HB

229

AL NOTE

STATE OF ALASKA
1995 LEGISLATIVE SESSION

BILL NO: HB 229

Revision Date: _____ Dept. Affected: Public Safety

Title: Prohibit loud vehicle sound systems — DPS Statewide Support

Component: Commissioner's Office

Sponsor: Representative Toohey

Requestor: (H) State Affairs — **COMPONENT SERIAL NO.** 0523

EXPENDITURES/REVENUES: (Thousands of Dollars) (inflation not included)

OPERATING	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01
PERSONAL SERVICES						
TRAVEL						
CONTRACTUAL						
SUPPLIES						
EQUIPMENT						
LAND & STRUCTURES						
GRANTS, CLAIMS						
MISCELLANEOUS						
TOTAL OPERATING	-0-	-0-	-0-	-0-	-0-	-0-
CAPITAL EXPENDITURES	-0-	-0-	-0-	-0-	-0-	-0-
CHANGE IN REVENUES ( ) Revenue Code	-0-	-0-	-0-	-0-	-0-	-0-

FUNDING: (Thousands of Dollars)

1002 Federal Receipts						
1003 GF Match						
1004 GF						
1005 GF/Program Receipts						
1006 GF/MHTIA						
Other						
TOTAL	-0-	-0-	-0-	-0-	-0-	-0-

Estimate of current year (FY 95) impact: $ _____

POSITIONS:

FULL-TIME	0	0	0	0	0	0
PART-TIME	0	0	0	0	0	0
TEMPORARY	0	0	0	0	0	0

ANALYSIS: (Attach a separate page if necessary.)
No fiscal impact is anticipated to the Department of Public Safety

Prepared By: Lee Ann Lucas, Special Assistant to the Commissioner — Phone: 465-4322

Division: Commissioner's Office — Date: 3/30/95

Approved by Commissioner: Del Smith — Date: 3/30/95

Agency: Ronald L. Otte, Dept. of Public Safety

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HOUSE COMMITTEE REPORT

(7)
Date Referred: April 5, 1995 FURTHER REFERRALS: Judiciary

Date of Committee Action: 4/20/95

The HEALTH, EDUCATION AND SOCIAL SERVICES Committee considered: HB 229

HOUSE BILL NO. 229 PROHIBIT LOUD VEHICLE SOUND SYSTEMS

"An Act prohibiting certain amplified sounds from automobiles; and providing for an effective date."

recommends it be replaced
with the following committee substitute _____

[ ] the same title
[ ] a new title

[ ] additional referral to _____ Committee
[ ] attached amendment(s)

ADOPTS: _____ Letter of Intent

ATTACHES NEW FISCAL NOTE(s): (Dept)

[ ] fiscal note(s) _____

_____

[X] zero fiscal note(s) Public Safety

_____

APPROVES PREVIOUS: (Dept/Date)

[ ] fiscal note(s) _____

_____

[ ] zero fiscal note(s) _____

_____

SIGNING WITH ~~RECOMMENDATIONS~~	DP	DNP	~~NR~~	AM
	✓			
				✓
			✓	
	✓			
		✓		
			✓	

CHAIR'S SIGNATURE Dan Bucshon

ALASKA STATE LEGISLATURE
House of Representatives

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Representative Norman Rokeberg

SPONSOR STATEMENT

HB 229 - "An Act prohibiting certain amplified sounds from automobiles; and providing for an effective date."

HB 229 is a bill that gives law enforcement a number of tools to enforce the peace and tranquility of our neighborhoods. The primary purpose is to limit amount of amplified noise that can be transmitted outside of a vehicle. Secondly, it reduces the hazards of emergency vehicles traversing through traffic by drivers who are unable to hear emergency vehicle warning signals. Thirdly, residents will not be subjected to loud amplified sounds in their neighborhoods. Fourthly, it allows law enforcement the opportunity to interview violators to make sure no additional laws are being broken. Lastly, elderly individuals and others will no longer be frightened by groups of people who use loud music to intimate.

There is no question HB 229 is a neighborhood friendly bill that will alleviate unwanted noise and gives people a means of recourse. Violation of this provision is an infraction and not considered a criminal offense and does not add points against a person's driving record.

bility of it to any government, agency, person or circumstance shall not be affected by it. If the compact is held contrary to the constitution of any party state, the compact shall remain in full force and effect as to the remaining states and in full force and effect as to the state affected as to all severable matters. (§ 18 ch 60 SLA 1986)

Chapter 40. General Provisions.

Sec. 28.40.050. Penalties for violations of law, regulations, and municipal ordinances. (a) It is a misdemeanor for a person to violate a provision of this title unless the violation is by this title or other law declared to be a felony or an infraction.

(b) A person convicted of a misdemeanor for a violation of a provision of this title for which another penalty is not specifically provided is punishable by a fine of not more than $500, or by imprisonment for not more than 90 days, or by both. In addition, the privilege to drive or the registration of vehicles may be suspended or revoked.

(c) Unless otherwise specified by law a person convicted of a violation of a regulation adopted under this title, or a municipal ordinance regulating vehicles or traffic when the municipal ordinance does not correspond to a provision of this title, is guilty of an infraction and is punishable by a fine not to exceed $300.

(d) An infraction, as provided for in (c) of this section, is not considered a criminal offense and may not result in imprisonment, nor is a fine imposed for the commission of an infraction considered a penal or criminal punishment; nor may the commission of a single infraction result in the loss of a driver's license or privilege to drive in this state except as may result from the accumulation of points under AS 28.15.221 — 28.15.261, or the registration of vehicles; nor does a person cited with an infraction have a right to trial by jury or to court-appointed counsel.

(e) *[Repealed, § 5 ch 85 SLA 1987.]* (§ 50-1-8 ACLA 1949; am § 12 ch 241 SLA 1976; am §§ 22, 23 ch 144 SLA 1977; am § 5 ch 85 SLA 1987)

Revisor's notes. — Formerly AS 28.35.230. Renumbered in 1984.

NOTES TO DECISIONS

This section governs the penalties for violations of this title, and creates three categories of traffic offenses: felonies, misdemeanors and infractions. State v. Clayton, 584 P.2d 1111 (Alaska 1978).

Violations of AS 28.35.050(a) are punishable under this section. Drabosh v. State, 442 P.2d 44 (Alaska 1968).

Prerequisite to suspension of license or privilege to drive. — A driver's license or privilege to drive cannot properly be suspended unless the driver was in fact licensed or otherwise actually privileged to drive a motor vehicle within the state. Roberts v. State, 700 P.2d 815 (Alaska Ct. App. 1985).

Generic penalty provision. — Subsection (b) is not a penalty provision dealing specifically with the offense of driving while license suspended; rather it is a generic penalty provision, broadly applicable to violations of all Title 28 provisions for which the specific penalties are given. Roberts v. State, 700 P.2d 815 (Alaska Ct. App. 1985).

Meaning of "law" in subsection (c). — The term "law," as used in subsection (c) of this section, refers to statutory enactments of the Alaska legislature and cannot be read to include the provisions of municipal ordinances. Anderson v. Municipality of Anchorage, 645 P.2d 205 (Alaska Ct. App. 1982).

Nature of "correspondence" between ordinance and statute required by subsection (c). — The requirement of correspondence stated in subsection (c) of this section calls for a level of similarity between a municipal ordinance and a provision of AS 28 that would make the ordinance a functional equivalent of its statutory counterpart. Anderson v. Municipality of Anchorage, 645 P.2d 205 (Alaska Ct. App. 1982).

The legislature's purpose in enacting subsection (d) was to eliminate the criminal stigma from minor traffic offenses while keeping the enforcement of such offenses within the criminal system's procedures. State v. Clayton, 584 P.2d 1111 (Alaska 1978).

A prosecution for a traffic infraction is a quasi-criminal proceeding to which certain criminal procedures including the issuance of warrants are applicable. State v. Clayton, 584 P.2d 1111 (Alaska 1978).

Although the language in subsection (d) with regard to an infraction not being considered a criminal offense nor a fine therefor a criminal punishment indicates that the legislature did not intend to make minor traffic offenses criminal offenses, it does not follow that the legislature by labeling infractions "noncriminal" meant that they are civil in nature and thus that criminal procedures are not available for the enforcement of infractions. State v. Clayton, 584 P.2d 1111 (Alaska 1978).

Notwithstanding the legislative labeling of a traffic infraction a noncriminal offense by this section, it retains many criminal terms, such as "convicted," "violation," "guilty," "punishable by a fine." State v. Clayton, 584 P.2d 1111 (Alaska 1978).

An infraction is not an offense for double jeopardy purposes. Carlson v. State, 676 P.2d 603 (Alaska Ct. App. 1984).

Jury trial. — AS 28.10.105(a) (now repealed) and the other registration statutes in pari materia do not specify a violation of the registration statutes as an infraction, and thus under this section, such a violation is a misdemeanor punishable by up to 90 days' imprisonment, and entitling a defendant to a jury trial, denial of which right constitutes prejudicial error, requiring a new trial. Epperly v. State, 648 P.2d 609 (Alaska Ct. App. 1982).

Traditional use of criminal process not affected. — In the absence of express contrary declaration, the legislature did not intend by the enactment of subsection (d) to affect the traditional use of the criminal process for enforcement of traffic infractions. State v. Clayton, 584 P.2d 1111 (Alaska 1978).

This section makes no changes in the traditional mode of proceeding in criminal matters with the exception of its declaration that a person cited with an infraction does not have a right to trial by jury or to court-appointed counsel. The action is brought in the name of the state; it is commenced by the filing of a complaint by a law enforcement official; it is prosecuted by the district attorney. The exceptions appear to merely codify existing constitutional law. State v. Clayton, 584 P.2d 1111 (Alaska 1978).

Applied in Munderson v. State, 655 P.2d 1320 (Alaska Ct. App. 1983).

Stated in Francis v. Municipality of Anchorage, 641 P.2d 226 (Alaska Ct. App. 1982).

Cited in Lowry v. State, 655 P.2d 780 (Alaska Ct. App. 1982).

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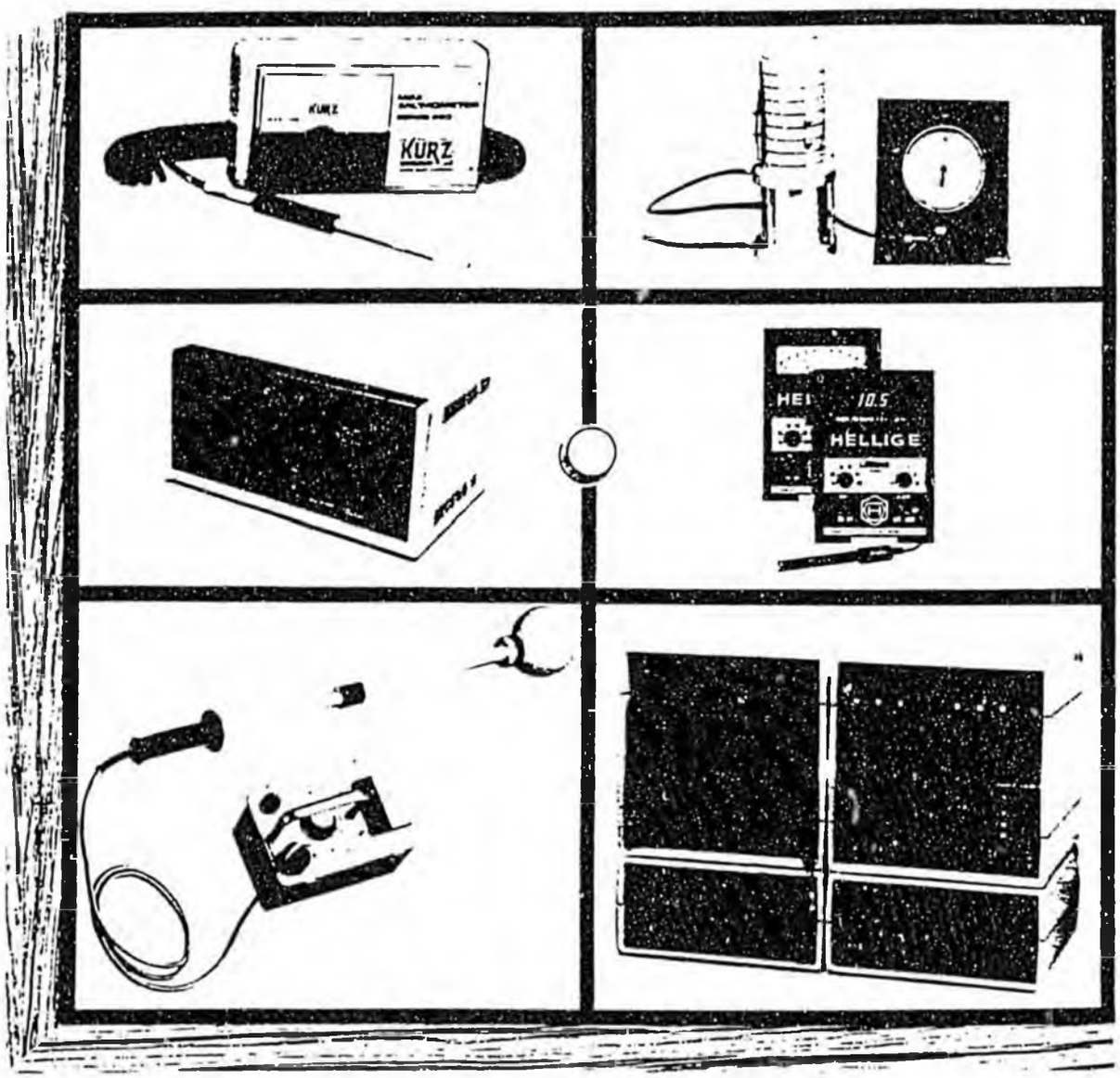

Featured: Instruments

Official Publication

Volume 45, Number 4
January/February, 1983

Sound Levels in Emergency Medical Service

John A. Rasmussen, MS, EMT-P John M. McLean, MPH, RS Roger S. Stasiak, Ph.D., RS

Abstract

Sound levels in an emergency medical service vehicle were measured during the summer of 1981. Excessive levels were found in the driver's compartment with the siren operating. Personnel measured showed low frequency hearing loss in the same range as the siren's operating frequencies.

