The Federal Noise Control Act of 1972 requires the identification of major noise sources. Under Section 18, noise emission standards for motor carriers engaged in interstate commerce were promulgated on October 29, 1974. Under Section 17, noise emission standards for railroads in interstate commerce were published July 3, 1974. As a requirement of Section 6, the Environmental Protection Agency published proposed standards for new medium and heavy trucks on October 30, 1974.

General Motors has been involved in noise control programs concerning both interior and exterior vehicle noise for more than 35 years. Control of interior sound is necessary to satisfy GM customers, and control of exterior sound is necessary to satisfy the community.

General Motors believes a federal noise control act was needed to achieve uniformity of standards across the nation through pre-emption of state and local regulations. Without federal preemption, the multiplicity of levels, test procedures, and compliance requirements that were being proliferated at an increasing rate by state and local governments would place a prohibitive burden on the manufacturer and add confusion to the work of the enforcing agencies.

Further, differing state and local requirements for motor vehicles meld into confusion as a result of travel, transfer, and resale of products among communities. Federal pre-emption will eliminate the chaos with respect to dBA values. Included within the federal
regulation should be a compliance enforcement program that ensures equal treatment for all.

We have determined that passenger cars and light trucks under 10,000 lb (4540 kg) frequently contribute significant amounts of sound energy when they are not well maintained or when they are intentionally modified to be noisy. Passenger cars and light trucks manufactured during 1973 and 1974 and in good repair typically produce sound levels in the following ranges when they are operated in the modes listed:

<table>
<thead>
<tr>
<th>Operating Mode</th>
<th>Range (dBA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAE J986a pass by</td>
<td>78 to 85</td>
</tr>
<tr>
<td>Normal city acceleration</td>
<td>62 to 74</td>
</tr>
<tr>
<td>40-mph (64-km/h) cruise</td>
<td>64 to 70</td>
</tr>
<tr>
<td>55-mph (88-km/h) cruise</td>
<td>66 to 75</td>
</tr>
<tr>
<td>70-mph (113-km/h) cruise</td>
<td>73 to 80</td>
</tr>
</tbody>
</table>

The SAE standard J986a test results represent near maximum power-plant noise of these vehicles. However, the levels emitted during normal operation are considerably lower. An investigation carried out by General Motors indicates that wide-open-throttle operation, and thus maximum power-plant noise, occurs less than 1 percent of the time. We have recently determined that sound levels of normal city acceleration for new light vehicles will be reduced somewhat when the wide-open-throttle sound level is reduced to 80 dBA beginning with 1975 production.

We wish to emphasize that newly manufactured vehicles are now performing in the community at acceptably low sound levels. Therefore, to consider a further reduction of the noise level standard that is associated with a 1 percent mode of operation of light vehicles is absolutely unnecessary. Additional regulations should not be imposed on the manufacturer in a misguided effort to reduce community sound levels. Rather, necessary regulations and enforcement programs should be adopted to ensure that users are held responsible for the operation and maintenance or modification of their vehicles. This approach will accomplish the most good with the least overall expenditure.

If the new passenger cars and light trucks are not the major cause of motor vehicle noise, then what is? The recently promulgated regulation for interstate motor carriers, which will become effective October 1975, established a limit of 86 dBA at 50 ft (15 m) from the lane of travel for speeds less than 35 mph (56 km/h) for vehicles weighing more than 10,000 lb (4540 kg) GVWR.

Even though the interstate motor carrier regulation is generally interpreted to include all trucks moving and handling goods in interstate commerce, probably only those vehicles operating on major highways will be inspected by the Bureau of Motor Carrier Safety. Therefore, a large segment of trucks used in urban areas (or intra-state) will probably escape federal enforcement. It is believed that these vehicles tend to be older and less well maintained. At the same time many of them are operated in densely populated areas and may expose the public to many times the noise energy of similar but well-controlled trucks. Allowing high noise-energy-producing vehicles to continue to operate in densely populated areas does not meet the objective of the interstate motor carrier regulation.

This regulation will not be an effective means of noise control unless all states adopt regulations that are identical to the interstate motor carrier regulation. This must be done to allow enforcement by local law officers, for the critical factor in accomplishing the first big reduction in highway transportation noise is effective enforcement. Uniform action in this area should be encouraged.

What should be the goal for quiet trucks? First, we must determine what community sound level is acceptable from the standpoint of the effects on the people and then determine what portion of the noise exposure is associated with trucks. Some of the current community noise models employed to evaluate potential progress in community noise reduction assume that all trucks already comply with the new interstate motor carrier regulation (86 dBA). When this condition is actually attained, we may
well have achieved a significant reduction in the ambient levels and the annoyance caused by the loudest vehicles in communities.

One fundamental but extremely important point that must be understood is that, when designing a vehicle to meet a regulated level, a manufacturer must establish a design margin sufficiently below that standard to assure that vehicles will comply. In so doing, the mean sound level of the vehicles produced to comply with a regulated standard will be some 2 to 3 dB below that standard. Thus, new vehicles produced to comply with a regulated level of 86 dBA will have a mean level in the range of 83 to 84 dBA, and new vehicles produced to comply with a regulated level of 83 dBA will have a mean level in the range of 80 to 81 dBA.

