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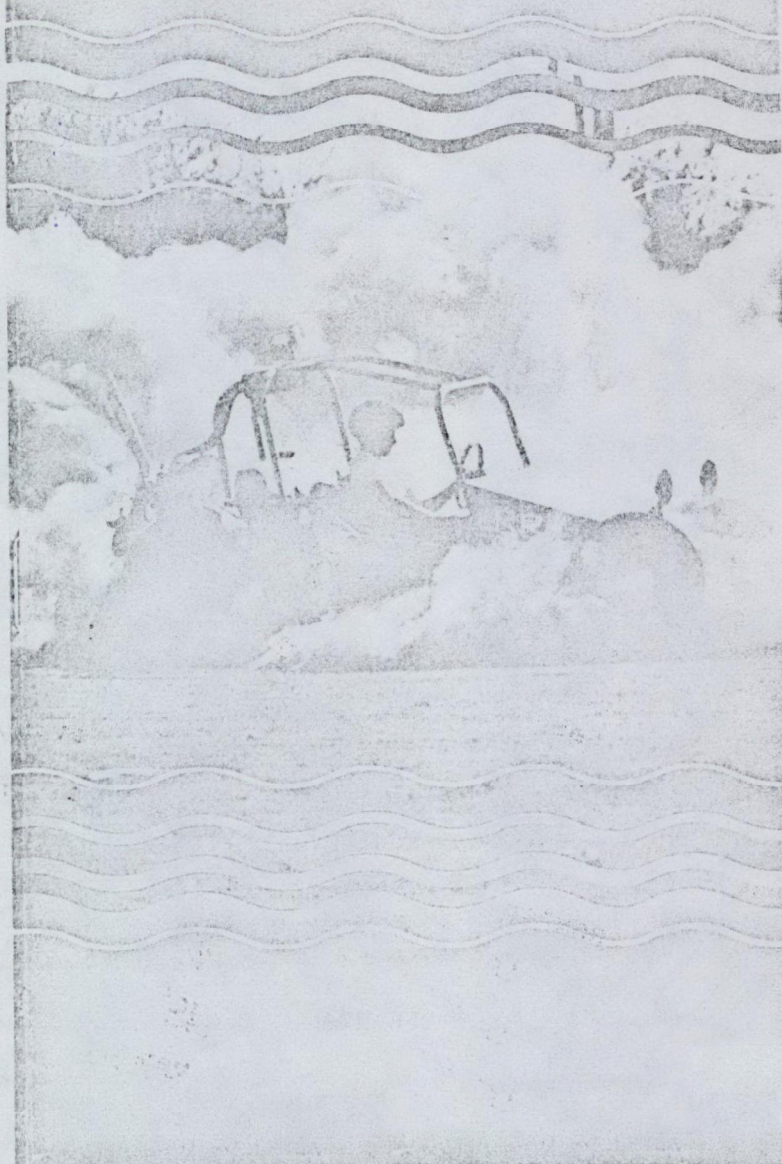
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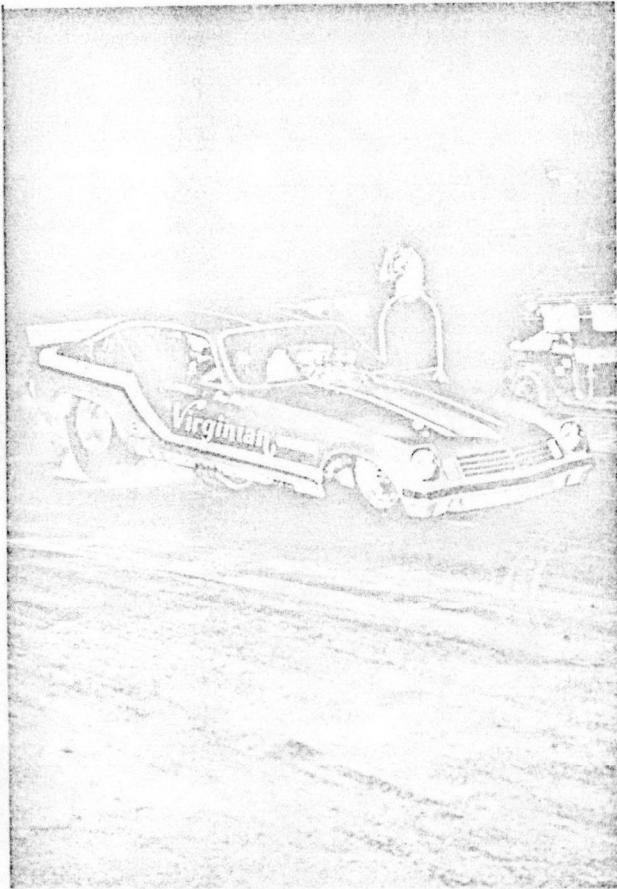