Emergency Medical Services (EMS) personnel are frequently exposed to high intensity sound levels while working in their profession. Studies have been reported in other occupations(4,5) to determine the effects of noise on the workers. These studies have ranged from qualitative to quantitative statistical analyses. None has concentrated on emergency medical services.

Kotsis found that sound levels in a diesel pumper exceeded 105 dBA while the lowest reading in a rescue unit was 93 dBA(5). Kam studied truck drivers and compared their hearing loss in each ear to exposure while the truck was in operation(4).

Reishel et al.(8) have recently performed large sample (n = 750) audiometric testing showing a positively accelerated hearing loss with age in firefighters.

Due to the multiple types of vehicles, manufacturers and styles of sirens, no single study can apply to all vehicles. The single most intense source of noise in the EMS vehicle is the siren; therefore, this study was limited to that single source.

Journal of Environmental Health, V. 45 (4) 176-178.

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Theory

Increasing numbers of people are becoming concerned with the problem of noise in everyday life. This includes communities(1) as well as industry and in virtually all settings in which noise is a noticeable entity(7). Sound at one time can be welcome and at another time be totally unwanted. It is already known that certain sounds can stress humans psychologically and physiologically(6). The growing interest is probably due to the much increased coverage of hearing loss when under workman's compensation laws and the implementation of federal and state laws for noise exposure.

The key to the health and welfare aspect of noise is the wide range of the human hearing mechanism. The human ear is capable of detecting sound from a threshold level to sound levels 10^{12} times as intense without pain. The hair cells of the ear are unregenerative; that is, they cannot be physiologically restored(9). It is not our intent to provide a total history or theory of the unwanted aspects of sound, but only to establish that noise may be a problem, and if so, it can affect the ability to communicate and to understand speech.

In determining compliance, the sound level regulation is a function of both sound level and daily exposure time. If the results of the measurements show an excessive combination of sound levels and exposure times, then a noise problem exists(3). Threshold limit values (TLV) refer to both sound level and exposure time. These are based on conditions that nearly all workers are exposed without adverse effects on their ability to hear and understand normal speech. The application of the TLV will not protect all employees from the adverse effects of noise exposure because of individual susceptibility(2). There is no standard program that applies to all situations.

Method

This study was conducted using a Classic II vehicle by Modulance$_{TM}$ on a Ford$_{TM}$ chassis (Type III ambulance). The siren on this vehicle is a Southern VP$_{TM}$ Model SA400 with two one-hundred watt speakers in a Code 3$_{TM}$ light bar. The speakers are located six inches above the cab roof, 30 inches from the respective sides and the speaker cone eight inches in front of the patient compartment.

In performing measurements the driver's and passenger's windows were closed, but the door between the cab and patient compartment was open as in the normal operation of the vehicle when in service. The vehicle engine was motionless idling and producing no measurable background. A Bauel and Kjar Type 2209 Pulse Precision Sound Level meter with a Type 1613 Octave Filter Set and a Type 4133 microphone, calibrated in accordance with the manufacturer's instructions was used. It was held to approximate the orientation of either the patient's, attendant's or driver's auditory canal (thus the microphone on the meter

was perpendicular to the long axis of the vehicle). The measurements were taken with the meter in the slow response mode and the maxium dB reading in each octave band was recorded. The measurements were reported 5 times. The values reported in this study represent the average of those five. In addition, dBA measurements were taken for each mode and position. The vehicle was parked on an empty driving range, thereby eliminating any echo effect.

During their annual physical examinations, the employees of the Madison County, Ky., Ambulance Service receive routine hearing threshold tests. The results of five of the tests were reported in octave bands and were used as measurements for this study. These measurements were made by an employee of the Madison County Health Department.

Results

The average of five measurements taken for each item are reported in Table 1. These readings were taken in the three common modes of the siren in both the patient compartment and the driver's cab. Table 2 shows the hearing threshold data for the five ambulance service employees. These data were taken by outside investigators; therefore, no control was made on the method used to obtain them.

Table 1
Maximum dB Reading* by Octave Band Centers compared with Position and Siren Mode

Octave Bands Centers (Hz) \ Position / Mode	Patient			Driver		
	Wail	Yelp	Hi-Lo	Wail	Yelp	Hi-Lo
16000	43	[illegible]	33	92	93	92
8000	44	[illegible]	40	91	92	91
4000	55	54	51	91	92	90
2000	72	68	65	91	93	90
1000	85	81	64	92	92	91
500	82	80	76	92	92	91
250	55	58	56	91	92	95
125	61	63	61	90	92	94
dBA	83	82	76	92	92	95

*Meter in slow response position

Table 2
Hearing thresholds for selected employees by Octave Band Centers
(Thresholds measured in dB)

Octave Band Centers	EMPLOYEE A		B		C		D		E	
	L ear	R ear	L ear	R ear	L ear	R ear	L ear	R ear	L ear	R ear
8000	12	12	22	20	70	70	35	55	15	15
6000	15	15	12	12	70	70	—	—	15	15
4000	15	15	12	12	40	40	40	40	15	15
2000	20	20	15	15	30	30	25	25	10	15
1000	30	30	20	20	25	25	25	25	20	15
500	40	40	30	30	25	25	25	25	25	25
Age	37		35		55		54		30	
Symbol	△		●		✗		—		—	

Figures 1, 2, and 3 graphically compare noise levels in the patient compartment with the driver's cab. Figure 4 graphically compares the hearing thresholds in the ambulance service employees.

Discussion

The sound levels recorded in the patient compartment are within the required Occupational Safety and Health Administration (OSHA) limit of 85 dBA; therefore, it can be assumed that patients and attendants are not exposed to excessive noise levels. Personnel and patients in the patient compartment should not suffer any permanent damage due to the sound produced by the siren. The dBA measurements in the vehicle cab, however, exceeded that eight hour exposure limit.

The Madison County Ambulance personnel work a 24/48 hour work shift (24 hours on duty and 48 hours off duty). This hour pattern is commonly used by ambulance services. The threshold limit must be altered to fit this unique work situation. Applying the unique work situation formula

$$\left[\text{Reduction Factor} = \left(\frac{8}{\text{hrs}} \times \frac{24\text{-hrs}}{16}\right)\right.$$

$\left.TLV_{(hrs)}\right]$ to the threshold limit for 8 hours yields no permissible time for excursion above the 85 dBA limit. Therefore, it would seem that all personnel in this work situation would be exposed to excessive noise every time the vehicle siren is sounded.

The frequency response curve in the patient compartment (Figures 1, 2, 3) for the siren closely resembles the frequency range published in the manufacturer's specifications (Table 3). The greatest intensity measured is

Table 3
Siren Specifications

MODE	FREQUENCY RANGE
Wail	600 - 1350 Hz
Yelp	600 - 1350 Hz
Hi-Lo	450 & 650 Hz

at 500 and 1000 Hz. The response curve in the driver's compartment is essentially equal at all frequencies. The dBA scale is logarithmic; thus, an increase of 1 dB is equal to 10 times the energy at the lower level. The dBA of 95 (Hi-Lo mode) in the driver's compartment is equal to 10[illegible] times the energy in the patient compartment (dBA of 76).

Figure 1
Sound Level vs. Octave Band Centers (Wail Siren Mode)

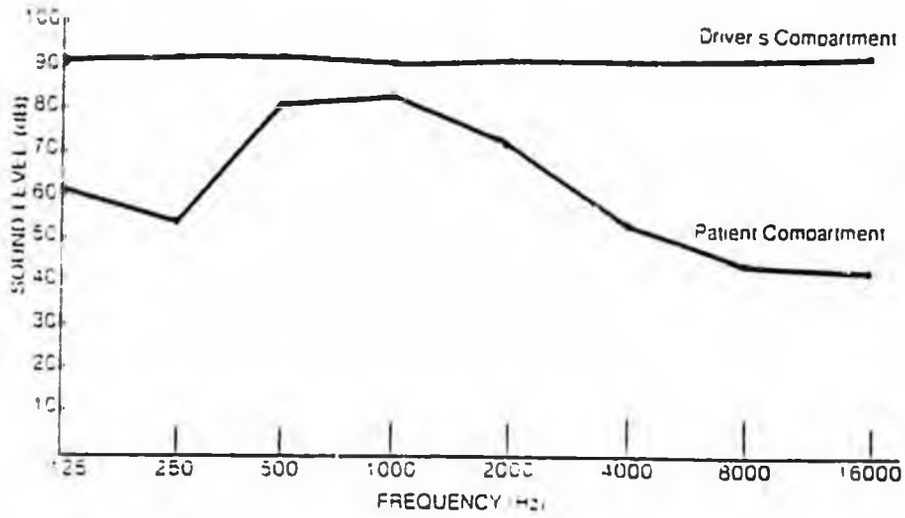


Figure 2
Sound Level vs. Octave Band Centers (Yelp Siren Mode)

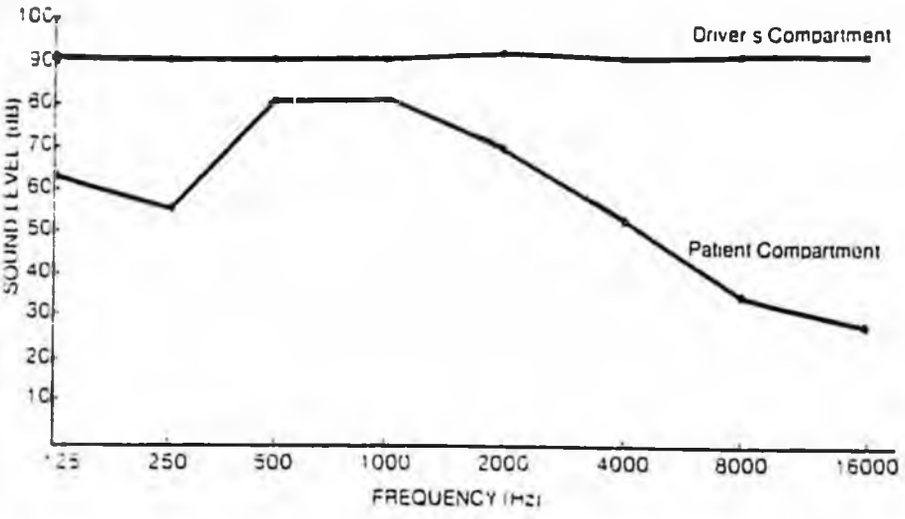
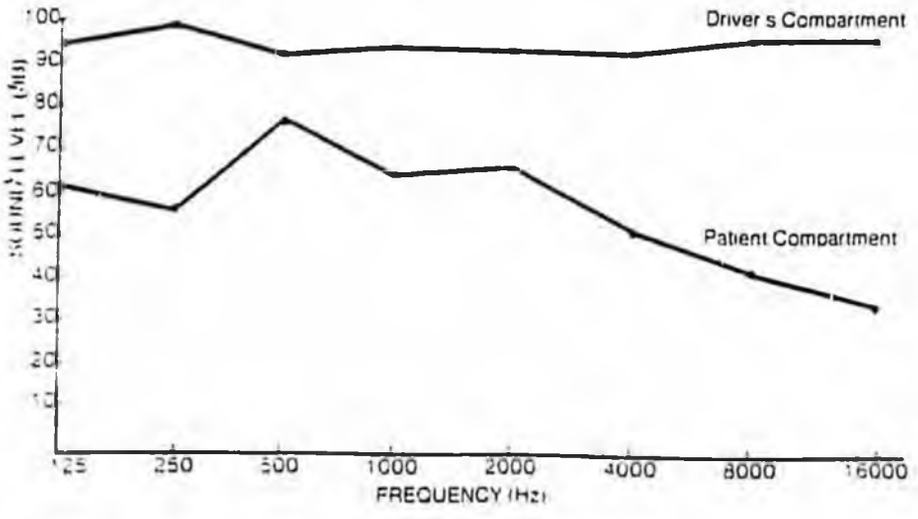


Figure 3
Sound Level vs. Octave Band Centers (Hi-Lo Siren Mode)



Comparing the frequencies produced by the siren and the hearing thresholds observed in the personnel, there is a qualitative correlation between low frequency hearing loss and the frequencies of output from the siren. The only intense low frequency sound in the history of the personnel is the siren of an emergency vehicle.

