noise POLLUTION

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by Robert M. Alexander

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NOISE POLLUTION

A Background and Status Report for Oregon

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The "sound of silence" can be one of the most devastating experiences known to man. Without the ability to hear we are cut off from direct communication with our environment; we exist in a peripheral world. But the nature of modern society is such that silence is not the dominant problem. Instead, we are constantly being bombarded with sound. When sound ceases to convey a direct message, when it fails to establish communication, when it interferes with our well-being, annoys and frustrates our emotions, it is no longer sound. It is noise. Thus, we can define noise as unwanted, disturbing sound.

THE PROBLEM OF NOISE POLLUTION

Noise is now recognized as one of our critical pollution problems. Like air and water pollution, noise pollution increases in proportion to the population density —in urbanized areas its effects are the most profound. The widespread and persistent application of the techniques of nature manipulation, better known as technology, can enhance physical and economic well-being. But technology can have undesirable consequences, or side effects, among them noise.

Noise is urban centered through the constant flow of traffic, and the presence of airports, factories and construction work. Added to this is the mounting noise related to recreation—the motorcyclist, vehicular racing, and electronically amplified music. Excessive urban noise is regarded as a principal factor in the exodus of the more affluent from the central city—the flight to the suburbs to escape. But the city street is not alone in its din. Beach buggy noises pollute our beaches, snowmobiles and trail bikes reach the mountain slopes and wilderness areas, and model airplanes invade the parks. In our increasingly mechanized homes we experience high levels of noise on an everyday basis. The kitchen is the noise center of the home. It houses the dishwasher, electric can opener, garbage disposal, and countless other noisy gadgets offered to us by technology.

Rural and suburban areas are not immune from the invasion of noise. A survey of suburban residential areas in 1967 revealed that noise levels had increased drastically from those recorded in an earlier survey in 1954. In the rural environment, farm machinery with its ever increasing power, poses a significant hearing loss hazard to equipment operators.

There are several concerns about the effects of all this noise. The most obvious is the hearing loss associated with extensive and persistent noise levels. Another concern is the less documented interrelated physiological and psychological impacts that are thought to foster hypertension and impaired cardiovascular function. The third effect is again obvious—loss of amenities or of livability associated with our noisy environment, and annoyances to our peace and well-being.

Sound and Noise—Nature and Assessment

Sound serves as a vital messenger. It conveys messages through the sensation experienced by the brain from vibrations against the eardrum. Sound travels invisibly in a pattern similar to waves across water. The sound waves are usually transmitted by air, but can be conducted through solid or liquid media. The size of the "ripple" of the sound wave is referred to as sound pressure. Sound pressure provides a primary basis for quantifying noise.

Because of the extremely large range of sound pressures commonly observed, measurements of sound pressure are expressed as the "sound pressure level". The term "level" implies a logarithmic, rather than a linear, scale of measurement and units of decibels (dB) are used. Each 6 dB increase in the sound pressure level means that the sound pressure has approximately doubled its initial value. Thus, a 20 dB increase in the sound pressure level raises the sound pressure tenfold from its starting level. And a sound pressure level of 80 dB is not twice as great as one of 40 dB; but reflects a sound pressure that is 100 times as great.

Another important quality of sound is its frequency. This is the quality which gives sound its pitch—its rumble, screech or roar. Frequency is measured in the number of waves which pass per second. Measurement is in cycles/second (CPS) or Hertz (Hz). The human ear usually hears in a frequency range of 20 to 20,000 Hz. The frequency above 20,000 is termed ultrasonic, too shrill for human ears, but detectable by dogs and other animals. Frequencies below our perception are referred to as infrasonic.

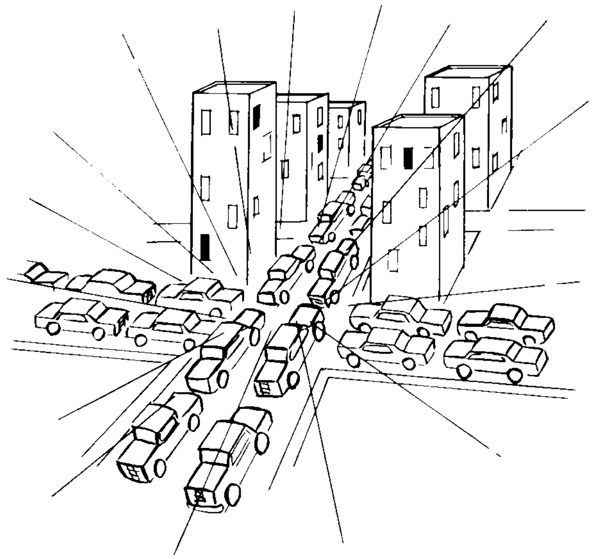
The human ear does not respond in the same way to all frequencies. Lower frequencies generally are not heard as loudly as higher frequencies. Sound pressure level meters are often supplied with filtering networks to respond in a manner that approaches that of the average ear. This decibel readout, when such filtering networks are employed, is referred to as the A scale, written dB(A). It is recognized as the best single number representation of human response to noise. Decibel usage in this report will be on this scale, the dB(A).

Levels of Noise

It has been established for more than a century that industrial noise affects hearing. Noise deafness is still a major health hazard of industry. It is recognized that up to 16 million workers in this country are in occupations hazardous to their hearing. Industrial equipment can produce noise levels, if uncontrolled, in the 100-120 dB(A) range. It has been reported that workers in saw mills can experience a 20-30 percent hearing loss within the first year of exposure to larger equipment. But regulations have been adopted establishing industrial noise level standards. Oregon has such legally enforceable standards for industrial noise. They are set at 90 dB(A).

Concern is now shifting to community noise. This is the ambient noise to which all of us are exposed—the problem of noise pollution. There are now many situations where noise levels encountered in the community exceed standards that have been found injurious in industry. The fact that the average 75-year-old American has trouble understanding what is being said to him is not a result of aging per se. Rather, it is a result, also, of having lived in a society that has become noisier each year. It has been reported that during the past two to three decades such urban noises as aircraft and motor vehicles have been increasing at a rate of 1 dB(A) per year. If one assumes, as certain reports have suggested is the case, that community noise levels have increased by a decibel/year over the last 30 years, this means that the sound pressure has increased some 32-fold since 1940. On the basis of how our ears judge noise loudness, the increase to the average person's ears would be around 8-fold.

Typical urban noise levels range from below 40 dB(A) during the quietest hours of the early morning to as high as 80 dB(A) in the noisiest part of the day. Traffic noises can exceed 90 dB(A) during peak rush hours. Recent monitoring in and near Portland recorded 5:15 p.m. traffic on the Sunset highway at 86 dB(A), with a passing truck reaching 102 dB(A). Noon traffic in downtown Portland (5th and Columbia) had a 70 dB(A) noise level.



The criteria for noise-induced hearing loss in industrial workers are aimed at protection for frequencies (500-2000 Hz) considered essential for everyday hearing. Current industrial standards under the federal Occupational Safety and Health Act set a maximum of 90 dB(A) for an 8-hour exposure. Louder noises are permitted for shorter periods, rising to 115 dB(A) for 15 minutes or less. At 90 dB(A) noise levels, an estimated 15 percent of the workers over their working years will suffer hearing impairments in addition to the normal effects of aging; at 85 dB(A), the figure is lowered to 6.5 percent. These levels, however, are based on the premise that these high noise levels occur only during the 40-hour work week. If the worker is exposed to high community and household levels during his nonworking hours, his ears cannot "rest and recover". Unfortunately this is now the typical pattern. There is considerable pressure to make these industrial standards more rigid, for example, reducing the maximum to 85 dB(A). A factor to be considered here is the rapidly rising level of nonindustrial noise.

