.

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8. 46 Federal Register 8497 (Tuesday January 27, 1981)

9. "Revised Analysis of the Benefits and Costs of the 80 dB Noise Emission Regulation for Medium and Heavy Trucks," Environmental Protection Agency, Washington, D. C., August 13, 1981

TABLE 7. COMPARISON OF THE RELATIVE COST-EFFECTIVENESS OF 83, 80 and 75 dB TRUCK NOISE EMISSION REGULATIONS (1980 Dollars)

Regulatory Level	Incremental Uniform Annualized Cost, (1980-2000) Millions	Average Annual Incremental Reductions in LWP, (1980-2000) Millions/Year	Cost-Effectiveness Relative to 83 dB Regulation
83 dB	328.4[1]	7.24[1]	100%
80 dB (1983)	133.2[2]	2.34[2]	79.7%
75 dB (1987)	395.8[2]	3.55[2]	40.7%

1. Incremental Costs and Benefits calculated relative to the unregulated truck.

2. Incremental Costs and Benefits calculated relative to the 83 dB truck regulation.