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United States  
Environmental Protection Agency  
December 1976

# Noise and Recreational Vehicles





A seemingly endless din assails people from every quarter: Noise from the kitchen mixer, radio and television, cars and trucks, planes and trains, office equipment and industrial machines, noise layered upon noise, annoying and sometimes harmful.

To varying degrees, noise affects both the physical and mental well-being of humans. The most well known and probably the most serious effect of noise is loss of hearing. There is also evidence to suggest that it increases the level of artery-clogging cholesterol and raises the blood pressure. Noise has the opposite effect on the blood vessels of the brain. It makes them dilate, or enlarge, and this could be

how noise causes headaches. Noise puts a stress on the body. Scientists think that it may even change the secretion of acid by the stomach, change the secretion of endocrine hormones, affect the functioning of the kidneys and increase susceptibility to viral infection. And noise affects nerves and emotions as well.

Noise intrudes on periods of rest and relaxation. The teenager across the street "lays a little rubber" as he leaves the neighborhood in his hot rod, the motorcyclist down the block "revs" his bike interminably prior to departures—shattering your neighborhood's quiet. Even in recreational areas your solitude is broken by people who have brought their favorite noise-makers along. Acid-rock music pierces the air from a new arrival's transistor radio, an outboard motor boat roars by. Even heavy snow cannot muffle noise, for there are some 2.5 million snowmobiles to shatter the quiet.

We know what noise does to people, and conservationists are beginning to wonder about what noise may be doing to wildlife as well. Because of the basic quiet in wilderness and recreational areas, (technically known as low ambient background levels) irregular noises from vehicles and equipment are the most disturbing.

This pamphlet focuses on different types of recreational vehicles, such as motorcycles, power boats, snowmobiles, all terrain vehicles (ATV), dune buggies, and mini-bikes and race cars and the noise problems associated with them. There has been a remarkable growth in the number of these vehicles in the last 20 years and it is a reflection of our times that with new recreation has come a new environmental problem in the form of noise in those very locations where people seek quiet.

Throughout this report, we use the word "decibel" (abbreviated "dB") which is the commonly used measure of sound. "A" (as in dB (A)) represents that scale of measurement which is related to the human ear's acoustical properties, which have to do with hearing or with sound as it is heard.

We hope this report will make you more knowledgeable about the problems of noise in recreational vehicles, particularly if you operate them.



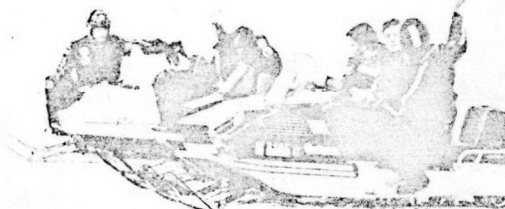
## Snowmobiles

The snowmobile is a relative newcomer on the leisure vehicle scene. Since its introduction in 1958 as a low-powered, lightweight, go-anywhere-in-the-snow vehicle, the snowmobile has been redesigned for family-type use. There are currently about 2.5 million snowmobiles in operation and most are used for recreation. People who live on farms own about 28 percent of all snowmobiles, and many farmers and ranchers in the West and Midwest rely on them for feeding and rescuing storm-stranded cattle. In addition, foresters and utility workers can use these vehicles to reach remote areas. The average snowmobile operator rides about 13 hours a week during the winter.