The vehicle manufacturer has little control over the other major highway noise source, namely, the interaction of the tires with the road. Of course, there are noisy tires and quiet tires, and proper selection will eliminate the worst offenders. However, tires perform many functions related to vehicle control and safety, and those must not be overlooked in determining the selection of quiet tires. There is a floor or minimum tire sound level that is speed dependent and essentially determined by a smooth tread or blank tire. Many designs of acceptable tires produce noise levels within about 5 dBA of the tire noise floor. A 5-dBA range from the tire noise floor should be used as a starting point for a performance guideline in future noise considerations. Barring a technical advance that we do not now foresee, tire noise will continue to establish a noise level floor while vehicles are operating at highway speeds. These levels are quite predictable based on the traffic volume, the kinds of vehicles, the sound levels of those vehicles, the traffic mix, and vehicle speed.

The motor vehicle industry is in the process of evaluating the federally proposed regulation on new medium and heavy trucks. To evaluate the ability and time required for industry to comply with a new regulation, we must define where we are now and where we will have to be when the new regulation is in effect. The preamble to the proposed regulation defines available technology in part as "technology applications that have been demonstrated to be feasible, as a prototype product upon which production manufacturing may be based." Such a demonstration on 1 or 2 trucks does not by any stretch of reason constitute evidence that the design is fit to be engineered into mass production. Hundreds of basic vehicle configurations need to be designed and extensively tested for performance, safety, reliability, and durability. Let me illustrate a few of the considerations.

1. The use of a specific muffler with a specific engine can have widely varying results depending on the relative locations, lengths, and diameters of pipes. One cannot simply specify that muffler 32 be used with engine D and guarantee the resultant sound level of the exhaust system.

2. Cooling systems must be designed to be adequate for the maximum demand condition even though that condition may seldom occur in the operation of any given truck. For trucks that require engine side-shielding and underpans to meet noise regulations, cooling becomes increasingly difficult. Since maximum cooling capability is required only a small percentage of operating time, a thermostatically controlled fan clutch can be used with attendant noise reduction and economy of operation when the fan is declutched. The fuel savings available in addition to the noise benefits will most certainly increase the use of clutch-controlled fans. During normal testing of the truck under the SAE standard J366b, the thermostatically controlled fan will not be in operation.

3. Engine-radiated noise becomes the dominant noise on many trucks after the exhaust, fan, and intake noises are sufficiently quieted to meet a regulated level of 83 dBA. Engine shielding presents a major problem of redesign when it must be integrated into existing configurations. Shielding in turn affects cooling, durability, and maintainability.

The cost of all aspects of obtaining products that are acceptable under the proposed new truck standards must be weighed against the benefits received. When we attempt
to quantify the benefits, we must consider the degree of reduction of noise and the number of people who are benefited. Benefit has been measured in terms of freedom from interference, freedom from annoyance, and improvement of the quality of life. The quantitative transfer functions by which we can relate these positive effects to economic values are difficult to derive at best and are subject to individual opinion. The costs are much more apparent. One of the considerations of cost during the remainder of this decade must be that noise control of vehicles contributes nothing to the productivity of the vehicles and with few exceptions contributes nothing to the productivity of the surrounding community. Adding cost to a product without increasing its productivity contributes to the inflationary trend. In the current economic climate, the value of reduced noise levels must be considered carefully. We should reserve the decision relative to the proposed federal levels of 80 and 75 dBA until the effectiveness of the regulation at 83 dBA including enforcement can be evaluated.

The strategy to be implemented for noise control should be considered not solely on the basis of whether new vehicles can be manufactured to these limits but also on an assessment of all of the effects including the reduction of the average energy level of overall highway noise, $L_{eq}$, and the day-night level, $L_{dn}$, and the effect of the single older loud vehicle on the affected population.

With that background and philosophy, let us now consider the following statements.

1. The cost of trucks per dB reduction in sound level rises rapidly as the mean level is decreased below 80 dBA.

2. In terms of the number of people exposed to various sound levels and the degree of reduction of that exposure, the benefit per dB reduction diminishes as the sound of the vehicles perceived by the listeners approaches the background levels established by tires and other ambient noise.

3. Therefore, the cost-benefit ratio, which is a function of both of the above effects, increases rapidly as the noise level of trucks is reduced below the range of 80 to 81 dBA, which would be the mean sound level corresponding to a regulated level of 83 dBA.

4. The following statements place perspective the benefit of attaining mean levels in the range of 80 dBA for maximum noise of new-truck power plants.
   a. New trucks will be mixed in with existing trucks, which have noise levels that range more than 10 dBA higher, such that 1 newly manufactured truck will emit only a tenth of the energy output of 1 old poorly controlled truck.
   b. The interstate motor carrier regulations can only affect that fraction of the operating medium and heavy trucks that come under the surveillance of the Bureau of Motor Carrier Safety.
   c. The eventual adoption by all states of identical regulations will permit enforcement nationwide so that a uniform level of 86 dBA may be achieved.
   d. But these levels will be achieved only if vigorous enforcement policies are implemented with instruments and personnel.
   e. If we are successful in bringing these trucks to 86 dBA, truck power-plant noise will be materially reduced. And the manufactured trucks with a mean sound level near 80 dBA will emit only about a fourth of the energy of those older trucks. Therefore, as the numbers of new trucks increase, the community noise level resulting from trucks will decrease materially.

5. Considerations relative to reducing power-plant noise of trucks should take into account the technology and attainable levels of tire noise. Power-plant noise in the 80-dBA range is dominated by tire noise at highway speeds for a typical 5-axle truck fitted with rib tires except for the cross-bar tires on the drive axles.

6. Adding cost without substantial benefit to both the customer and the community should be viewed cautiously, especially in an inflationary period.

Is it logical and cost-effective to assign to trucks a regulated noise level lower than 83 dBA? At this time, we think not.