Conclusion

The sound (noise) levels produced by the siren in the patient's compartment of this vehicle are within the 85 dBA level established by OSHA. The levels in the driver's compartment exceed even levels permissible as excursions. There appears to be some correlation between the hearing threshold loss of personnel and the frequencies of exposure observed on an emergency medical service vehicle. The measured hearing loss is at the frequencies of maximum sound energy produced by the siren; thus, personnel in the driver's compartment should wear protective equipment to prevent permanent hearing loss.

Acknolegdements

The authors thank Madison County (KY) Ambulance Service for the use of the vehicle and the crew (Ms. Pat Wilson, EMT-P, and Randy Isaacs, EMT) for their cooperation. Mary Ellis is also thanked for her aid in compiling data at the test site. Eastern Kentucky University provided funding for this project.

References

1. Air Pollution Control Association (1974) *Environmental Noise Control*, pp. 1-6.
2. American Conference of Governmental Industrial Hygienists (1981). *Threshold Limit Values for Chemical Substances in Workroom Air* Adopted by ACGIH, Cincinnati, OH, pp. 81-83.
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4. Kam, J.K.H. (1980). "Noise Exposure Levels Among 20 Selected Truck Drivers." *J. Environ. Health* 43:83-85.
5. Kotsis, Captain R.L. (1981). "Firefighters are Losing Their Hearing." *Fire Command*, June 12 & 23.
6. Olisbifski, J.B. and F.E. McElroy (1971). *Fundamentals of Industrial Hygiene*, National Safety Council, Chicago, IL., pp. 168-173.
7. Peterson, P.G. and E.E. Gross (1967). *Handbook of Noise Measurement*, General Radio Company, West Concord, MA. pp. 1.2
8. Reischl, U., T.G. Hanks and P. Reischl (1981). "Occupation Related Firefighter Hearing Loss." *Amer. Ind. Hyg. Assoc. J.*, Sept.: 656-662.
9. U.S. Environmental Protection Agency (1973). *Public Health and Welfare Criteria for Noise*, Washington, D.C., pp. 1-1 to 1-3.

1977 EDITION

Fourth Edition

SANITARIAN'S HANDBOOK
Theory and Administrative Practice
for
Environmental Health

By

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Please note the three types of noise pollution

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Table 3 summarizes the reference and equivalent methods.

Pollutant	Measurement principle or method	Reference method	Equivalent methods
TSP	High-volume sampler (manual method)	High-volume sampler	None possible
SO_2	Pararosaniline (manual method)	Pararosaniline*	Manual or continuous
CO	Nondispersive infrared	*	Manual or continuous
O_3	Chemiluminescence	*	Manual or continuous
NO_2	Chemiluminescence	*	Manual or continuous

From: EPA's Role in Ambient Air Quality Monitoring, A. J. Hoffman et al.
* None specified. Manufacturer must submit data documenting that the analyzer meets performance specifications.

Table 4 identifies the number of stations monitoring each pollutant according to the method or principle being used. Most air monitoring is being conducted with reference methods or principles. These are the sole members of the "approved" category at present. Other methods that are not reference methods but are considered reasonable candidates for passing equivalency tests are listed as "unapproved." The last category, "unacceptable," includes those methods or measurement principles that are generally acknowledged to be inaccurate and obsolete.

Table 4. Pollutant method station summary, 1974.

Pollutant	Method or principle*	No. of stations	Percent of total	Approved	Unapproved	Unacceptable
TSP	High volume (FRM)*	3683	100	X		
CO	NDIR (FRM)	316	96	X		
	Coulometric	2	n*			X
	Flame ionization	10	4		X	
	Total	328				
SO_2	Colorimetric	122	6		X	
	Conductimetric	93	4		X	
	Coulometric	223	10		X	
	Flame photometric	59	3		X	
	Sequential conductimetric	6	n		X	
	Pararosaniline (FRM)	1648	77	X		
	Total	2151	100			
NO_2	Colorimetric	139	11		X	
	Coulometric	5	1		X	
	Chemiluminescence (FRM)‡	49	4	X‡		
	Saltzman bubbler	5	1			X
	Sodium arsenite (orifice)	294	24		X	
	Sodium arsenite (frit)	730	59		X	
	TEA				X	
	TGS				X	
	Total	1220	100			
O_3	Alkaline KI	10	1			X
	Coulometric	14	2		X	
	Neutral KI	71	19		X	
	Phenolphthalein	1	n			X
	Alkaline KI bubbler	18	5			X
	Ferrous oxidation	20	5			X
O_3	Chemiluminescence (FRM)	225	39	X		
	Coulometric	2	n		X	
	Ultraviolet				X	
	Total	580	100			

From: EPA's Role in Ambient Air Quality Monitoring, A. J. Hoffman et al.
*FRM, Federal reference method or principle. †n = negligible. ‡Proposed measurement principle to replace Jacobs-Hochheiser procedure

For several years, *chlorofluorocarbons* (FCC's) have been known to be environmental pollutants. Both CCl_2F_2 and CCl_3F have been detected at concentrations varying from background levels of 50 to 100 parts per trillion (ppt). These pollutants are suspected of destroying O_3 (ozone) in the stratosphere allowing greater amounts of ultraviolet reaching the earth, thus increasing the incidence of skin cancer. These chemicals are used as aerosol propellants, refrigerants, solvents, and foaming agents. See table 5.5 Control use of these chemicals will have to be initiated.

Table 5. Applications of FCC's in the United States in 1972

Compound	Aerosol propellants x10^6 kg	Refrigerants (x10^6kg) Prefabricated units	Refrigerants (x10^6kg) Large commercial units	Solvents x10^6 kg	Foaming agent (x10^6 kg)	Total x10^6 kg
CCl_3F	111		4		21	136
CCl_2F_2	119	31	29		20	199
$CHClF_2$		21	15			36
$CClF_2CFCl_2$				23		23
$CClF_2CClF_2$	9					9
Total	239	52	48	23	41	403
Percentage of total	59	13	12	6	10	100

From: Chlorofluorocarbon Sources of Environmental Contamination, R. J. Howard & A. Hanchett

The 3 types of *noise* pollution—transportation noises, occupational noises, and community noises—continue to increase and will double in the next decade. Human hearing ranges from approximately zero decibels of sound to about 140 db. at which point pain and permanent ear damage occurs. Conversation proceeds at about 40-50 db. Some permanent hearing loss results from prolonged exposure to sound exceeding about 90 db. A jet plane flying at 1,000 feet bombards a large area with sounds exceeding 100 db. A car going 65 mph subjects a person standing 25 feet away to 80 db. Noise near a busy highway averages 64 db. Inside the home, a garbage disposal grinds away at 80 db, and a food blender at 88 db. "Although the number of persons in U. S.) exposed to potentially hazardous noise cannot be accurately assessed..... a total of 40 million people might be reasonable.[6]

"Man may soon enter an era of energy pollution of the environment comparable, in public health and ecological implications, to the chemical pollution of today".[7] There are two important health hazards associated with high voltage transmission lines: (1) air pollution resulting from chemical reactions that take place in the corona discharge, and (2) electromagnetic effects, particularly the strong electric field that exists in the vicinity of these lines. It has been shown that people exposed to intense electric fields 500 and 750 kilovolts, over long periods of times without protective measures will result in "shattering the dynamic state of the central nervous system, heart and blood-vessel system, and changing blood structure. Young men complained of reduced sexual potency.[8]" As a result, the Soviets set up rules for exposure as follows:

5 Chlorofluorocarbon Sources of Environmental Contamination, R. H. Howard, A. Hanchett, Science, Vol. 189, pp. 217-219, July 18, 1975

6 Noise: The Unseen Pollution, R. H. Gilluly, Science News, Vol. 101, No. 12, pp 189-191, March 18, 1972

7 Pollution by Electrical Transmission, L. B. Young, H. P. Young, Bulletin of The Atomic Scientists, pp. 34-38, December 1974

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Municipal and Rural SANITATION

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both ventilation and lighting, an increase in area required by local conditions should be obtained by increasing their width.

Placing windows as high as possible gives the greatest sky angle in all parts of the room and thus secures the greatest lighting effectiveness. Windows extending to less than 30 inches from the floor tend to cause glare and obstruct furniture placement without increasing illumination to any extent. Inside walls should have reflection factors of at least 30 per cent and ceilings, 70 per cent. A mat (dull) finish paint should be used because glossy paints produce glare. Venetian blinds and window shades are useful to prevent glare, the former being especially valuable in allowing reflection to inner parts of the room.

Direct sunlight is desirable, for at least part of the day, for all dwellings, especially in winter. Sunlight, particularly its ultraviolet rays, is recognized as being of value to the body. The amount which enters a dwelling depends upon the sky angles of the windows and the orientation of the buildings. For dwellings in rows a desirable orientation is to face 20 to 30° east or west of south. This allows sunshine to penetrate the yard on both sides of the structure. Casements which open substantially throughout their area are more desirable than double-hung windows for admitting ultraviolet rays of sunlight. Ordinary window glass eliminates most of the ultraviolet rays.

Artificial Illumination. Where electricity is available, and this is desirable for lighting in order to avoid fires, sufficient illumination should be arranged so that all areas in the room may be covered by adequate light without glare, with at least three convenient outlets in the living room and two in other rooms. For accurate illumination with regard to foot-candle requirements, it is suggested that the I.E.S. standards be followed. For the control of glare, all bulbs should be shielded from view by suitable reflectors, globes, and shades to prevent excessive brightness against the background of the luminaire. Ceiling fixtures of the semi-indirect type, and floor lamps of the direct-indirect type go well together for local and general illumination. Shades of table and floor lamps should be of such thickness and color that their surfaces are not a source of glare.

15–4. Protection against Excessive fects of excessive noise are given in Art. 19-18. Noises should be excluded from dwellings to the extent that the noise level does not exceed 50 decibels (Art. 19-19); 30 decibels should be the upper limit in sleeping rooms.[1] Housing sites should be chosen away from such sources of noise as factories, highways, railways, and athletic fields. Motor horns and radios should be con-

[1] These figures are based upon European practice and call for further examination under American conditions, where the greater numbers of radios and automobiles produce higher noise levels.

trolled. Small enclosed courts should be avoided in housing developments since noise may be reflected from the building walls.

Noises which are transmitted by the air in a multifamily dwelling can be reduced about 50 decibels by party walls equivalent to an 8-inch brick wall. Apartment doors opening into public passageways should be fitted to exclude noise.

Noises which are transmitted by the structure, such as footsteps or furniture moving, can be reduced about 15 decibels by proper construction. Airborne noise can also be reduced. Two thicknesses of wood flooring on standard joists with a lath and plaster ceiling effect a reduction of 10 to 15 decibels. If the laths or ceiling boards are fastened to the joists with spring clips and the floor is laid so as to allow some "play" between the subfloor and the joists, a reduction of well above 15 decibels may be obtained. Concrete floors are effective against air-borne but not against structure-borne noise. All plumbing, steam pipes, and valves should be correctly designed so that steam "hammer" and "singing" in valves do not occur. Refrigerating and heating equipment, pumps, and blowers should be so installed that vibrations are not transmitted to the structure. Plumbing stacks and water riser pipes should preferably not be located in living-room or bedroom walls.