The table "Sound Levels and Effects of Illustrative Noises" presents some generally accepted guidelines of noise effects and noise levels from various sources.

SOUND LEVELS AND EFFECTS OF ILLUSTRATIVE NOISES*

Noise Range dB(A)†	Perception and Effects	Community Noise Sources	Industry and Home Noise Sources	Loudness–Subjective Judgement of Noise †
130–140	Near permanent damage level from short exposures	Military jet takeoff from carrier (50 ft)	Hydraulic press (3 ft)	135 dB(A)–64 times as loud as 75 dB(A)
120–130	Pain to ears	Turbo-fan jet at takeoff power (100 ft)	Oxygen torch Boiler shop	125 dB(A)–32 times as loud as 75 dB(A)
110–120	Uncomfortably loud	Rock and roll band Unmuffled motorbike (2-3 ft)	Scraper–loader Riveting machine	115 dB(A)–16 times as loud as 75 dB(A)
100–110	Discomfort threshold	Jet fly over (1,000 ft) Unmuffled cycle (25 ft)	Textile loom Noisy newspaper press	105 dB(A)–8 times as loud as 75 dB(A)
90–100	Very loud	Train whistle (500 ft) Diesel truck (25 ft)	Air compressor (20 ft) Power lawnmower	95 dB(A)–4 times as loud as 75 dB(A)
80–90	Intolerable for phone use	Steady flow-freeway traffic 10-HP outboard motor	Garbage disposal Food blender	85 dB(A)–2 times as loud as 75 dB(A)
70–80	Prevention of extra auditory physiological effects	Passenger car, 65 mph (25 ft) Busy downtown area	Automatic dishwasher Vacuum cleaner	75 dB(A)–sought after maximum community level‡
50–60	Quiet	Large transformer (200 ft)	Window air contioner in room	55 dB(A)–1/4 as loud as 75 dB(A)
40–50	Prevention of sleep interference	Occasional private auto at (100 ft) Bird calls	Quiet home during evening hours	45 dB(A)–1/8 as loud as 75 dB(A)
30–40	Very quiet	Soft whisper (5 ft)	Room in quiet house at midnight	35 dB(A)–1/16 as loud as 75 dB(A)

*Data for this table were obtained from several references. Most decibel levels for specific noise sources were adapted from data of Dr. Alexander Cohen.

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†On the logarithmic decibel scale on the left each increase of 10 dB represents a several-fold increase in sound pressure, but only an approximate doubling in a subjective assessment of loudness as the average human ear hears the noise or as it affects the nervous system. This subjective loudness range is shown in the column on the right. This column was adapted from one presented in the 1970 report by Branch.

‡Seventy-five dB(A) is the level recommended, for example, in a recent Los Angeles study as the maximum permitted noise level to be achieved within three years for cars, motorcycles, construction equipment and other tools, vehicles and equipment used in the urban setting as measured from a distance of 25 feet.

Noise Caused Hearing Loss

The vital part of the ear in terms of hearing ability is the cochlea in the inner ear. Sound waves transmitted by the eardrum create waves in the liquid of the cochlea; these waves in turn cause small sensitive hair cells, the cilia, to trigger electrical impulses that travel to the hearing center of the brain.

Hearing loss is measured in two ways. The first is a temporary loss resulting from sharp loud noises over a short period of time, similar to that experienced after firing a rifle. Such hearing loss is termed temporary threshold shift (TTS) and occurs at levels above 85 dB. Physiologically, the cilia, or hair cells, become fatigued from pressure. Typically, TTS will gradually disappear after exposure and normal hearing will be restored. The second type of hearing loss is permanent and is associated with excessive and persistent noise. This more extensive damage is termed noise-induced permanent threshold shift (NIPTS). Permanent and irreversible hearing loss appears to be associated with loss of effective cilia. The noise damaged ear becomes deaf to certain frequencies of sound. Speech perception, within these certain frequencies, becomes garbled.

The human ear is most sensitive to and most easily damaged by noises in the higher frequency range. Low frequency noises result in less chance of damage. A rumble is less damaging than a screech. Sirens, jet engines and many industrial emissions are among the most damaging higher frequency noises.

Like susceptibility to stress in general, people vary greatly in the extent of hearing loss incurred from given noise levels and intensities. At one extreme, surveys indicate that some 10 percent of the population can be exposed to 90 dB(A) of a given frequency noise over a 30-year period without suffering loss. But another 10 to 20 percent would suffer major loss in their hearing ability. The other 80-90 percent would fall between those extremes.

Hearing loss studies have shown that people not exposed to industrial noise have hearing which averages 10 to 30 percent better than that of industrial workers in comparable age groups. One study compared persons in their mid-50's who had lived and worked in quiet surroundings to others exposed to noisy working conditions. Those having significant hearing impairment varied from 22 percent for the quiet exposure group to 46 percent in the high noise group.

Physiological and Psychological Effects of Noise

It is clear that there are physiological and interrelated psychological effects of noise other than hearing loss. Anyone suffering loss of sleep from noisy surroundings, for example, can attest to this. There is considerable understanding, too, regarding the nature of this effect. But evidence is not conclusive on the extent to which such effects result in permanent health impairment. The issue centers on hypertension produced by noise and its relation, in turn, to the incidence of heart disease, stroke and other ailments. It is recognized that part of the noise impact is physical and part psychological.

Research and surveys conducted in recent years have pointed to various possible physiological effects of noise. Laboratory animals have been subjected to high noise levels in an attempt to determine effects on various bodily functions. Among effects reported have been an increased incidence of high blood pressure and dental caries; increased susceptibility to viral infections and gastric ulcers; interference with kidney function; and changes in hormonal output, glandular function, and cholesterol levels.

Limited research, much of it in Europe, has been done with human subjects. Initial findings related to noise effects on blood circulation. Noise, even at low levels, caused blood vessels in peripheral zones to constrict, decreasing the blood supply there. Other research demonstrated certain minimal, but consistent effects of 90 dB(A) noise levels on blood pressure and heart function. Other effects noted have included migraine headaches, gastrointestinal disorders, and allergies, as well as certain endrocrine and metabolic effects. A German researcher, Dr. Gerd Jansen, qualified his findings with a tie to psychological factors, "If noise . . .makes you angry, or you are in opposition to the noise source, or it it frightens you, pulse and pressure will go up."

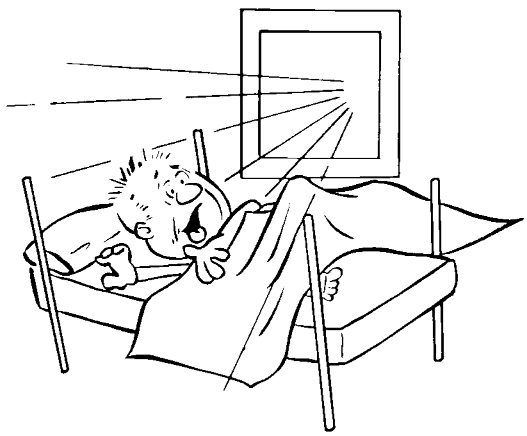
Dr. Aram Glorig summarized the nonaudio physiological effects at the 1969 American Medical Association meeting on Noise Pollution as follows:

> ". . . . it is well known and documented that noise from 75 dB up will produce various temporary changes in the physiological state. The most important of these is a reduction in the size of the median and small arterials. Some of the side effects of this phenomenon are an increase in pulse rate, a paling of the mucous membrane throughout the organism, and an increase in respiration rate. This is probably related to the autonomic system. Studies of animals and humans show that they carry over to produce permanent effects. Some investigators have postulated that these temporary effects may become chronic if they reoccur frequently over long periods of time and theoretically can produce hypertension, ulcers and dermatoses. Further studies in the comparisons of non-noise exposed groups and noise-exposed groups with respect to these problems are essential before valid conclusions can be drawn."