The original snowmobile concept called for an engine light in weight, but powerful for its size. For this reason, early models possessed unshrouded engines and unmuffled or poorly muffled exhausts. The rise in popularity of snowmobiles led to numerous complaints about their excessive noise. As more vehicles were produced, users demanded more and more power until today, some snowmobiles are capable of speeds of nearly 100 miles per hour. Their adverse effect on the environment may be heightened by the fact that a limited number of owners remove factory-installed muffler systems in an attempt to achieve more power. In many cases this actually results in less power and greater noise.

Studies show that continued use of snowmobiles over a span of many years may cause some permanent hearing loss to operators and passengers. Conservationists are also concerned that noise from snowmobiles may be detrimental to wildlife, especially in winter when most species are particularly weak and vulnerable. As a result, legislation has been introduced in many States to restrict snowmobile noise levels. Minnesota introduced the first snowmobile noise regulation in 1970, restricting their noise level to 86 dB(A) at fifty feet.

Public concern about snowmobile noise prompted manufacturers to reduce the noise levels of 1971 models. Most of this noise reduction resulted from improved exhaust systems that may also prolong engine life and performance. The post-1971 models produce noise levels ranging from 77 to 86 dB(A) under maximum noise conditions measured at 50 feet, and 105 to 111 dB in the driver's seat. The noise levels from pre-1971 models ranged from 90 to 95 dB at 50 feet, and some racing machines reached noise levels as high as 105 to 110 dB. The operators of several machines surveyed experienced noise



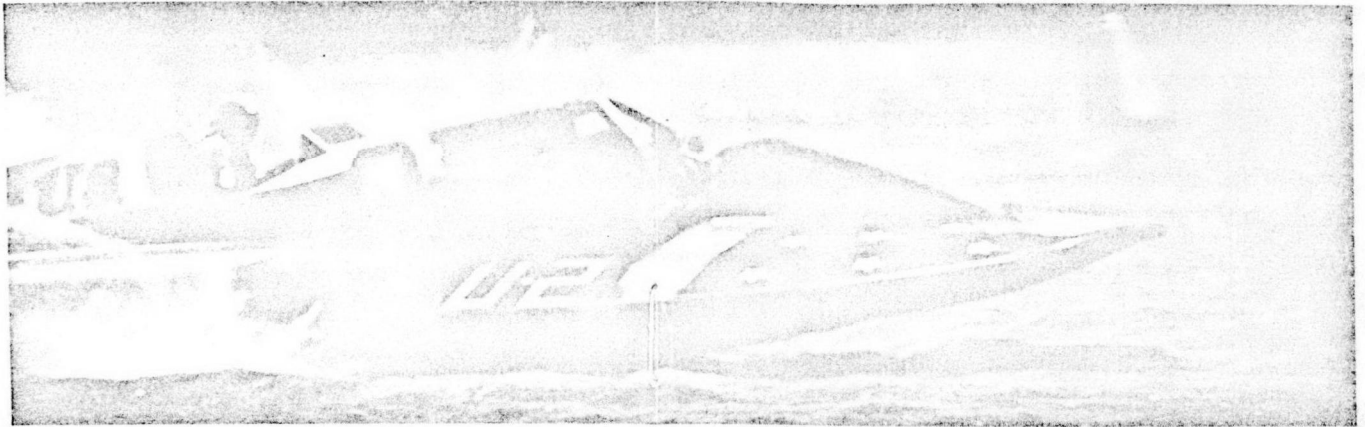
levels as high as 108 dB while operating under normal conditions. (Remember, continued exposure to noise in excess of 70 dB can result in increased risk of hearing loss.)

The following list cites the major sources of noise in snowmobiles:

**Exhaust system** - The chief source of snowmobile noise is the engine exhaust. Designs which minimize engine space and *emphasize* lightweight construction, and consumer demands for maximum power, have restricted the use of highly effective silencing devices.

**Mechanical noise** - A major factor in the overall noise output of snowmobiles is engine noise. The lightweight, 2-cycle, highpower design of snowmobile engines limits the application of quieting techniques to the internal engine structure. Insulated engine cowlings (covers) provide the most suitable and practical means for reducing engine noise.

**Air intake** - Many snowmobile manufacturers do not quiet the engine air intake. Unfortunately, this intake is usually situated ahead of the operator and contributes to his noise exposure. Some sacrifice in engine performance may be required to reduce the noise of the air intake system. Manufacturers are now producing air-cleaner units which will aid in reducing this problem.