15-5. Provision of Adequate Exercise and Play Space for Children. Playground and recreation space is considered to be essential to the physical and mental well-being of children and adults. It should be considered by all who are concerned with the construction of homes. This is primarily a problem of neighborhood and city planning and must be considered from the standpoints of the types of recreation to be provided, including indoor recreation, the amount and location of existing recreation facilities, the availability of trained recreation leaders, etc. In any case play spaces for very young children should be provided within each large group or block of buildings. Athletic fields within half a mile are desirable for adolescents.

15-6. Water Supply. The source of water for a single dwelling or a housing project should, wherever possible, be a city supply which is controlled as to quality by health authorities. If a well or some other individual supply must be used, methods of construction and protection should be as described in Chap. 5. Within the building the water supply should be protected from contamination by cross connections, or fixtures which have inlets at insufficient distances above the highest possible water level in the fixture. Where defects are found to exist, corrections should be made. Routine inspections of large projects should include checking on alterations which may be made from time to time.

15-7. Excreta Disposal. Water-carried sewerage should be available for all dwellings as the best means of preventing the spread of disease by flies or in other ways. A separate toilet should be available for each

family, and it should
danger of flooding.
have floors and walls
room should be well
house drainage systen
or storm water into
the dwelling is chos
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the branch serving t
ment fixtures may be
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Such pumps should
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Isolated dwellings
system as described i
Chap. 3.

15-8. Prevention of
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Where the populati
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15-9. Food Storage.
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15-10. Provision of
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the INDUSTRIAL ENVIRONMENT — its EVALUATION & CONTROL

see page 329
+ page 330

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Center for Disease Control
National Institute for Occupational Safety and Health

 ington, D.C. 20402

Exposure to excessive noise causes an irreversible sensorineural hearing loss. Damage to the hair cells is of critical importance in the pathophysiology of noise-induced hearing loss. Invariably, degeneration of the spiral ganglion cells and the peripheral nerve fibers accompany severe injury to the hair cells.

Sensorineural hearing loss may be attributed to various causes, including presbycusis, viruses (e.g., mumps), some congenital defects, and drug toxicity (e.g., streptomycin).

Mixed Hearing Loss

Mixed hearing loss occurs when there are components and characteristics of both conductive and sensorineural hearing loss in the same ear.

Central Hearing Loss

A central hearing loss implies difficulty in a person's ability to interpret what he hears. The abnormality is localized in the brain between the auditory nuclei and the cortex.

Psychogenic Hearing Loss

A psychogenic hearing loss indicates a "nonorganic" basis for an individual's threshold elevation. Two conditions in which such a loss may occur are malingering and hysteria.

AUDIOMETRY

The pure tone audiometer is the fundamental tool used in industry to evaluate a person's hearing sensitivity. It produces tones which vary in frequency usually from 250 Hz to 8,000 Hz at octave or half-octave intervals. The intensity output from the audiometer can vary from zero dB to 110 dB, and is often marked "hearing loss" or "hearing level" on the audiometer.

Zero dB or zero reference level on the audiometer is the average normal hearing for different pure tones and varies according to the "standard" to which the audiometer is calibrated. Zero reference levels have been obtained by testing the hearing sensitivity of young healthy adults and averaging that sound intensity at specific frequencies at which they were just perceptible. It is to be differentiated from the 0.0002 microbar references for the sound pressure level measurements. If a person has a 40 dB hearing loss at 4,000 Hz, it means that for the individual to perceive a tone the intensity of that tone must be raised to 40 dB above the "standard."

The audiogram serves to record the results of the hearing tests. A graphic description of the faintest sound audible is obtained by plotting the intensity against the frequency. Examples of audiograms which indicate conductive and sensorineural losses are shown in Fig. 24-8. In conductive hearing losses, the low frequencies show most of the threshold elevation, whereas the high frequencies are most often involved with the sensorineural losses.

The recording of an audiogram is deceptively simple, yet for valid test results, one must have a properly calibrated audiometer, an acceptable test environment to eliminate interfering sounds, and a qualified audiometrician. When a marked hearing loss is encountered, bone conduction audiometry and more sophisticated hearing tests are often helpful in diagnosing the site and cause of the hearing loss.[3] For more details concerning appropriate American National Standard Institute (ANSI) standards and the objectives of a good audiometry program, refer to the preferred reading list.

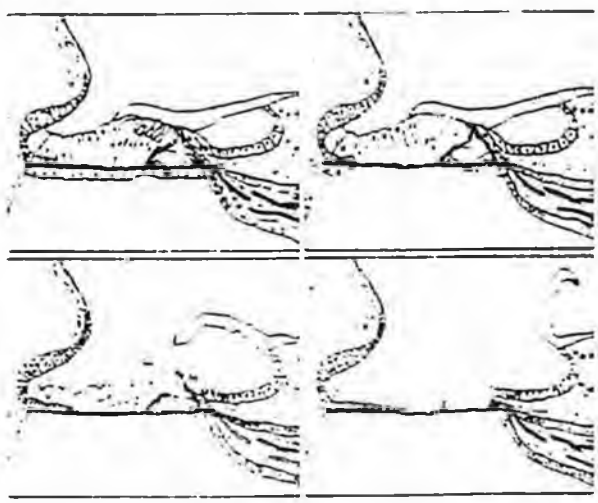
EFFECTS OF EXCESSIVE NOISE EXPOSURE

Since the ear does not have an overload switch or a circuit breaker, it has no option but to receive all the sound that strikes the eardrum. In industry, excessive noise constitutes a major health hazard. Such exposure can cause both auditory and extra-auditory effects.

Auditory Effects

Noise induced hearing loss (NIHL) can happen unnoticed over a period of years. At first, excessive exposure to harmful noise causes auditory fatigue or a temporary threshold shift (TTS). This shift refers to the difference in one's hearing sensitivity measured before and after exposure to sound. It is called "temporary" since there is a return of the individual's pre-exposure hearing level after a period of hours away from the intense sound.

However, repeated insults of excessive noise can transform this TTS into a permanent threshold shift (PTS). In fact, studies substantiate that the hearing sensitivity of factory workers in heavy industry is poorer than that of the general population. Fig. 24-9 depicts the stages of destruction



Lawrence M.: Auditory problems in occupational medicine. Arch. Environ. Health 3:2888, Copyrignt 1961, American Medical Association, Chicago, Ill.

Figure 24-9. Stages of Destruction of the Organ of Corti. (A) The normal organ of Corti. (B) A stage of hair cell degeneration following the first subtle changes within the cytoplasm of the cells. The internal hair cell remains intact. (C) Both inner and outer hair cells are gone, and the supporting structures are degenerating. (D) In the final stages, the entire organ of Corti is dislodged, leaving a denuded basilar membrane, which may become covered with a simple layer of epithelial cells. (Arch. Environ. Health)

of the organ of Corti in a laboratory test animal that was overstimulated by loud continuous noise.

Many factors influence the course of NIHL. The overall "decibel level" of the noise exposure is obviously important. If a noise exposure does not cause auditory fatigue, then such exposure is not considered harmful to one's hearing sensitivity.

Another consideration is the "frequency spectrum" of the noise. Noise exposure which has most of its sound energy in the high frequency bands is more harmful to a worker's hearing sensitivity than low-frequency noises.

Another factor is the daily "time distribution" of the noise exposure. In general, noise which is intermittent in character is less harmful to hearing than steady state noise exposure. As the "total work duration" (years of employment) of a worker to hazardous noise is increased, so too does the incidence and magnitude of his NIHL. However, no report of "total" hearing loss has been attributed to excessive noise exposure alone.

Finally, the "susceptibility" of the worker to hazardous noise must be considered, since not every individual will suffer identical hearing impairment if exposed to the same noise intensity over the same time period. A small percentage of workers will be highly susceptible or, on the other hand, refractory to the degrading effects of noise.

The hearing loss from "acoustic trauma" should be differentiated from the insidious, irreversible sensorineural NIHL that results after months or years of exposure to excessive noise conditions. Acoustic trauma refers to the loss of hearing secondary to head or ear trauma, or after exposure to a sudden, intense noise such as that of firearms or explosions. A conductive type of hearing loss results when the trauma causes a perforated eardrum or disruption of the middle ear ossicles. The trauma can cause a sensorineural loss, but not infrequently, the hearing loss is temporary in nature. Besides causing hearing loss, hazardous noise levels can mask speech, be a source of annoyance, and occasionally degrade a worker's job performance.[7]

Extra-Auditory Effects

The extra-auditory effects of noise result in physiologic changes other than hearing. We are familiar with the reflex-like startle response of an individual to a loud, unexpected sound. Less commonly noted are the cardiovascular, neurologic, endocrine and biochemical changes secondary to intense noise exposure. Subjective complaints of nausea, malaise, and headache have been reported in workers exposed to ultrasonic noise levels. Vasoconstriction, hyperreflexia, fluctuations in hormonal secretions, disturbances in equilibrium and visual functions have been demonstrated in laboratory and field studies. These changes have been for the most part transient in character, and it remains to be clarified whether such noise exposure has long lasting ill effects on the organism.[7]

SUMMARY

The important function of the hearing mechanism is to convert the mechanical energy of sound pressure waves into an electrochemical response. Excessive noise exposure can tax the physiologic limits of the hearing mechanism and cause an irreversible, sensorineural hearing loss. Noise is just one of many causes of hearing loss, so that a relevant medical history and a detailed history of a worker's previous employment will eliminate many false conclusions concerning the cause of a worker's loss of hearing.

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sure. Its reading is interpreted according to the theory that noise exposures producing little temporary hearing loss are not likely to produce much permanent hearing loss even after many repetitions.

ACCEPTABILITY CRITERIA

Criteria for the acceptability of noise are dictated by the effects which are to be avoided. The most important of these is hearing damage resulting from prolonged exposure to excessive noise. Another undesirable effect is speech interference or interruption of communications by noise. Annoyance is a third undesirable effect of noise more difficult to assess. There are also certain nonauditory effects of noise we are just beginning to recognize, which are discussed later in this chapter.

Hearing Damage

The damaging effect of noise on hearing depends on (1) the level and spectrum of the noise, (2) duration of exposure, (3) how many times it occurs per day, (4) over how many years daily exposure is repeated, (5) the effects on hearing regarded as damage and (6) individual susceptibility to this type of injury. All of these factors must be considered in establishing limits of acceptable exposures to dangerous noise.

Noise Evaluation. Early in the study of the effects of noise on hearing, it was learned that noise frequency as well as intensity influenced the effect produced. High frequency noise was found to be more damaging than low frequency noise of the same sound pressure level. Therefore, noise spectra were evaluated with standard octave band analyzers which were the only portable spectrum analyzers then available.

As knowledge of noise effects grew, some investigators began to feel that octave band analysis was a needlessly complicated evaluation of noise which could be replaced with the A-weighted sound level measured using a standard sound level meter. It seemed that the A-weighting network made the meter less sensitive to low frequency sounds to about the same extent that the ear is less susceptible to injury by these low frequency sounds.

In these studies, the damage to be avoided was impairment of ability to understand "everyday speech" as defined by the medical profession.[7] This medico-legal definition allows some observable change in hearing thresholds not sufficient to affect ability to understand everyday speech significantly.

Steady Noise. All day exposure to steady noise has been investigated to determine the level at which hearing damage begins after many years of redundant exposure. Such studies are the basis for the curves in Figure 25-6 which indicate the risk of hearing impairment associated with exposure to a steady noise level at work.[8] Each curve indicates on the vertical scale the percentage of workers that showed impaired hearing as defined by the medical profession after working continuously in the noise levels shown on the horizontal scale.