Physiologically, noise exposure can pose a problem even in the prenatal stage of life. Scientists are now confirming what expectant mothers have long recognized, that noise can be detected by the unborn child. They report that it causes the fetus to kick and move around. Studies in Sweden have shown that the baby responds to even moderate noises by increasing the rate of its heartbeat. Research has also indicated that noise as a stress may be a factor in developmental abnormalities in the fetus.

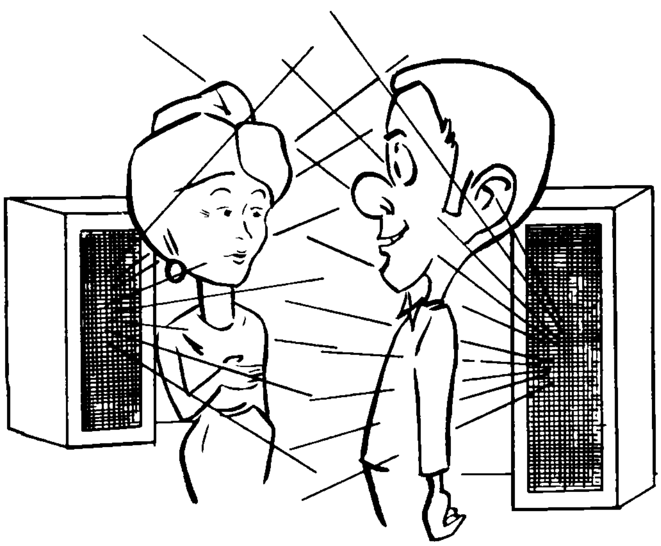
Psychologically, a person will normally tolerate and accept a given noise when he feels that it is an inevitable byproduct of a useful service. He also tolerates it more when it does not overtly affect his health or frighten him. One airport noise survey indicated that a person's general connection between noise and his fear of aircraft crashing has more effect on the degree of annoyance than did the actual level of noise. Humans seem to respond to the mid-frequencies (500-2000 Hz) more than they do to the low or high frequencies in terms of annoyance or a subjective impression of loudness. It is also becoming apparent that it is the unplanned or unprogrammed noise which is most upsetting.

Without question, one of the most disruptive effects of noise both physically and mentally is loss or interruption of sound sleep. It is well established that sleep is a physiological necessity and any disruption of sleep can be prejudicial to physical as well as mental health. But it has now been postulated that victims may also develop psychotic symptoms because their dreams are interrupted. It has also been shown that the physiological symptoms of constriction of the blood vessels can still take place while one is asleep.



Another obvious effect of noise is simply making it more difficult to communicate or be alerted to impending hazards. This can be both an irritant, as well as an element of danger. High noise can produce temporary threshold shifts which can interfere with awareness to hazards.

Several other effects of noise are recognized, some of which are psychological or behavioral in nature. Among these, persons exposed to unwanted noise tend to become irritable and unsociable more easily. Baron noted in his study that "workers in noisy jobs tend to be more quarrelsome at work and away from it than those doing equivalent jobs, but who are not subjected to similar noise stresses." The effect of noise on work efficiency, performance and concentration in both the industrial plant and the office are of growing concern. It has been stressed that people working in a noisy environment make more mistakes and their thinking can get slow and fuzzy.

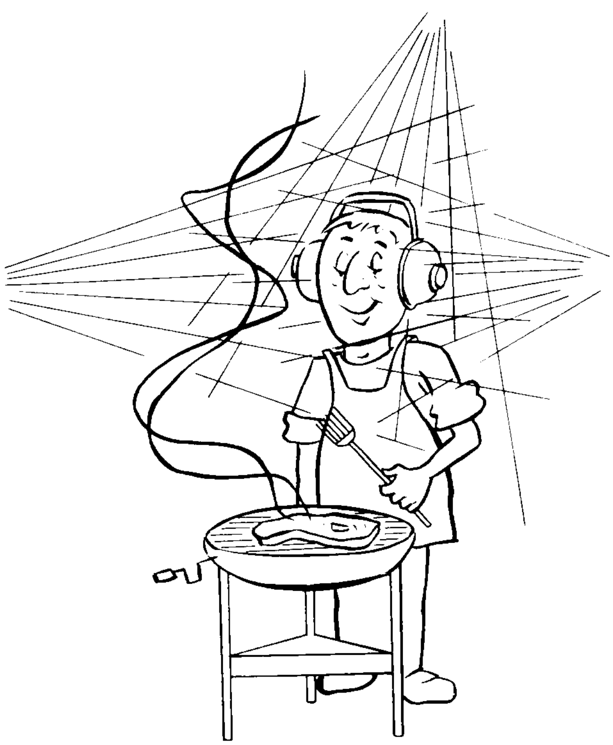


Another factor is our ability to screen, or mask, noise with which we are not directly concerned. More specifically, it enables us to hold a conversation amid many conversations. It often operates in conjunction with the reflex which causes one to speak up as background noise increases. How much one is able to overlook or mask the background noise depends largely upon his attitude. If the experience is pleasurable people will tend to be able to tolerate more noise. This is vividly shown by today's teenage worship of amplified music. On the other end of the scale, when people are frustrated and tired at the end of a day, it is far more difficult for them to tolerate the blaring horns and screeching tires of 5 p.m. traffic. When already tired ears are then subjected to high levels of unwanted sound such as amplified music, the situation can become highly charged emotionally. It is easily understandable how the threat to a person's mental health can be attributed to expanding noise levels.

When assessing the psychological effects of noise, it must be realized that a complexity of factors concerning both the noise and the subject should be considered. These include the intensity, pitch, and distractiveness of the noise, as well as the general health and fatigue level of the subject.

Loss of Amenities and Livability from Noise Pollution

The reduction in livability resulting from our increasing level of community noise was often overlooked prior to the environmental movement of the past several years. Previously, if an environmental stress or "insult" could not be quantified in terms of specific physical impairment to hearing or other bodily functions, it was given little consideration. This situation has now changed significantly. The general loss of natural amenities is a factor now receiving much greater attention. Society is no longer endorsing, without meaningful challenge, new technologies that contribute to economic development, or otherwise enhance national well-being, but which have undesirable environmental side effects. Side effects in the form of noise have received less attention to date than those manifest in water and air pollution, for example. But this situation is now changing. The dramatization of the noise problem from the sonic boom and SST debates has been a factor in this awakening.



One important aspect of the loss of livability from excessive noise is our adaptation process. As is the case with pollution and environmental deterioration in general, we can adapt to increasing noise levels without recognizing that this is happening. It often takes a dramatic incident to cause us to realize the extent to which we have made our adaptation. Jet aircraft, the sonic boom and the SST issue have been such dramatic situations.

Livability is of great importance to Oregonians. The state is noted for its excellent natural beauty and favorable climate. Outdoor activities are important. But noise can restrict such activities. An outdoor barbeque or a walk in the park are not enjoyable under conditions of high community noise levels.

SOURCES OF COMMUNITY NOISE AND MEANS OF ABATEMENT

One recent noise pollution report noted that in the community, the noise pollution problem is just beginning, for noise in any machine is related to power output, a quantity growing rapidly in the home, industry, farm, and street corner. Another statement stressed that today's urban noise is largely the result of people's insatiable desire to reach distant places even more rapidly and comfortably. As we have developed faster ways to transport ourselves and our commercial goods, we have created a noise nuisance that is becoming increasingly difficult to live with. Cars, buses, trains, trucks and airplanes are a necessary part of our lives. It does not follow, however, that all the noise created by these machines is necessary. Clearly, the sources of noise are increasing both in number and intensity.