## Motorboats

The motorboat has been around longer than any other of the leisure vehicles. Outboard motor noise was recognized by industry as an annoyance long before any legislative bodies acted to control its effect. In the 1920's and the 1930's, manufacturers, in response to public pressure, began experimenting with underwater exhaust systems to reduce noise. Their success in the 1940's was one of the factors leading to a dramatic growth market for motorboats. In the mid-1950's, more sophisticated quieting techniques were incorporated, and the outboard engine has been continually refined since then. Today's outboard motor probably represents the quietest example of a two-stroke engine available.

In a recent survey of inboard and outboard motor boats, the maximum noise level ranged from 65 to 95 dB(A). Small outboard engines (usually 6 to 10 horsepower) made the least noise. In another series of tests, levels exceeding 110 dB(A) at 50 feet were recorded for an inboard powerboat - a type used for water skiing - with "dry stack" exhausts (unmuffled and not expelled under water).

Engine exhausts are the principal source of noise from power boats. On the larger-engined boats used for water skiing, air intakes and mechanical engine noise also contribute significantly to the problem. However, even though the exhaust is expelled under water on most boats, it is still the major noise source. As the engine size is reduced, the noise levels are generally lowered. In medium (10 to 20 hp) and smaller (6 to 10 hp) outboard engine sizes, engine noise and air intake (though acoustically shielded) make almost as much noise as the exhaust system.

Many of the complaints about motorboat noise are aimed at the large inboard boats which have "dry stack" exhausts. In addition, many inboard owners

use automobile "hot rod" techniques to achieve maximum horsepower with their engines. The engine may be fully exposed and usually has an unsilenced carburetor air intake, as well as unsilenced exhausts. These machines produce noise levels up to 112 dB(A) at 50 feet. With underwater exhausts, their noise levels have been reduced to about 97 dB(A). Many States are now considering legislation to prohibit the operation of the "dry stack" boats.

Future noise reduction efforts need to be directed toward protecting operators from excessive noise. Crash helmets, some of which help protect hearing, should be worn, but these are seldom used by boaters except during racing events. Hence, the engine noise level in this type of pleasure craft must receive more attention. It is probable that safeguards to protect the hearing of powerboat operators will come about only through changes in engine designs and coverings.

## Dune Buggies, All-terrain Vehicles, and other Off-road Vehicles

The principal noise from dune buggies, all-terrain vehicles (ATVs) and other off-road vehicles is produced by their exhausts. Because these vehicles are unregulated for the most part, owners feel free to attempt to achieve maximum power by using tuned and straight-through (unmuffled) exhaust systems. Engine and air intake noise is also quite loud, but is about 15 to 20 dB less than the exhaust.



## Mini-bikes

Mini-bikes are a particularly annoying residential noise problem. The bikes are normally sold with mufflers which reduce their noise levels at 50 feet to the 75 to 80 dB(A) range. These machines are used primarily by youngsters not old enough to obtain drivers' licenses. The problem is aggravated when the stock muffler is replaced with an expansion chamber exhaust system which the owner believes will contribute to the engine's power. The machines are then capable of noise levels reaching 85 to 90 dB(A) at fifty feet.

## Motorcycles

Motorcycles have undergone a remarkable increase in popularity over the past ten years. They have long been criticized for their excessive noise, and this noise is partly the result of designs which incorporate lightweight features while sometimes neglecting adequate mufflers. Many motorcycle riders associate noise with power and performance. This association is no longer valid with modern designs, particularly for two-stroke engines. The major manufacturers have taken steps only recently to change this belief. Currently, the industry is in the process of trying to convince the consumer that more noise does not necessarily mean more power.

This is an essential step in preparing the consumer to accept the quieter, new-generation of motorcycles.

Most current production motorcycles intended for highway use comply with the California noise standard. Under the guidance of the Motorcycle Industry Council, most major manufacturers have agreed to place mufflers on all their off-road motorcycles to limit their noise levels to 92 dB(A) at 50 feet.