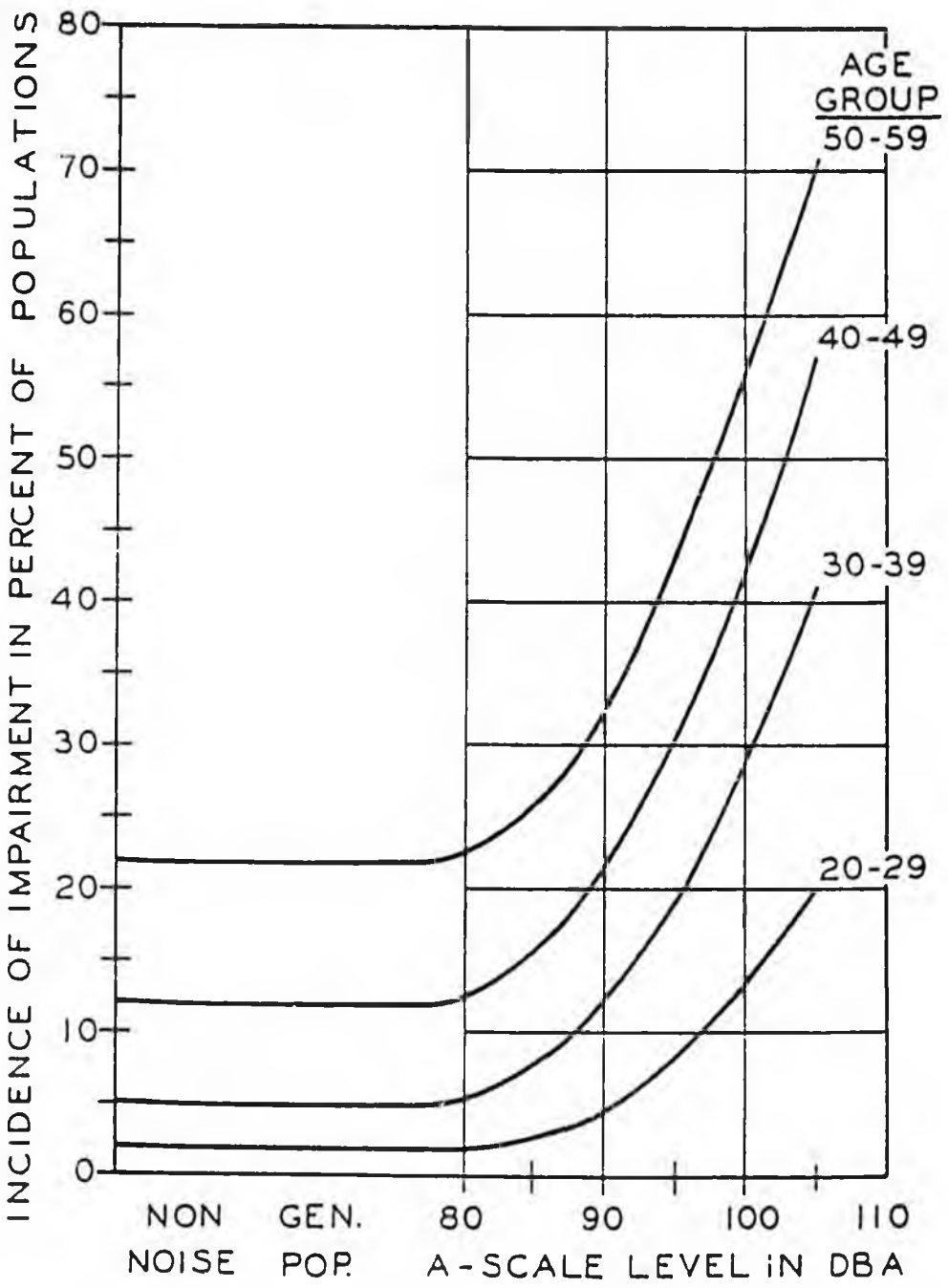
To interpret the Figure, note that the upper curve shows that in a group of 100 men aged 50 to 59 years, which has been exposed to 90 dBA at work for 33 years, 33 men should show evidence of impaired hearing. However, note that the lower flat portion of the same curve indicates that the general population and others not exposed to dangerous noise at work exhibit 22 cases of impaired hearing out of every hundred. Therefore, near-lifetime exposure to 90 dBA at work seems to produce about 11 more cases of impaired hearing per hundred surviving than would otherwise have occurred. As the data generating the curves of Figure 25-6 are not so consistent as the precise lines would indicate, this difference of 11 percentage points is about the smallest that can be considered significant. For lower age groups exposed for shorter periods, the increase in prevalence of impaired hearing is much less pronounced. The curves of Figure 25-6 suggest 90 dBA as one limit for steady exposure to continuous noise, a limit that has become rather widely accepted. Future standards may lower this limit.

Intermittent Noise. Most occupational noises are intermittent rather than continuous. Interrupting harmful noise allows the ear to rest and recover which reduces the likelihood of permanent damage.[9] Such intermittent exposures have not been studied much because of the great complexities of exposure description. As a result, theories are relied upon to set limits for intermittent noise.

The theory most generally accepted postulates that the hazard of noise exposure increases in proportion to the average temporary hearing loss which the exposure would produce in a group of normal ears. This theory arises out of the observation that those noise exposures that ultimately produce permanent hearing loss also produce temporary hearing loss in normal ears. Conversely, those noise exposures that do not produce permanent hearing loss do not produce temporary hearing loss in normal ears. While the true relation between temporary and permanent hearing loss has not been established, it is logical to assume that those noise exposures that do not cause much temporary loss will not cause much permanent loss either. Any temporary threshold shift (TTS) that disappears before the next exposure to noise commences is considered acceptable.

On the basis of this assumption, results of TTS studies have been used to define safe limits for all day exposures to steady noise. These limits agree with those established by permanent threshold shift studies.

TTS studies have also indicated that intermittent noise is much less harmful than steady noise. The laws describing growth of TTS during exposure and recovery afterwards have been used to calculate exposures producing acceptably small amounts of TTS.[10] Combinations of sound level, duration of exposure and degree of repetition that are considered acceptable for personnel exposures at work are shown in Table 25-3.[9] This method for appraising noise exposures was derived from the report describing hazardous exposure to intermittent and steady-state noise prepared by the National Academy of Science-National Research



Guidelines for noise exposure control. Sound and Vibration 4:21, 1970.

Figure 25-6. Prevalence of Impaired Hearing and Sound Levels at Work.

Council, Committee on Hearing, Bio-acoustics and Bio-mechanics, generally referred to as CHABA.[3] Maintaining exposures within the limits CHABA recommended will allow few additional cases of impaired hearing to occur.

TABLE 25-3

Maximum Permissible Sound Levels for Intermittent Noise When Occurrences Are Evenly Spaced Throughout the Day

Total noise duration per day (8 hours)	Number of times noise occurs per day						
	1	3	7	15	35	75	160 up
8 h.	89	89	89	89	89	89	89
6	90	92	95	97	97	94	93
4	91	94	98	101	103	101	99
2	93	98	102	105	108	113	117
1	96	102	106	109	114	125	125 (1½ h)
30 m.	100	105	109	114	125		
15	104	109	115	124			
8	108	114	125				A-weighted
4	113	125					sound levels,
2	123						dBA

Reproduced with permission from "Sound and Vibration" Bay Village, Ohio (4-16, 1970).

To use Table 25-3, select the column headed by the number of times the noise occurs per day, read down to the average sound level of the noise and locate directly to the left in the first column the total duration of the noise permitted for any 24 hour period. It is presumed that the noise bursts are evenly spaced throughout the work day so that an opportunity for rest and recovery between noise bursts exists. It is permissible to interpolate in the Table if necessary.

Table 25-3 shows that intermittency is as important as duration and level. For example, it shows that a continuous noise level of 91 dBA can be tolerated for 4 hours; 101 dBA can be tolerated also for 4 hours if it is presented in 15 evenly spaced bursts lasting 15 minutes each. Thus, the interruption of the higher noise reduces the effect on hearing to that which would be produced by a steady noise of equal duration 10 decibels lower. So you might say that the interruptions are equivalent to a 10 decibel noise reduction.

Impulsive Noise. Exposure limits for impulse noise are based on studies of the average TTS caused in normal ears by exposure to various impulses. Limits that will cause little TTS and, therefore, little expected permanent damage have been set.[4] These limits are complicated to apply and, as a result, have not been widely used.

However, an approximate method of determining whether these limits are likely to be exceeded can be carried out with the sound level meter using the C-weighting and "fast" meter response. To do so, set controls so that zero on the meter scale corresponds to a level of 130 dB. If the impulse does not cause the meter needle to jump above 125 dB (minus 5 on the meter scale), then it probably is not excessive.[5]

ACGIH TLV for Noise. The noise exposure limits expressed in Table 25-3 are inconvenient to use in practice. So, a simplification of the table was adopted in 1970 by the ACGIH as a threshold limit value (TLV) for noise.[6] It is shown in Table 25-4. The simplification embodies the presumption that practically all noise exposures are interrupted at least a few times a day by meals or rest periods, machinery stoppages, etc. The limits of Table 25-4 correspond very closely to those of Table 25-3 for noises that occur three to seven times per day. Since these exposure limits do not take proper account of intermittency, they do not provide a true evaluation of hearing damage potential of the noise exposure. They are too liberal for absolutely continuous noise and too conservative for noise that is interrupted very frequently.

If an exposure consists of two or more noise levels, the combined effect must be considered. To do so, it is necessary to compute the ratio of the duration of each level to the duration allowed by Table 25-4. The sum of these ratios for all noise levels involved in the exposure must not exceed unity if the exposure is to be acceptable. Noise levels below 90 dBA are not considered in these calculations. The graph in Figure 25-7 is convenient for calculation of exposures involving several levels.

For impulsive sounds, ACGIH proposed a limit of 140 dB peak which is quite conservative compared to the recommendations of Coles et al.[4]

TABLE 25-4

Threshold Limit Values for Non-impulsive Noise Adopted by the American Conference of Governmental Industrial Hygienists

Duration per day, hours	Permissible sound level, dBA
8	90
6	92
4	95
3	97
2	100
1½	102
1	105
¾	107
½	110
¼	115 max.

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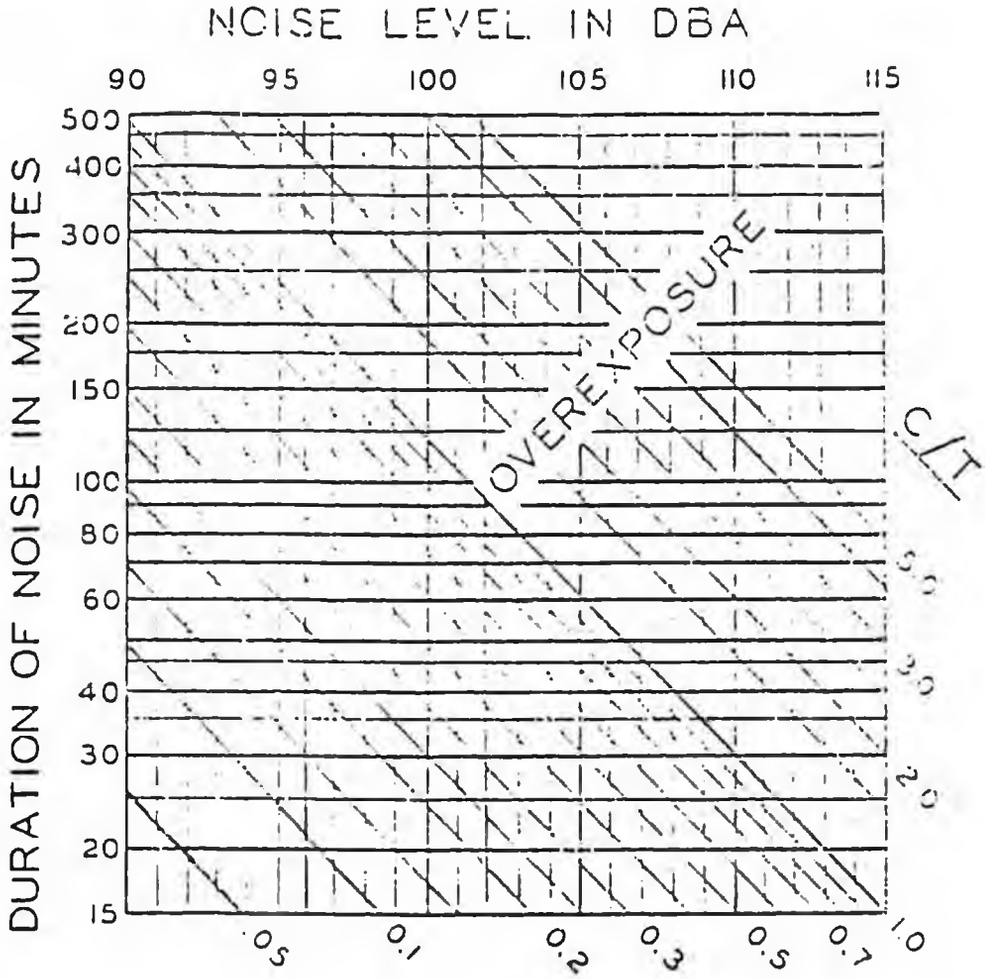


Figure 25-7. Graphical Presentation of ACGIH TLV for Noise. To use the graph, locate the point corresponding to the noise level and duration; then read off the exposure ratio C T from the diagonal lines interpolating if necessary.