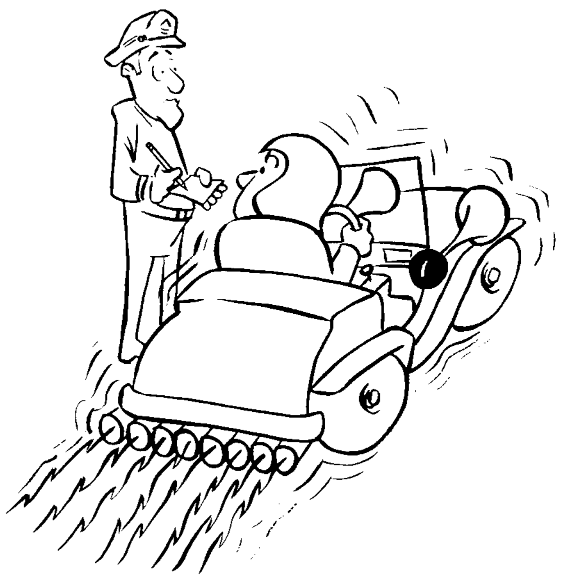
Three basic approaches have been employed in the technical abatement of noise. These are 1) reduction at the source, such as developing quieter equipment; 2) dampen or insulate noise from existing sources; and 3) mask with other sounds, such as music.

Noise Problems from Motor Vehicles and Trains

Noise monitoring and community surveys generally identify vehicular traffic as the principal source of community noise. More than 100 million motor vehicles are now in operation in the United States. And we will add an estimated 12 million to this number this year. These are made up of private automobiles, trucks, buses, motorcycles and motorbikes. In addition to increases in numbers, other noise factors are an upward trend in speed and weight, and the nearly universal adoption of the diesel engine for commercial vehicle use.

One of the most obvious and alarming noise sources from motor vehicles is that caused intentionally by the honking of horns. Horns are designed to blare in the frequencies that are most easily heard in order to obtain attention. Auto horns, too, must get louder over time in order to pierce through the added noises to which drivers are subjected at increasing highway speeds and with noise producing gadgetry such as air conditioning and radios in the vehicle.

Another obvious vehicle noise source is its engine. Noise production is increased in modern engines with the trend toward higher compression ratios and higher peak combustion pressures. One of the most offensive and disturbing engine noise problems is that of engine exhaust. Mufflers are designed to baffle exhaust noise levels, but some vehicles are recognized for their lack or inadequacy of mufflers. On regular passenger cars the only significant problem is defective mufflers. The sports car, however, poses a special problem both from its small, higher speed engine, as well as its small muffler. Trucks with defective mufflers, or with mufflers that have been disconnected in the hope of increasing horsepower are a major noise source.



However, the worst offenders are ineffective mufflers or modified mufflers on motorcycles and motorbikes. One study has shown that of those which are equipped with mufflers, 40 percent had purposely had their muffler modified to increase noise levels or in an attempt to increase engine efficiency and power.

Automatic transmission and gear shift noises in buses and trucks can also be particularly annoying.

Another major noise source is motor vehicle tires. A number of factors are responsible for noise production from tires. Vehicular speed is of most significance. Other factors influencing noise levels are the type of tread, tire pressure, wear, road smoothness, and temperature. Road surface characteristics are of special significance in Oregon. Because of heavy rainfall in western Oregon, safety has favored rock-based, relatively rough road surfaces. These generate the highest noise levels. Regular "circular" tread designs are the noisiest; uneven or irregular tread patterns provide quieter operation.

As a class, trucks make more noise than other motor vehicles, with diesels being the worst offenders. A single large diesel truck can produce more noise than 30 passenger cars. The average truck at 60 miles per hour is generally twice as noisy as a steady stream of passenger automobile traffic. Truck noise tends to be more irritating, too, because of the sporadic nature of truck traffic.

Motorcycles and motorbikes constitute a special problem. They are air cooled, have a short exhaust system and an unshielded engine. Motorcycles and motorbikes (including the so-called "mini bikes") have been increasing at a phenomenal rate. In some cities, numbers have tripled in a period of less than five years. In one measurement made of sound levels at a point 18 inches above the tailpipe, recordings were as high as 122 dB(A). The lowest recording was 110 dB(A) at 20 mph on a single cylinder 2-cycle engine. A factor which must be considered is that many riders desire high noise levels.

Among the suggestions frequently made to reduce vehicular noise problems are 1) eliminate horns, depending instead on visual warning systems; 2) change tire tread patterns to eliminate uniformity and associated whine; 3) alter street surfaces, such as application of pliable materials; 4) introduce new power sources, such as steam propulsion (a reduction of air pollutants would also be a beneficial side effect), and modify conventional engines; 5) encase engines, use mufflers, and otherwise modify motorcycles and motorbikes; 6) keep development away from freeways with 500 feet considered desirable; and 7) construct freeways on a depressed, trough basis or provide barriers or baffles to shield against noise.

Principal noise problem sources of the train are its shrill whistle, the rumbling, particularly at higher speeds, braking sounds, and the loud impact noise in the train yard when freight trains are joined. Technological methods suggested to reduce train noise have included modifying tracks and couplings and reducing the noise from whistles when this can be done without jeopardizing safety.

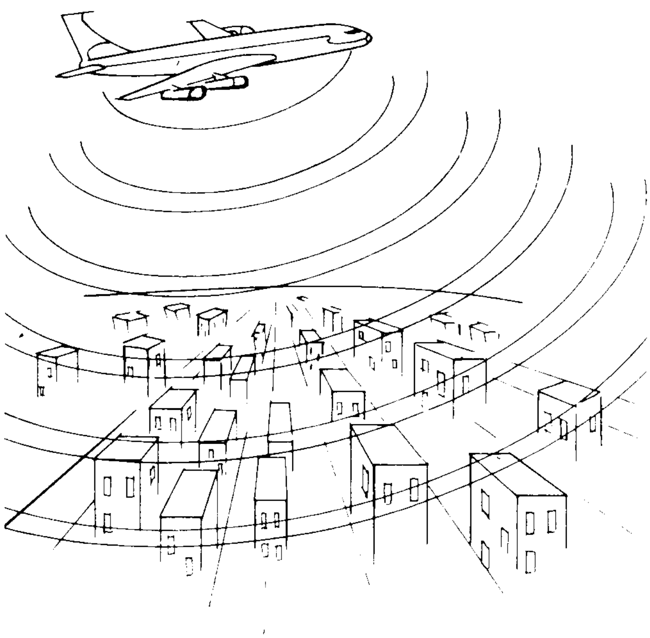
Airplanes, Airports and the Sonic Boom

Air transportation has brought in a significant new dimension in noise pollution. Few industries can match its sustained growth rate. Passenger traffic handled by scheduled airlines has been and is expected to continue to grow in the near future at an annual rate of 15 to 25 percent.
Thirty-four million Americans traveled by plane in 1969. At the Portland International Airport passenger enplanements grew from just under 3/4 million in 1965 to 1 1/4 million in 1970. In addition, the number of private planes is growing at a rapid rate, and is expected to exceed 200,000 nationally by 1980. The kinds of planes which have been added are those in the higher noise producing categories—jets and helicopters.

Of particular significance in air noise levels is the shift from propeller to jet planes. With propeller planes, the noise source centered on takeoff when maximum power was exerted. In landing they glided in with relatively low noise levels, producing appreciable noise only when they reversed the pitch of the propellers to slow the aircraft. Jets, on the other hand, are noisy in both takeoff and landing. They are brought down to land with engines running full throttle, nose tilted upward for maximum lift. And the noise they make as they reverse the thrust of the engines on landing can be louder than on takeoff.