The noise levels of current motorcycle models vary widely depending on the manufacturer and the engine size. Most motorcycles now meet the 86 dB(A) maximum noise specification imposed by several States. Achieving further noise reductions will mean some design compromises, but the technology does exist to produce quieter motorcycles.

The amount of noise a motorcycle produces while cruising depends on its speed and the way it is operated. Many off-road motorcycles are capable of speeds of 80 to 100 mph, and are often operated in the lower gears or at medium to high engine revolutions. Except when cruising at constant speeds, these vehicles are operated at full throttle, and near their maximum noise output.

The exhaust contributes the most to the motorcycle's overall noise level. Although exhaust systems can be designed to reduce this noise, significant engine housing and weight limitations must be overcome.

A critical problem that remains to be solved in silencing motorcycles is engine and mechanical noise. Insulated cowlings have been found to be impractical solutions for quieting air-cooled engines. The U.S. Environmental Protection Agency plans to propose standards for newly manufactured motorcycles in 1977.





## Race Cars

Many people don't realize the amount of noise generated by an auto speedway unless they are sports-car enthusiasts or live near an auto track. To fans, the noise is part of the attraction, and fans equate a race car's noise with its power. An individual living near a speedway, however, may feel differently about the noise and traffic and its effect on the enjoyment of his property. Legal action and civil suits are pending against speedways all over the United States, and in some areas, local legislation restricting noise levels has forced some speedways to close.

Beltsville, Maryland provides an interesting example of how citizens were successful in easing a speedway noise problem. After receiving numerous complaints about a local speedway's noise, county officials conducted a survey to find the extent of the problem. The survey results showed that the speedway was a serious disturbance in the community, and that further study and corrective action were warranted.

Officials believed that barriers could be used to reduce the racing noise reaching the community. However, barriers made of straw, two bales deep, were found to be inadequate. The County Commissioners then issued a permit which stipulated that racing would be permitted only after the speedway owners erected a barrier constructed of half-inch plywood, 20 feet high and 1,100 feet long. The permit also stated that no racing would be permitted after 11 p.m., and that sound measurement would have to be continued at the speedway's expense to provide a basis for considering the next year's permit application.

New surveys taken in 1971 showed that noise levels from the speedway were still annoying and that further action would be required. Continued complaints finally resulted in an ordinance prohibiting racing with vehicles not equipped with exhaust mufflers, and requiring the speedway to limit its noise impact on the community to 60 dB(A). This created a new problem since there was little information about the noise-reducing capability of race car mufflers and their effects on engine performance, cooling, and racing speeds.

After many tests, a particular brand of muffler was found that could deliver performance and achieve a 20 dB noise reduction. This became standard racing equipment at the speedway. The initial spectator reaction was not favorable. But, after a new speed

record was set at the Indianapolis Speedway by a muffler-equipped car, the skeptics were won over.

The Beltsville experience shows that noise control is workable and practical at most speedways. Noise levels for all but the nearest neighborhood residents have been lowered to acceptable levels. Consistent and significantly lower noise levels have been measured at trackside. With mufflers, drivers can now hear what is going on in their machines and listen for specific mechanical malfunctions, while protecting their hearing. Fans have found that the races are as competitive with mufflers as without them. Additionally, the public address system can now be heard over the noise, and fans actually can converse during the races.

## What you can do to reduce the noise impact of recreational vehicles

First of all, insist of manufacturers and State and Federal officials that suggestions for reducing noise be included with all new power vehicles and equipment being sold. This material should stress the noise suppression techniques that can be used by the operator to reduce the noise hazard to himself and the nuisance factor to others.

Wear ear protection devices in the form of commercially available plugs or muffs. Cotton is *not* enough. Some snowmobiles, motorcycles, and boats present a risk of permanent hearing damage to operators and passengers.

Check your local municipal and State noise ordinances. Some communities have prohibited the use of powered equipment between the hours of 8 p.m. and 8 a.m. in order to reduce noise annoyance in local neighborhoods.

Finally, compare the noise levels of different makes of recreational equipment you are planning to buy. This means taking a test ride if possible. Remember, it's your hearing and the peace of your neighborhood that are involved. With increased buyer preference for quieter machines, manufacturers will respond with more research and development in this important area.