The ACGIH TLV for noise was accepted by the U.S. Department of Labor for promulgation under the provisions of the Occupational Safety and Health Act of 1970. It is being adopted also by many states for enforcement as part of their occupational health regulations.

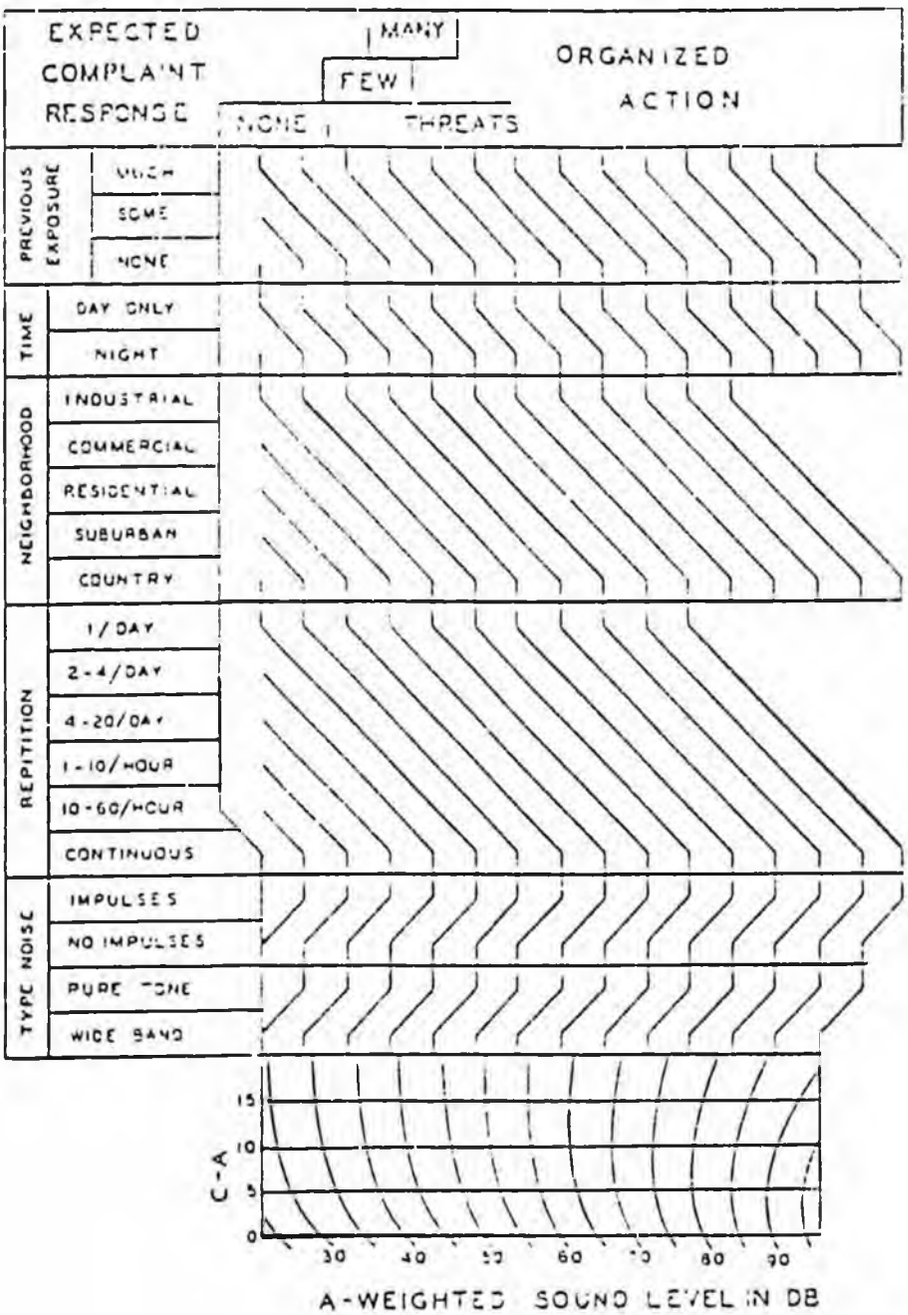
Non-occupational Exposures. All that has been said up to now about hearing damage applies to the noise exposures at work. Medical evaluation of hearing handicap from occupational noise exposure disregards changes in hearing that do not affect ability to understand everyday speech significantly.

When it comes to the non-occupational exposures in transportation vehicles, public places, etc., none of these mitigating influences exist. Yet levels equalling those in industry are often encountered and there is a tendency to apply industrial standards when appraising the hazard. Stricter standards of safety should be imposed for non-occupational exposures so that no change in hearing whatsoever can occur. Dr. Cohen has recommended limits 15 dB below the limits shown in Table 25-4.[16]

Speech Interference

Noise can mask or "blot out" speech sounds reducing the intelligibility of messages. Laboratory studies of these effects have appraised the disruptive potential of the noise by its "speech interference level" which is the average sound pressure level of 500, 1000, and 2000 Hz octave bands.[17] The distances at which difficult messages can be conveyed reliably are shown in Table 25-5 as a function of speech interference level. Simple, redundant messages normally used at work can be understood at greater distances.

The speech interference level is closely related to the A-weighted sound level. It is lower by 7 decibels for most common noises. Using this conversion, the speech interference effects of various noises may be estimated from A-weighted sound levels using Table 25-5.



Botsford J. H.: Using sound levels to gauge human response to noise. Sound and Vibration 3:16, 1969.

Figure 25-8. Chart for Estimating Community Complaint Reaction to Noise. To use the chart, locate in the curved grid at the bottom the point corresponding to the sound levels of the noise under consideration (C-A is the difference between the C- and A- weighted sound levels). From this point, project directly upward into the first of the six correction sections bounded by the horizontal lines. When entering a correction section, follow the lane entered until reaching a position opposite the condition listed at the left which applies to the neighbornood noise under consideration, and then proceed vertically, disregarding lanes, until the next section is reached. In this way, work up through the lanes of the correction sections until reaching the top where the community reaction to be expected is shown.

Annoyance

Annoyance by noise is a highly subjective phenomenon which is very difficult to relate to the sound that causes it. Noises become more annoying as they get louder than the background noise on which they are superimposed. Noises that are unsteady or contain tones are most annoying as are those that convey unpleasant meaning.

Indoors, noise is likely to become annoying when the A-weighted sound level exceeds 30 dBA in auditoria or conference rooms, 40 dBA in private offices and homes, or 50 dBA in large offices or drafting rooms. Outdoors, a noise can be expected to prove annoying if it exceeds the background level by 10 dBA or more.

A procedure for rating the annoyance potential of a noise in the community is given in Figure 25-8.[4] It provides a method for estimating community complaint reaction to a given noise condition.

TABLE 25-5

Maximum Speech Interference Levels for Reliable Communication at Various Distances and Vocal Efforts.

Distance,	Vocal Effort			
feet	Normal	Raised	Loud	Shout
0.5	76	82	88	94
1	70	76	82	88
2	64	70	76	82
4	58	64	70	76
8	52	58	64	70
16	46	52	58	64
32	40	46	52	68

Reproduced with permission of General Radio Company, West Concord, Mass., from "Handbook of Noise Measurement," 1967

Non-Auditory Effects

Audible noise produces other effects which are just beginning to be examined.[5] Laboratory studies have shown that noise reduces efficiency on some tasks, can upset the sense of balance, and can cause blood vessels to constrict, raising blood pressure and reducing the volume of blood flow. It causes the pupils of the eyes to dilate. Even when we are sleeping, noise can cause changes in electro-encephalograms and blood circulation without waking us. Noise can also cause fatigue, nervousness, irritability, hypertension and add to the overall stress of living. There is no convincing evidence so far that any of these effects become permanent and thus are deleterious to health.

Very intense noise below 1000 Hz can be felt as well as heard. Airborne vibrations can stimulate mechano-receptors throughout the body, including touch and pressure receptors and the vestibular organs. The respiratory system is affected by sounds in the 40 to 90 Hz range because of the resonance characteristics of the chest.

Sounds too high in frequency to be heard by the normal ear produce no significant effect when they reach the body by air pathways. However, transmission of ultrasound into the body through fluid or solid media is more efficient and can produce cavitation of the tissue as well as deep burns.

Intense sound below the audible frequency range can cause resonant vibration of the eye balls and other organs of the body. Dizziness and nausea can result. Levels of 130 dB or more are required to cause there effects, and are not often encountered in industry.

SURVEY TECHNIQUES

One should become thoroughly familiar with operation of noise measuring instruments through study of operating instructions before attempting to make noise surveys. Set up the equipment and check its operation before embarking. At intervals during the survey, batteries should be checked as well as overall instrument calibration.

When transporting instruments, they should be protected from vibration and shock as much as practical. Instruments should also be protected from extremes of temperature. Overheating, such as might occur in the trunk of a car parked in the sunshine, can damage circuit components. Allowing the instrument to become very cold in a car parked overnight in the winter will result in condensation of water vapor in the instrument when it is used in a heated space the next morning. Water condensed from the air can cause electrical leakage resulting in low readings.

When conducting surveys, it is important to be assured that the meter indication is due to noise and not to other influences. One way of doing so is to listen to the meter output with a pair of headphones to learn whether the sound heard is the noise being measured.

Wind blowing across the microphone causes a rushing sound that is registered on the meter. Use of a wind screen can minimize this effect. Electric and magnetic fields can also cause needle deflections. This interference may occur around welding on large assemblies and becomes apparent when the meter needle does not move in step with the loudness of the noise heard. These electromagnetic effects can be reduced by reorienting the meter until minimum coupling with the electrical fields is obtained as indicated by minimum meter reading. One particularly troublesome location where electrical interference is observed is around electric furnaces. Here, the electrical interference and the noise are coincident so that it is easy to confuse these spurious signals with noise.

When taking readings, one should obtain representative data. The microphone should be moved about to determine that standing waves are not present. If they are, a spatial average should be obtained.

Exposure Surveys

When conducting exposure surveys of various kinds, the most important consideration is to measure levels that are typical of those at the auditor's location. It is not necessary, in fact it is undesirable, to measure sound right at the ear since diffraction around the head can alter the sound field. It is better to measure at some loca-

ENVIRONMENTAL ENGINEERING AND SANITATION

THIRD EDITION

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almost all sound contains multiple frequencies. The relationship is not simple because of the interference effects of the sound waves.[16] For example, increasing sound pressure level by 3 dB is equivalent to increasing the intensity by a factor of two. Increasing sound pressure level by 10 dB is equivalent to increasing the intensity by a factor of 10, and increasing the sound pressure level by 20 dB is equivalent to increasing the intensity by a factor of 100. Expressed in another way, whereas 10 decibels is 10 times more intense than one decibel, 20 decibels is 100 times (10 × 10) more intense, and 30 decibels 1000 times (10 × 10 × 10) more intense.

Loudness Loudness or amplitude of sound is sound level or sound pressure level as perceived by an observer. The apparent loudness varies with the sound pressure and frequency (pitch) of the sound. This is illustrated in Figure 6-14. It is specified in sones or phons. For a pure tone, each time the sound pressure level increases by 10 dB the loudness doubles (sones increase by a factor of two). Sound levels of the same intensity may not sound the same since the ear does not respond the same to all types of sound.

A 1000-Hz pure tone, 40 dB above the listener's hearing threshold (0 dB), produces a loudness of one *sone*, which is a unit of loudness[17,18] This loudness of one sone is equal to 40 phons. Loudness levels are usually expressed in phons. For practical purposes, each doubling of the sones increases the phons by 10, that is, 1 sone = 40 phons; 2 sones = 50 phons; 4 sones = 60 phons. Also for pure tones, a 10-dB increase in sound level would be perceived as a 10-phon increase in loudness by a person with good hearing in the frequency range of 600 to 2000 Hz.

Take for example a human listener with normal hearing who hears a 100-Hz pure tone with a sound pressure level (SPL) of 90 dB. What loudness does the listener perceive?