There are two significant kinds of noise from the jet engine. One is the whine from the siren-like compressors at the front of the engine, a factor primarily associated with turbo-jets. The other is the roar of the burning fuel and air mixture as it comes out the rear of the engine.

Jet aircraft can affect a large geographic area with their noise emissions. A Noise Advisory Committee in a report to the 1971 California Legislature noted that "a typical long-range, four-engine jet transport on takeoff spreads an unacceptable noise level contour 34,000 feet long from the end of the runway and 6,000 feet wide. On landing, the same aircraft generates an unacceptable noise contour 11,000 feet long and 1,500 feet wide. This is a total of approximately eight square miles of land outside



the airport being exposed to a generally unacceptable level of noise." The committee strongly recommended more stringent zoning powers to prevent incompatible uses of land near airports. Residences, schools and hospitals are incompatible with aircraft and airport noise. Acoustically treated industrial buildings and certain types of recreational uses and most agricultural operations are much more compatible. Specifically, the committee's recommendation was to "amend the Public Utilities Code to require Airport Land Use Commissions to achieve, by zoning, compatible land uses in the vicinity of all new airports and . . . existing airports which are not surrounded by land devoted to incompatible uses, or enact other legislation to achieve this end."

Three broad approaches are available to control or to lessen the impact of airport related noise. These are 1) technical adjustments to the aircraft, 2) operational procedures used by the aircraft and the airport, and 3) policies and procedures by the airport and by the community to prevent noise exposure.

Regarding technical adjustments to the aircraft, two approaches at noise reduction are being employed. One is acoustical treatment to the aircraft. The other is the development of quieter engines. These approaches could apply to existing as well as to new aircraft.

In acoustical treatment to existing planes, the approach is referred to as "nacelle retro-fit." It involves giving (fitting retroactively) acoustical treatment to the enclosed part (the nacelle) of the aircraft that houses the engine. In older jets, nacelle treatment would be effective primarily in reducing fan noise associated with landing. In specific noise reduction, NASA tests have indicated, for example, that the "long nacelle" treatment to the Boeing 707 would cut approach noise by 15.5 EPNdB, (starting at around 118 EPNdB approach noise) sideline noise by 3.5 EPNdB and takeoff by 3.0 EPNdB. (The effective perceived noise decibel (EPNdB) is used in aircraft noise determination because this more closely approximates our subjective judgment of noisiness and the irritation it produces. In the 95-110 range its value will be 10 to 15 decibels greater than the dB(A) scale.) This nacelle treatment would, however, increase the nacelle weight by 30 percent, affect thrust and range, cost a million dollars to install, and add 9 percent to direct operating costs.

The quiet engine approach would involve modifications to existing engines and design changes for new engines. Concentration would be on increasing the by-pass ratio and maintaining a moderate turbine-inlet temperature.

Nacelle treatment and engine modification for any significant noise reduction will not be an inexpensive program. A conclusion from the NAS-NAE study on expansion of the Kennedy airport was "that the present fleet of 707 and DC-8 aircraft could be quieted to 95 PNdB for an added investment of approximately four million dollars per aircraft." There would be some improvement in performance. Ignoring this, the investment would mean a 7 to 10 percent increase in ticket price. Another study, by the Rohr Corporation, concluded that reductions of approximately 5 EPNdB on takeoff, and 10 EPNdB on approach, could be obtained for all current low-by-pass, turbo-fan-powered aircraft at an investment on the order of $500,000 per plane, with an overall increase in operating costs of 4.5 percent—a 0.4 percent increase in ticket price.

The so-called second generation jets (B-747, DC-10, L1011) will be significantly quieter than the first generation planes. The NAS-NAE study indicates they are "being powered by engines that produce over four times the net thrust of the first commercial jet engines and yet are significantly less noisy." They incorporate some of the quiet engine and nacelle features. Full incorporation could render substantial further noise reduction, but at the sacrifice of engine thrust-to-weight ratio, fuel consumption, and payload of passengers and cargo.

Specifically, the modified 747, with potential passenger capacity of 500 is some 5 EPNdB quieter on takeoff and 10 EPNdB on approach than the 707. The DC-10 and L1011 are reported to be even quieter.

There are three means currently employed in operational procedures for noise abatement. These are 1) power cutback in takeoff procedures, 2) steeper landing and turns to avoid built-up areas, and 3) runway selection, again to avoid heavily developed areas. Limitations on the extent to which operational procedures can be modified to reduce noise impacts are imposed by such factors as safety, pilot skills and passenger comfort. Airports with major urban developments in their environs are now placing increasing emphasis on noise reduction aspects in their operational procedures.

The most drastic actions that are being considered, and in some instances adopted, have been 1) moving airports away from developed areas even at the social cost of transporting passengers much greater distances to and from the airport, and 2) buying property or certain property rights or treating property near the airport that is affected by noise. The second possibility can be handled by actual purchase of the property, by purchase of easements on air rights, by the payment of damages, or by the installation of sound insulation in residences and in office and industrial buildings which are affected.

The engineering technique of Noise Exposure Forecast (NEF) contours is now being employed in airport and land use planning in relation to the noise problem. It is a methodology used for obtaining a single number rating of the cumulative noise produced in the vicinity of an airport. NEF values are computed from a complex of input data. These data include knowledge or prediction of the total mix of aircraft that are or will be in use at the airport, segregated by aircraft class; the sound spectra and output levels of the aircraft engines being used or to be used; effective perceived (subjective) noise level information for each aircraft class; number, frequency and duration of overflights by class; the time of day or night they occur; flight-path characteristics; and possible atmospheric conditions. Integration of these factors permits the delineation of NEF areas or zones within which various degrees of community reaction against aircraft noise exposure may be expected. The three NEF values of greatest importance are 1) less than 30, 2) between 30 and 40, and 3) greater than 40. The land use-airport planning guidelines for new airports are that residential areas should be less than NEF 30; that the land area in the 30 to 40 NEF range be restricted to noise compatible uses; and that all land in the NEF 40 zone be within the airport boundary.

Related to aircraft noise is the particularly troublesome problem of the sonic boom. As a supersonic jet plane exceeds 750 miles per hour it breaks the sound barrier. The resulting sonic boom occurs suddenly and without warning, causing people to be startled and concerned. With the advent of supersonic jet transport the possibility of the community being subjected to increasing numbers of sonic booms has been the topic of intense controversy and research. Outside of the immediate psychological reaction to and the property damage from the noise impact, no other damage, including physiological, has been indicated. Interference with sleep, rest, and conversation, and damage caused from vibration such as shattered glass and windows, are some of the complaints received as a result of sonic booms.

Noise from Industry, Construction and Service Activities

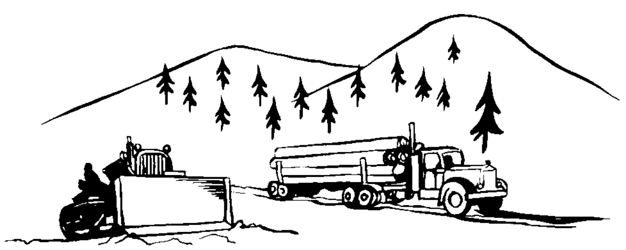
Industrial areas can generate high levels of noise. In a brief tabulation of city noises, the Industrial Acoustics Company of New York City found that at 100-foot distances, transformer stations had noise emissions of 55-65 dB(A); generating plants, 100-120 dB(A); air-conditioning cooling towers, 85-95 dB(A); light manufacturing plants, 50-90 dB(A); and heavy manufacturing plants, 50-100 dB(A).

On city streets, construction crews demolish buildings and reconstruct new ones. The pneumatic drills, or jackhammers, are among the most annoying, loudest tools used in this industry. Hammering, sawing, and sanding during construction also add a great deal to high noise levels. Not only are the operators of these tools exposed to high noise levels, but so is the adjacent community.

Much of the noise produced by industrial and construction sources can be reduced by installing modification to muffle the noise or by altering the basic design of equipment. For instance, quiet pile drivers have been developed which work on the principle of a humming vibration rather than pounding steam hammers. Pneumatic tools can be silenced by mufflers on intake and exhaust by as much as 20 dB(A). Much of the machinery used can be enclosed or encased in acoustical paneling.

Moving out of industrial areas and into office buildings does not bring immunity from noise pollution. Offices contain typewriters, adding machines, copying equipment, and a host of attention getting instruments, the most demanding of which is the telephone. Piped-in music may be playing—designed to sooth nerves, combat fatigue, alleviate boredom and counteract other more disturbing noises. Instead, it is often a contributor to high levels of background noise and irritating to many people when used in this way in offices, elevators, and restaurants.

The harvesting and processing of forest products constitutes a noise source of significance in Oregon. Forest product operations account for well over half of the state's industrial activity. A number of forest harvesting and processing operations are particularly noisy. Logging involves the use of diesel powered equipment, chain saws, hoisting and conveying equipment, and on occasion, blasting. Oregon's 350 saw mills are characterized by high noise levels from saws and planers, as well as transport, yarding and loading equipment. But logging, and often the milling, is done in remote areas so that noise is a problem primarily for the workers. The noise problem in other segments of the forest products industry, such as the pulp and paper mills, centers on noise exposure of employees.



Like forestry generated noise, agricultural operations are generally apart from developed areas. But this is not always true, particularly of processing activities. There are approximately 30 large food processing plants in Oregon. Processing plants, such as slaughter houses and canneries, can also generate high noise levels, again of concern principally to workmen. Operating farm equipment such as tractors and combines, can generate noise levels up to 100 dB(A) on a continuing basis to affect the equipment operators.

Of much greater annoyance from a community standpoint than industrial noise are the increasing sources associated with general living and service activities. Air conditioning units, power lawn mowers and paving repair equipment, to mention just a few of these sources, operate amid homes, offices and downtown stores. Street departments use mechanical sweepers and paved drive-in restaurants employ giant vacuum cleaners to operate during the early morning hours. This pattern fits in with traffic and business operation but not with nearby residents who want to sleep.

Recreational and Other "Living" Generated Noise

The great dilemma of pollution is that what is one man's job or fun is another's pollution source. Noise pollution is no exception. Recreational activities, including loud music and vehicular racing, are a source of enjoyment to some, but noise pollution to others.

Turning from the more acute, startling noises to the not so soothing notes of music, the latter can actually result in greater damage. Modern music has indeed become a factor in the community level of noise. Today's music exposes not only the musician but the listener to intense levels of amplified sound. The difference between loud music of past generations and the music today is that a larger number of people are affected. And much of today's music is electronically magnified. One audiologist, Dr. James M. Flugrath, has noted that, "It is quite possible that due to modern amplified rock-and-roll music, we are raising a nation of teenagers who will be hard-of-hearing before they reach what they consider old (30 years old)." Exposure levels measured at dances have reached 100-120 dB(A). This is similar to ". . . having your head under the hood of your car and someone leaning on the horn for a couple of hours." Dr. David Lipscomb, another researcher in audiology has commented that, "we have apparently reached a point that the young people are losing sufficient hearing to jeopardize their occupational potential. We must enter into a program of safety or the consequences are going to be pretty dire." It is inevitable that with continued exposure at these high levels of noise, damage to hearing will occur.

Two reasons are often cited to explain why loud music has become vogue. Teenagers like and are able to pay for loud music whether by purchasing expensive equipment and instruments or by putting a coin in a juke box and turning it up. And, they are now given the opportunity to buy the amplification equipment by manufacturers who provide these systems for public consumption. Formerly, this kind of equipment was not manufactured for the public but was available only to the professional musician.

Vehicle racing is another recreational noise source that is generating mounting concern. It can take the form of either legitimately sponsored races or the illegitimate drag races on public streets and highways. The community noise problem caused by auto or cycle race tracks has its impact on those who live, work or are otherwise present in the vicinity. The best control measure is to locate the race track at a considerable distance from those who wish to pursue quiet activities. The racing noises also can be lessened by shielding the track with tall noise barrier fences and vegetation. The time of operation can also be restricted to minimize interference with sleep.

Unprogrammed drag racing, particularly of motorcycles and motorbikes, poses a special, intensifying problem. Races frequently take place in outlying residential areas during sleeping hours. Abatement would seem to lie with stricter police action in apprehending racers. The problem with loud motorcycles and motorbikes could also be abated by the establishment of specific noise standards and by making it a punishable offense to operate a vehicle not meeting these standards. The problem of recidivism is frequently encountered when the only police action is to require correction of equipment (which means the muffler has been removed or modified). In other words, the operator fixes the muffler and squares the police citation. He then immediately modifies his vehicle to make it noisy again.

One recreational noise source in Oregon on which measurements were taken recently was boat racing. Measurements were made during the Emerald Cup Hydro-plane Races at Dexter Lake (near Eugene) on Sunday, August 15, 1971. In a recording made from a residence in the town of Lowell, background levels prior to the race were 56 dB (A). One noise measurement during the race from the same location had a peak level exceeding 100 dB(A). Even the announcer was excessively loud. From a 10-meter distance his noise level was recorded in the 90-100 dB(A) range.

Use of Ear Protectors

Various types of earplugs and muffs are used in occupational and recreational activities where high noise levels are encountered. Such devices can protect against both temporary threshold shifts and permanent hearing loss from repeated exposure.

One common misconception in the use of ear protectors is that they interfere with hearing and thus prevent awareness of approaching danger. As indicated in correspondence from a state health official, "You can hear the approaching danger better with the ear muffs on than you can with the ear muffs off in a high noise area." Temporary hearing loss is prevented and the wearer can concentrate better. Research has demonstrated, for example, that it is easier to communicate in a noisy situation when muffs are worn.

Recommendations have been made that ear protectors be worn by persons exposed to high noise levels from recreational activities. Some participants in high noise recreational activities such as target shooters do wear protectors, but the typical hunter does not.

LEGISLATION FOR NOISE CONTROL

Control patterns for noise pollution have typically been based on legal action through the courts and regulations imposed by government. Only the regulatory pattern imposed through governmental action will be discussed.

Most towns and cities in the United States have one or more ordinances on their books relating to noise. Usually they have been broadly worded so as to make it an offense to create noise that can be considered a public nuisance. Often noise offenses have been included in general ordinances covering a range of public health and welfare problems. Most cities have specific ordinances, generally requiring adherence to state law, regarding motor vehicles. The major concern has been defective mufflers.

A number of cities have adopted or are now in the process of adopting much more comprehensive ordinances that provide specific noise standards which have to be met by various sources. A time scale for meeting the new standards by some future date is generally employed. This program of standards for sources with a time set for compliance is regarded as the "modern" approach to community noise control.

At the state level, New York has pioneered with modern noise pollution abatement legislation enacted in 1965. California followed with even more stringent requirements in 1967. Motor vehicle noise has been the major source covered in these state programs.

At the federal level, limited control had been exerted, prior to 1969, on industrial and aircraft related noise. Then in 1969, initial federal standards for occupational and aircraft noise were issued. Limited federal legislation relating to the general community noise problem was enacted in 1970. All indications point to increasing federal participation on the noise pollution problem on a basis comparable to that followed during the past six years in water and air pollution control.

A number of other countries, including most European nations, are considerably ahead of the United States in public action for community noise control. In the sections which follow more detailed coverage will be given to control programs that have been enacted or are being considered by governments in this country and abroad.