From Figure 6-14, a SPL of 40 dB at approximately 100 Hz equals a loudness of 10 phons. Since a 50 dB increase in SPL is equivalent to a 50 phons increase in loudness, the tone's loudness is 60 phons or 4 sones.

Noys Noys is a measure of the perceived noise level (PNL) in dB in relation to the noisiness or acceptability of a sound level. Although similar to loudness, the ratings by observers when tested were different.

Procedures for the calculation of loudness and noisiness are given in standard texts.[19]

Effects of Noise—A Health Hazard

Noise pollution is an environmental and workplace problem. Excessive noise can cause permanent or temporary loss of hearing. Loud sounds affect the circu-

[16] M. L. Davis, *Air Resources Management Primer*, ASCE, New York, August 1973.

[17] *The Industrial Environment — Its Evaluation and Control*, "Sound and Noise," by Charles D. Jaffe, PHS Pub 614, GPO, Washington, D.C., 1958, p. B-20. 2.

[18] *Environmental Health Criteria 12, Noise*, WHO, 1980, pp. 24–25.

[19] Arnold P. G. Peterson and Erwin E. Gross, Jr., *Handbook of Noise Measurement*, General Radio Company, Concord, Mass., 1974, pp. 23–35.

Figure 6-14
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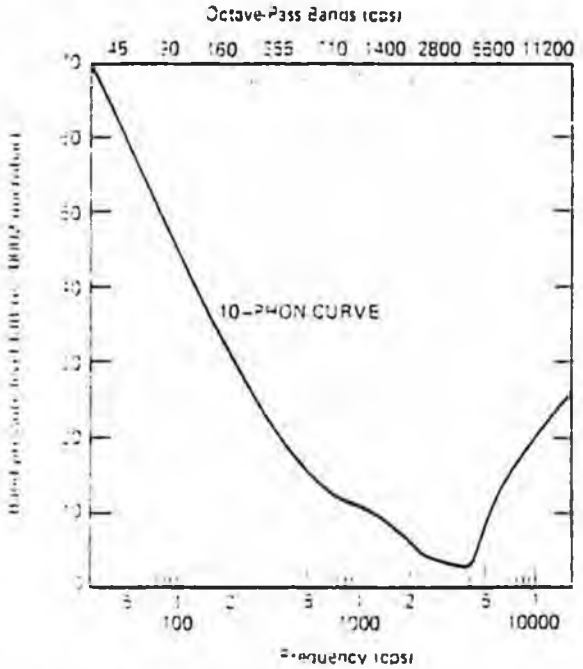

Figure 6-14 Equal loudness contour. (Source: *Toward a Quieter City*. A report of the Mayor's Task Force on Noise Control, New York City, 1970.)

latory and nervous systems, although the effects are difficult to assess. It interferes with speech, radio, and TV listening; disturbs sleep and relaxation; affects performance as reduced work precision and increased reaction time; causes annoyance, irritation, and public nuisance. Sonic boom can cause physical damage to structures. With the WHO definition of health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity," then excessive noise is clearly a health problem. David G. Hawkins, assistant USEPA administrator reported that

> A recent poll conducted by the U.S. Bureau of the Census showed that noise is considered to be the most undesirable neighborhood condition—more irritating than crime and deteriorating housing.[39]

Criteria for hearing protection and conservation have been established primarily for the worker. The major factors related to hearing loss are intensity (sound pressure levels in dB), frequency content, time duration of exposure, and repeated impact (a single pressure peak incident). In measuring the potential harm of high-level noise, frequency distribution as well as intensity must be considered. Continuous exposure to high-level noise is more harmful than intermittent or occasional exposure. High- and middle-frequency sounds at high levels generally are more harmful than low-frequency sounds at the same levels. Greater harm is done with increased time of exposure.

[39] "E.P.A., Battling Noise Pollution, Tells of Extent of Damage to Ears," United Press International, *New York Times*, November 11, 1979

Individuals react differently to noise depending on age, sex, and socioeconomic background. The relation of noise to productivity or performance is contradictory and not well established.

For workers, a sound level over 85 dBA calls for study of the cause. A level above 90 dBA should be considered unsafe for daily exposure over a period of months and calls for noise reduction or personal ear protection if this is practical. A level of 120 dBA causes discomfort; levels of 120 to 140 dBA pain and possibly nausea and dizziness.

A USEPA report identified a 24-hr exposure level of 70 dBA as the level of environmental noise which will prevent any measurable hearing loss over a lifetime. Levels of 55 dBA outdoors and 45 dBA indoors are identified as preventing annoyance and not interfering with spoken conversation and other activities such as sleeping, working, and recreation.[41] Some common sound levels and human responses are noted in Figure 6-15.

Other effects of noise are reduced property values; increased compensation benefits and possible accidents, inefficiency, and absenteeism; and increased building construction costs.

Sources of Noise

Transportation, industrial, urban, and commercial activities are the major sources of noise, plus the contributions made by household appliances and equipment. The major sources of transportation noise are motor vehicles including buses and trucks, aircraft, motorcycles, and snowmobiles.

Industrial, urban, and commercial noises emanate from factories, equipment serving commercial establishments, and construction activities. Construction equipment sources are power tools, air compressors, earthmovers, dump trucks, diesel cranes, pneumatic drills, and chain saws; also garbage collection trucks. Compactor trucks manufactured after October 1, 1980 may not exceed a noise level of 79 decibels and may not exceed 76 decibels after July 1, 1982 measured on the *A*-weighted scale, seven meters from the front, side, and rear of the vehicle while empty and operating.

Residential noise is associated with dishwashers, garbage disposal units, air conditioners, power lawn mowers, and home music amplifier units.

Measurement of Noise

Noise measurement equipment selection is dependent upon the task to be performed. For an initial survey, a sound level meter is adequate for a rapid evaluation and identification of potential problem areas. To study and also determine the characteristics of a noise problem area, a sound level meter, fre-

[41] *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*. USEPA Report 550/9-74-004, March 1974.

Carrier Deck,
Jet Operation

Jet Takeoff (200 ft)
Discotheque
Auto Horn (3 ft)
Riveting Machine
Jet Takeoff (2,000 ft)
Garbage Truck
New York Subway Station
Heavy Truck (50 ft)
Pneumatic Drill (50 ft)
Alarm Clock

Freight Train (50 ft)
Freeway Traffic (50 ft)

Air-Conditioning Unit
(20 ft)
Light Auto Traffic (100 ft)

Living Room
Bedroom
Soft Whisper (15 ft)
Broadcasting Studio

Figure 6-15 Sound level
Office of Planning Manag

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Sound Level Meter
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	Noise Level	Response	Conversational Relationships
	150		
Carrier Deck. Jet Operation	140		
		Painfully loud	
	130	Limit Amplified Speech	
Jet Takeoff (200 ft)	120	Maximum Vocal Effect	
Discotheque			
Auto Horn (3 ft)			
Riveting Machine	110		
Jet Takeoff (2,000 ft)			
Garbage Truck	100		Shouting in Ear
New York Subway Station		Very Annoying	
Heavy Truck (50 ft)	90	Hearing Damage (8 hr)	Shouting at 2 ft
Pneumatic Drill (50 ft)			
Alarm Clock	80	Annoying	Very Loud Conversation 2 ft
Freight Train (50 ft)			
Freeway Traffic (50 ft)	70	Telephone Use Difficult	Loud Conversation, 2 ft—Possible contribution to hearing impairment begins
Air-Conditioning Unit (20 ft)	60	Intrusive	Loud Conversation, 4 ft
Light Auto Traffic (100 ft)	50	Quiet	Normal Conversation, 12 ft
Living Room			
Bedroom	40		
Soft Whisper (15 ft)	30	Very Quiet	
Broadcasting Studio	20		
	10	Just Audible	
	0	Threshold of Hearing	

Figure 6-15 Sound levels and human response. (Source: *Sound Levels and Human Responses*, Office of Planning Management, USEPA, July 1973.)

quency analyzer, and recorder are needed to determine sound pressure distribution with frequency and time. More sophisticated equipment would be needed for research or solution of special noise problems.

Sound Level Meter A sound level meter is used to measure the sound pressure level; it is the basic instrument for noise measurement.

Meters are available to cover the range of 20 to 180 dB. The specifications usually refer to the American National Standards Institute (ANSI) and particularly to the "American National Standard Specification for Sound Level Meters," ANSI S1.4-1971. Three weighting networks, A, B, and C, are provided to give a number which best approximates the total loudness level for a particular situation, with consideration of the sound frequency, intensity, and impact levels. There are three types of meters. Type I is highest quality; Type III

should meet established criteria for comfort, tension, sound attenuation, simplicity, durability, and so on. To be effective however, the worker must cooperate by wearing the protective device where needed. Dry cotton plugs do not provide significant sound attenuation.

Control of Transport Noise

Noise from various forms of transport and its transmission into the home may be reduced:[44]

1. At the source, i.e., by controlling the *emission* of noise.
2. By means of town and country planning and traffic engineering, i.e., by controlling the *transmission* of noise.
3. In the home, i.e., by controlling the *reception* of noise by the occupants.

Some specific measures to reduce the effect of highway noise include:

1. Enclosure of highways going through residential areas.
2. Wider rights-of-way, i.e., separation or buffer zone between the source and the receptor.
3. Walls designed to deflect or absorb noise.
4. Changes in highway alignment and grade to avoid sensitive areas; minimizing stop-and-go traffic, and shifting to low gears.
5. Setting lower speed limits for certain sections of a highway.
6. Adjacent barriers, nonresidential buildings in sound transmission path, earth embankments or berms, elevation or depression of highways. It is reported however that barriers provide little attenuation of low frequency sounds and that a thick band of deciduous trees 200 to 300 ft in width is relatively ineffective in cutting down traffic noises, reducing them only on the order of 4 or 5 dB.[45] Separation distance is most effective in reducing noise from highways.
7. Establishing alternate truck routes.
8. Building codes requiring building insulation to limit interior transmission of noise. Additional measures are masonry walls, elimination of windows, use of double windows or glazing, soundproofing of ceilings, thick carpeting, over-stuffed furniture, and heavy drapes.

Noise Reduction

Sound Absorption

The amount of sound energy a material can absorb (soak up) is a function of its absorption coefficient (α) at a specified frequency. The sound absorption coefficient is the fractional part of the energy of an incident sound wave that is absorbed by a material. A material with an absorption coefficient of 0.8 will absorb 80 percent of the incident sound energy. A material that absorbs all incident energy, such as an open window, has an absorption coefficient of one. The sound absorption of a surface is measured in sabins. A surface hav-

[44] *Health Hazards of the Human Environment*, WHO, 1972, p. 265.
[45] J. E. Heer, Jr., D. J. Hagerty, and J. L. Pavoni, "Noise in the Urban Environment," *Pub. Works*, October 1971, pp. 60–64.

method. In general, if there are no sound reflecting surfaces in the vicinity, a sound pressure level will be reduced approximately 6 dB for each doubling of the distance. Doubling the air space between panels increases the transmission loss by about 5 dB.

Federal Regulations

Maximum acceptable or permissible noise levels are established for certain categories by federal or state regulations or by local ordinances. Some guides are given in Table 6-13.

The Department of Labor in May 1969 issued the first federal standards for occupational exposure to noise. OSHA sets and enforces regulations, under the Occupational Safety and Health Act of 1970, for the protection of workers' hearing. See Table 6-14. The federal regulatory approach is to start control at the point of manufacture.

The Federal Highway Act of 1970 led to design noise levels related to land use as a condition to federal aid participation. If design noise levels shown in Table 6-15 are exceeded, noise abatement measures are required in the highway design. Federal highway funds may also be used to abate noise on previously approved highway projects.

The Noise Control Act of 1972 (P.L. 92-574) requires regulation of noise from a broad range of sources and products. The USEPA and the Department of Transportation have been given responsibilities to implement the law. The USEPA estimates that 16 million people are presently exposed to aircraft noise levels with effects ranging from moderate to very severe.

The Federal Aviation Administration (FAA), in the department of transportation, has primary authority for aircraft noise regulations and standards. The FAA has adopted noise emission standards for new aircraft and has a plan to retrofit older aircraft.