National Legislation Regarding Community Noise Control

One provision of the amendments to the Clean Air Act passed in 1970, which became effective January 1, 1971, called for the establishment of an Office of Noise Abatement and Control in the Environmental Protection Agency (EPA). The role of the office was to identify and classify causes and sources of noise and determine their effects on public health and welfare. The law also provided for studies on effects of noise on people, wildlife and property; effects of sporadic and intermittent noises; expected growth of noise problems through the year 2000 and such other data as were determined to be appropriate. A comprehensive report is to be provided to the federal Congress early in 1972. It will cover information on present federal activities, on state and local laws, regulations, and enforcement capabilities and on the state-of-the-art of noise control technology. Recommendations are also to be provided on the type of long-range noise abatement programs which should be adopted by the federal government. Another provision of the law requires that federal agencies involved in projects generating noise are to consider this problem in any environmental impact statement which would be prepared and presented to the EPA.

A comprehensive noise control bill is currently being considered by the federal Congress. Several other bills relating to specific noise problems such as aircraft are also before the Congress. The noise control act which is being considered would provide the EPA with authority to set or to amend standards limiting the noise generating characteristics of new construction, transportation and other equipment powered by the internal combustion engine. Products manufactured after the establishment of these standards and failing to meet them, would be prohibited from sale in interstate commerce. Removal or modification of noise control equipment on these products would be prohibited. One of the most controversial features of this legislation is the preemption clause which provides that states would not be allowed to establish more restrictive requirements than the federal standards. They are restricted to issuing regulations limiting use of the products. This specific provision is receiving a great deal of attention by those states and cities, like California and Chicago, that have already enacted fairly rigid standards. Another feature of the proposed act would empower the EPA to review and approve Federal Aviation Administration (FAA) standards regarding aircraft noise.

Another significant provision of the proposed legislation is the labeling of noise levels that could be expected from high noise generating household and other widely used equipment. Specifically, it would provide that the EPA may require that a notice of level of noise generation be attached to products producing harmful noise or a notice of effectiveness for products sold on the basis of their ability to reduce noise. Both foreign and domestic products would be covered under the labeling provisions, as well as under the standard requirements. In labeling, as in setting standards, state or local governments would not be allowed to adopt more restrictive requirements than the federal government. Enforcement is provided with fines of up to $25,000 prescribed. Additional funding would be provided for research, including the development of measurements and control techniques, and for assistance to state and local governments that may be setting up noise control offices.

Related to community noise, more stringent federally initiated control of industrial sources has also been authorized during the past year (1971). The provisions of the Walsh-Healey Act, which covered standards and enforcement for noise inside certain large factories, have been extended through the federal Occupational Safety and Health Act, to anyone with an employee subjected to high noise levels in his work. The extensions also impose more stringent penalties for violations. Nonfactory workers, including agricultural employees and truck drivers, will be covered under these new requirements.

Recent State and Local Governmental Action on Community Noise

The pioneering ordinance following the new concept of setting or basing regulations on specific standards was passed in 1954 by the city of Milwaukee, Wisconsin. It spelled out permissible traffic noise in specific decibel limits. It provided, for example, a limit of 95 dB(A) as measured 20 feet from the vehicle in motion. This pattern of specific standards for noise sources was adopted also in 1954 in the model nationwide law passed in Switzerland. It set a maximum of 90 dB(A) at 24 feet for trucks, buses and 4-cycle motorcycles; 80 dB(A) for autos and motorized bicycles; and 85 dB(A) for 2-cycle motorcycles.

In the late 1950's a number of other cities in the United States established ordinances following the Milwaukee pattern. Cincinatti, Beverly Hills, and Memphis were among the cities which passed such legislation at that time.

In Oregon, the City of Eugene has recently passed a comprehensive noise ordinance dealing with "unreasonable and raucous noise" from specific sources. Specific standards are also being provided to accomodate enforcement. Other Oregon cities with noise ordinances using specific noise standards include Lake Oswego, Beaverton, and Klamath Falls.

The present Oregon State Motor Vehicle Code contains the following provisions regarding noise.

"It is unlawful:

- For any person to operate a motor vehicle on a street or highway unless such motor vehicle is equipped with a muffler in good order and in constant operation to prevent excessive or unusual noise and annoying smoke;
- To equip any motor vehicle with a 'muffler cutout';
- For any person to operate or for any owner of any motor vehicle to permit to be operated upon any public road, street, or highway any motor vehicle so as to cause any greater noise or sound than is reasonably necessary for proper operation of such vehicle."

Portland's vehicle ordinance has the three provisions from the state code along with three others covering 1) noises other than mufflers from poor vehicle repair, 2) unnecessary use of vehicle horns, and 3) use of gongs or sirens except on authorized vehicles.

In state control programs, the legislation passed by the State of New York in 1965 applied the pattern of enforceable standards to various classes of motor vehicles. It defined, for example, excessive noise for trucks as 88 dB(A) measured at 50 feet. Noise was measured at check stations with trucks passing by at specified speeds.

The most comprehensive state vehicle noise legislation was that passed in California which became effective in January, 1968. It provided that the state highway patrol would enforce a statewide vehicle noise program keyed to the type of vehicle and relative speed. The enforcement pattern adopted by the highway patrol is for a two-man team of officers to check noise levels of passing vehicles. One officer reads the vehicle's noise level and if a violation is noted, the other officer gives chase. In addition, a major inspection program is followed. It is anticipated that in 1971 a total of over one million vehicles will be tested for noise levels. The present new vehicle standards provide for an 88 dB(A) level for motorcycles, trucks and buses, with 86 dB(A) for other vehicles.

California has also been a pioneering state in aircraft noise regulations which are based on specific noise standards. These standards provide for a noise level reduction near larger aiports to 75 dB(A) by 1975; to 70 dB(A) by 1980 and then to 65 dB(A) by 1985. Smaller airports with noise problems are expected to reach 70 dB(A) immediately and to reach 65 dB(A) by 1985. It is projected that major airports will set up monitoring systems and employ these systems on a planning, as well as an enforcement, basis for noise abatement.

Action by 1970-71 Legislative Session in Oregon

"The Legislative Assembly finds that the increasing incidence of noise emission in this state at unreasonable levels is as much a threat to the environmental quality of life and health, safety and the welfare of the people of the state as is pollution of the air and waters of this state." This is the wording at the beginning of HB 1669, passed by the 1971 Oregon Legislature. This act authorized the Environmental Quality Commission to "adapt reasonable statewide standards for noise emissions permitted within this state and to implement and enforce compliance with such standards." Efforts are now underway by the Department of Environmental Quality to develop background and data on noise problems in Oregon needed as a basis for setting noise control standards.

City of Chicago Noise Ordinance

Possibly the most stringent city ordinance regarding community noise sources was that which became effective July 1, 1971 for the City of Chicago.

Under their new regulations, manufacturers of equipment which contribute to community noise must certify that their products meet the noise limits of the ordinance. Noise levels will be determined on both new equipment and equipment in operation to check conformance to the standards. And the significant feature is the very low noise levels which will be required to be met in 1980. For cars, trucks, buses, motorcycles and motorbikes, the level is reduced from an 86-92 dB(A) range at present, depending on the type and year of the vehicle, to a 75 dB(A) level in 1980. Essentially all vehicles in this class could not now meet this requirement. A recent estimate from California, based on their testing, was that 97 percent of current passenger vehicles could not meet a 75 dB(A) standard. Most could meet an 80 dB(A) standard. Thus, drastically quieter design on the part of all vehicles in this class would be required.

Regulations for construction equipment, including tractors, bulldozers, cranes and paving machines, became effect in 1972, with a 94 dB(A) limit and will be reduced to an 80 dB(A) maximum limit effective in 1980. For power equipment such as chain saws that would occasionally be used in residential areas, the present limit is 88 dB(A) with reductions to a maximum of 80 dB(A) by 1980. Power equipment used in residential areas, such as lawn mowers and other types of motorized garden and snow removal equipment, would have an initial limit of 74 dB(A) with a reduction to 65 dB(A) by January 1, 1978. Snowmobiles would be limited to a level of 86 dB(A) at the present time and would be forced to meet a standard of no more than 73 dB(A) by June 1974. Somewhat comparable requirements would be necessary for dune buggies, go-carts and minibikes. Another provision is that motor vehicles not in motion may not blow horns or otherwise produce audible signals. Moving vehicles may blow horns only in emergencies. Noise projections from commercial vending operations or sound trucks are also prohibited.

Requirements are placed on the equipment owner or user to see that the product is kept in good working condition after purchase. The ordinance requires that no modifications can be made that will make it noisier. Penalties are provided for such modifications.

Stringent requirements are also placed on noise levels in residential, business and commercial districts. These provide that noise will be measured at the boundaries of the lots for such noise sources. In residential areas, maximum output will be 55 dB(A). In business and commercial areas the maximum is 62 dB(A). Limitations are also imposed in manufacturing districts.

Noise Control Programs in Europe

European countries are well ahead of the United States in noise control programs. Most have comprehensive national legislation. It has been suggested that one basic difference is that in Europe there is an attitude that men should be protected from excessive noise. Here, there is often an assumed right to make as much noise as you want to regardless of its effect on others. And in Europe, anti-noise citizen's groups have been in operation for a number of years.

In regard to vehicular noise, Switzerland, as noted earlier, pioneered in national legislation in 1954 with specific limits on various vehicular and other noise sources. West Germany adopted regulations for noise levels on new vehicles in 1956. France adopted a code in 1962 specifying maximum noise emissions for motor vehicles. Britain adopted stringent requirements in 1968. Specific maximum decibel levels were set for all types of motor vehicles. European legislation also places much more responsibility on the offender. A citation can be given for a noisy vehicle, for example, and it is then up to the offender to prove that his vehicle, either as it existed or after correction, meets the required standards. In Switzerland or Germany a police citation requires an immediate check-up at the testing station and grounding until certified as quiet. Issuing of operator licenses can be withheld due to noise violations.

As another example of more stringent noise regulations, the Noise Abatement Act passed by the British in 1960 grants substantial rights to citizens to initiate legal action against apparent violators. The French passed similar legislation in 1966.

In other control practices, several European nations have initiated quiet zones in which vehicular traffic is forbidden during certain periods.

A great deal has also been accomplished among European nations in standards for construction to hold down building noise. Building codes there typically contain noise control requirements. It is reported that as long ago as 1938, Germany had a building code with specific decibel loss requirements through walls at various sound frequencies. Norway has had sound transmission loss requirements of 50 dB in its building code since 1948.

SUMMARY AND OUTLOOK

- *Hearing loss associated with employment in noisy industrial plants has been recognized and of concern for many years. Regulations to limit such noise are in effect in Oregon. It has been clearly established that workers in noisy industrial plants have substantially poorer hearing than individuals of comparable age who have lived and worked in quieter surroundings. Industries of concern in Oregon include food processing, sawmills, and pulp and paper mills.*

- *There is growing concern today with community noise. This is the noise pollution problem. Some estimates have placed the increase in community noise as high as 1 decibel (dB) per year over the last 30 years. Because of the logarithmic decibel scale, this would mean that there has been over a 32-fold increase in sound pressure in this 30-year period.*

- *It is recognized that industrial and community—including household—noise are related. Industrial noise standards are based on the premise that workmen's ears can rest and recover during nonworking hours. However, with the dramatically higher levels of community noise now encountered this premise is no longer true.*

- *The detrimental effects of noise pollution, in addition to hearing loss, are such physiological and related psychological impacts as increased hypertension, loss of sleep, and greater irritability. General loss of livability is also now being considered a major effect of increasing noise at the community level.*

- *The greater power production levels and higher speeds in all types of motor vehicles and aircraft have been major contributors to increased community noise levels. Diesel trucks, jet aircraft, and poorly or nonmuffled motorbikes are among the worst offenders. Other sources contributing to increased community noise have included such noisy equipment as power lawn mowers, chain saws, jackhammers and air compressors. Electronically amplified music is another source of noise of mounting concern. This intense sound affects teenage listeners, as well as those not wanting to be exposed to what is to them a loud noise source.*

- *The community noise level in Oregon is currently less pronounced than that existing in states with higher levels of urbanization and industrialization. Only limited motor vehicle traffic and jet aircraft problems now exist. However, with continuing population growth, industrial development, and associated urbanization, the problem will become more intense unless control programs are initiated.*

- *Federal legislation to set specific noise limits on various sources and to indicate noise levels on equipment labels, is being considered by the present Congress. It appears likely that legislation of this type will be enacted within the next several years. Such legislation would become nationwide in scope. The legislation is aimed at forcing the recognition of noise emissions in the development and production of new equipment and the adoption of other technologies.*

- *European nations and several states and a number of cities in this country, now have comprehensive, "modern" regulations to limit noise levels. Such regulations are based on setting specific noise emission levels and requiring enforcement of these levels or standards. The State of Oregon has no such standards. Several cities in Oregon, including Eugene, Lake Oswego, Beaverton and Klamath Falls, have regulatory programs based upon specific noise standards. State legislation setting specific decibel standards for community noise is being explored by the Oregon Department of Environmental Quality.*

FOR MORE INFORMATION ON NOISE POLLUTION, SEE:

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ABOUT THIS REPORT

This report, *Noise Pollution–A Background and Status Report for Oregon*, has been prepared to provide background information on and to indicate the status of community noise problems in the State of Oregon. It was prepared by the Advisory Committee on Environmental Science and Technology, which was established in 1970 by the Governor and Oregon State University, to provide a more effective interchange of ideas and mobilization of resources to meet environmental problems in Oregon.

An initial effort of the Advisory Committee was a comprehensive report published a year ago entitled, *Environmental Quality in Oregon–1971: A Summary of Current and Future Problems*. The subject of community noise was covered briefly in this report. Because of the increasing importance of the noise problem, the committee agreed that this topic deserved added attention. Thus, the assignment was given for the preparation of this more thorough review and assessment of the community noise problem in Oregon.

The initial report of the Advisory Committee was directed to concerned citizens and public officials in Oregon. It was aimed at providing useful information for them regarding the important problem of environmental quality. This report has been written for the same audience. It is hoped that it will provide useful information to the citizens of the state and to their elected and appointed governmental representatives.

When asked, as a member of the Advisory Committee on Environmental Science and Technology, to be responsible for the preparation of the report on noise problems, it was recognized that a great deal of technical help would be required. Noise is a very complex, technical subject area. Therefore, Milton B. Larson, Professor of Mechanical and Nuclear Engineering, was asked to accept the responsibility for technical accuracy of the report. He was extremely helpful throughout the preparation of the report and his efforts are acknowledged with appreciation.

Others who read a final draft of the report and provided helpful suggestions included: D. R. Armstrong, Department of Environmental Quality; Kessler Cannon, Assistant to the Governor and member of the Advisory Committee on Environmental Science and Technology; Edward A. Daly, Daly Engineering Company; Darrel D. Douglas, Department of Human Resources–Health Division; Harry Reeder, Environmental Specialist–CH_2M/Hill; Archie R. Tunturi, M.D., Consultant in Architectural Acoustics and Noise Control and Associate Professor at the University of Oregon Medical School; and James M. Witt, Executive Secretary of the Environmental Health Sciences Center and Agricultural Chemist, Extension Service, Oregon State University. Their assistance is acknowledged with an expression of sincere appreciation.

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