Table 6-13 Some Guides for Maximum Acceptable Sound Levels

Space	Sound Level (dBA)
Private offices	40 to 45
Small conference room	35 to 40
Secretarial offices	55 to 60
Drafting rooms	55
School rooms	30 to 40
Hospital rooms	40
Hotel rooms	45
Libraries	40 to 45
Restaurants	50
Auditoriums	30 to 45
Movie theaters	35 to 45

Table 6-14 Permissi

Duration per (hours)
(10)
8
6
4
3
2
1½
1
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Source: *Guidelines To Supply Contracts*. U.S. I
Note: Workers must no one second should not e
[a]Occupational Safety an 1969 to contractors with
[b]The upper limit of a da percent of the exposed p

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Table 6-15 Design N

Design Noise Level (dBA)	
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70 (Exterior)	Re lib
75 (Exterior)	De cat
55 (Interior)	Re lib

Source: U.S. Dept. of mittal 279, February 8,

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Sound Level (dBA)
40 to 45
35 to 40
55 to 60
55
30 to 40
40
45
40 to 45
50
30 to 45
35 to 45

Table 6-14 Permissible Noise Levels in Plants[a]

Duration per Day (hours)	Sound Level at Slow Response (dBA)	
	Existing	Proposed
(10)	(87)	82
8	90[b]	85
6	92	87
4	95	90
3	97	
2	100	95
1½	102	
1	105	100
½	110	
¼ or less	115	

Source: *Guidelines To The Department of Labor's Occupational Noise Standards for Federal Supply Contracts*, U.S. Dept. of Labor, Washington, D.C., December 4, 1970.
Note: Workers must not be exposed to sound levels above 115 dBA. Impact noise lasting less than one second should not exceed 140 dB (unweighted).
[a]Occupational Safety and Health Act of 1970 extends Walsh-Healey Public Contracts Act of May 1969 to contractors with federal contracts of $10,000 or more.
[b]The upper limit of a daily dose which will not produce disabling loss of hearing in more than 20 percent of the exposed population.

The Department of Housing and Urban Development (HUD) has criteria for the sound insulation characteristics of walls and floors in row houses, nursing homes, and multifamily housing units. These criteria must be met by housing of this type in order to qualify for HUD mortgage insurance.

The National Bureau of Standards and the National Science Foundation are concerned with research in noise control and abatement in factories, homes, offices, and commercial work areas.

Table 6-15 Design Noise Level—Land Use Relationships

Design Noise Level (dBA)	Description of Land Use Category
60 (Exterior)	Areas such as amphitheaters, certain parks or open spaces in which local officials agree serenity and quiet are of extraordinary significance.
70 (Exterior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, recreation areas.
75 (Exterior)	Developed land, properties or activities not included in above two categories.
55 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums.

Source: U.S. Dept. of Transportation Policy Procedure Memorandum 90-2 Appendix B, Transmittal 279, February 8, 1973.

Table 6-16 Noise Levels for Sleeping Quarters in New Structures

Exterior	Interior
Does not exceed 45 dBA for more than 30 min per 24 hours (Acceptable)	Not greater than 55 dBA for more than an accumulation of 60 min in any 24-hour day
Does not exceed 65 dBA for more than 8 hours per 24 hours (Normally Acceptable)	Not greater than 45 dBA for more than 30 min during nighttime sleeping hours 11 p.m. to 7 a.m., and Not greater than 45 dBA for more than an accumulation of 8 hours in any 24-hour day

Source: HUD Circular 1390, amended Sept. 1, 1971.
Note: Not greater than 30 dBA preferred for bedrooms.

The USEPA has issued noise control regulations for interstate trucks, for interstate railroad carriers, for new medium and heavy-duty trucks, and for new air compressors. USEPA and DOT regulations establish a maximum noise level of 90 dBA for interstate trucks and buses over 10,000 pounds in speed zones over 35 mph and 86 dBA at 35 mph or less, measured 50 ft from the center line of the lane of travel. For new trucks less than 10,000 pounds, the USEPA has proposed 83, 80, and 75 dBA after January 1977, 1981, and 1983 respectively.

The USEPA program for certain noise-emitting and noise-reducing products requires a noise rating giving the number of decibels (dBA) a product emits and a noise reduction rating.

HUD noise levels for new sleeping quarters are given in Table 6-16.

State and Local Regulations

New York State enacted a state highway anti-noise law in 1965 and California followed in 1967. Chicago put into effect a comprehensive noise control program in July 1971. Regulations require reduced noise levels after 1979 for vehicles, construction machinery, home powered equipment, and the like manufactured equipment. St. Louis County has a noise code which limits noise in residential areas to 55 dBA and in industrial areas to 80 dBA. New Jersey enacted comprehensive noise legislation January 1972. Most states in the snow belt have established a maximum noise level for snowmobiles of 78 dBA at 50 feet. Some 12,000 states and municipalities have noise control legislation but enforcement has been weak and spotty.

Local regulations which are consistent with federal and state laws and which are enforced locally are encouraged as being more practical for enforcement

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State Dept. of Environ
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control ordinances).

TABLE 3	
RECREATIONAL VEHICLE NOISE EMISSION STANDARDS	
Vehicle Type	*Sound Level Limit (dBA)*
Snowmobile	76
Motorcycle	76
Any other vehicle	76

(Adapted from GAAB 16.85, am AO 78-48).

15.70.095 Motor vehicles-Electronically amplified sound system.

A. Notwithstanding any other provisions of the Anchorage Municipal Code, with the exception of Ch. 15.70, no person operating in or in control of a parked or moving motor vehicle shall operate, or permit the operation of an electronically amplified sound system in or on the motor vehicle so as to produce sound that is clearly audible more than 50 feet (15 meters) from the motor vehicle or in violation of the provisions in section 15.70.060 (a) or (c).

B. If this section is determined to be in conflict with any other section of the Anchorage Municipal Code, with the exception of Ch. 15.70, this section shall take precedence.

C. Penalties. Any person violating the provisions of this section shall pay a civil penalty of $100 for the first violation or date of violation, $300 for the second violation within six months of the first violation, and $1,000 and forfeiture of the sound system or components of the sound system up to $1,000 in value, for the third violation within one year of the first violation. The civil penalties for violations will be assessed through the Administrative Hearings Officer as provided for in AMC Ch. 14.20.

D. Enforcement - Powers of Arrest or Citation. Any authorized police officer shall issue a citation for any violation under this article, except they may arrest for instances when the alleged violator refuses to provide the officer with such person's name and address and any proof thereof as may be reasonably available to the alleged violator. (AO No. 94-77(S), §3, 5-31-94).

15.70.100 Hazardous noise emission standards.

A. Except as otherwise provided in subsection B, the director shall order an immediate halt to any sound that exposes, where such sound levels are received, any person to continuous sound levels in excess of those shown in Table 4 or to impulsive sound levels in excess of those shown in Table 5. As soon as reasonably possible following issuance of such an order, the municipal attorney shall apply to the Superior Court, Third Judicial District, Anchorage, Alaska, or other court having jurisdiction for an injunction to replace the order.

B. No order pursuant to subsection A shall be issued if the only persons exposed to sound levels in excess of those listed in Tables 4 and 5 are exposed as a result of trespass, invitation upon private property by the person causing or permitting the sound, or employment by a contractor or the person causing or permitting the sound. In determining continuous sound levels shown in Table 4, equal energy time-intensity trade off shall be used if the sound level varies, and the energy equivalent over 24 hours shall be found.

TABLE 4

HAZARDOUS CONTINUOUS NOISE EMISSION LEVELS

Sound Level Limit (dBA)	*Duration*
90	24 hours
93	12 hours
96	6 hours
99	3 hours
102	1½ hours
105	45 minutes
108	22 minutes

TABLE 5

HAZARDOUS IMPULSIVE NOISE EMISSION LEVELS

Sound Level Limit (dBA)	*Number of Impulses per 24-Hour Period*
145	1
135	10
125	100

(Adapted from GAAB 16.85, am AO 78-48).

NATIONAL CONFERENCE OF STATE LEGISLATURES
1560 Broadway
Suite 700
Denver, Colorado 80202
Phone: (303)830-2200
FAX No.: (303)863-8003

Telecopy to: Shirley Armstrong

From: Jeanne Mejeur

Message: Attached are state laws on vehicle noise. Only Georgia's specifically refers to music/stereo noise, though several of the others refer to decibel levels, which addresses the issue.

Number of Pages Telecopied (including cover sheet): 11

Date Sent: 3-23-95

Please place fax number and authorization code on reverse side.

VARIOUS STATE LAWS ON VEHICLE NOISE

Rank: 1 OF 1
Citation: GA ST s 40-6-14

CODE OF GEORGIA
TITLE 40. MOTOR VEHICLES AND TRAFFIC
CHAPTER 6. UNIFORM RULES OF THE ROAD
ARTICLE 1. GENERAL PROVISIONS

Current through Act 1437, approved 5-8-92

40-6-14 Limits on sound volume produced by radio, tape player, or other mechanical sound-making device or instrument from within the motor vehicle.

(a) It is unlawful for any person operating or occupying a motor vehicle on a street or highway to operate or amplify the sound produced by a radio, tape player, or other mechanical sound-making device or instrument from within the motor vehicle so that the sound is plainly audible at a distance of 100 feet or more from the motor vehicle.

(b) The provisions of this Code section shall not apply to any law enforcement motor vehicle equipped with any communication device necessary in the performance of law enforcement duties or to any emergency vehicle equipped with any communication device necessary in the performance of any emergency procedures.

(c) The provisions of this Code section do not apply to motor vehicles used for business or political purposes, which in the normal course of conducting such business use sound-making devices. The provisions of this subsection shall not be deemed to prevent local authorities, with respect to streets and highways under their jurisdiction and within the reasonable exercise of the police power, from regulating the time and manner in which such business may be operated.

(d) The provisions of this Code section do not apply to the noise made by a horn or other warning device required or permitted by Code Section 40-8-70. The Department of Public Safety shall promulgate rules defining "plainly audible" and establish standards regarding the measurement of sound by law enforcement personnel.

(e) A violation of this Code section shall be a misdemeanor.

(Code 1981, s 40-6-14, enacted by Ga. L. 1991, p. 417, s 1.)

Code, s 40 6-14
GA ST s 40-6-14

END OF DOCUMENT

WEST'S FLORIDA STATUTES ANNOTATED
TITLE XXIII. MOTOR VEHICLES
CHAPTER 316. STATE UNIFORM TRAFFIC CONTROL

Current through 1992 Special 'H' Session

316.293. Motor vehicle noise

(1) Definitions. The following words and phrases, when used in this section, shall have the meanings respectively assigned to them in this subsection, except where the context otherwise requires:
(a) "dB A" means the composite abbreviation for the A-weighted sound level and the unit of sound level, the decibel.
(b) "Gross combination weight rating" or "GCWR" means the value specified by the manufacturer as the loaded weight of a combination vehicle.
(c) "Gross vehicle weight rating" or "GVWR" means the value specified by the manufacturer as the loaded weight of a single vehicle.
(d) "Sound level" means the A-weighted sound pressure level measured with fast response using an instrument complying with the specification for sound level meters of the American National Standards Institute, Inc., or its successor bodies, except that only A-weighting and fast dynamic response need be provided.
(e) "Department" means the Department of Highway Safety and Motor Vehicles.
(2) Operating noise limits. No person shall operate or be permitted to operate a vehicle at any time or under any condition of roadway grade, load, acceleration, or deceleration in such a manner as to generate a sound level in excess of the following limit for the category of motor vehicle and applicable speed limit at a distance of 50 feet from the center of the lane of travel under measurement procedures established under subsection (3).

(a) For motorcycles other than motor-driven cycles:

	Sound level limit	
	Speed limit 35 mph or less	Speed limit over 35 mph
Before January 1, 1979	82 dB A	86 dB A
On or after January 1, 1979	78 dB A	82 dB A

(b) For any motor vehicle with a GVWR or GCWR of 10,000 pounds or more:

	Sound level limit	
	Speed limit 35 mph or less	Speed limit over 35 mph
On or after January 1, 1975	86 dB A	90 dB A

(c) For motor-driven cycles and any other motor vehicle not included in paragraph (a) or paragraph (b):

	Sound level limit	
	Speed limit 35 mph or less	Speed limit over 35 mph
Before January 1, 1979	76 dB A	82 dB A
On or after January 1, 1979	72 dB A	79 dB A

(3) Measurement procedures. The measurement procedures for determining compliance with this section shall be established by regulation of the Department of Environmental Regulation as provided in s. 403.415(9), in cooperation with the department. Such regulations shall include the selection of measurement sites and measurement procedures and shall take into consideration accepted scientific and professional methods for the measurement of vehicular sound levels. The measurement procedures may include adjustment factors to be applied to the noise limit for measurement distances of other than 50 feet from the center of the lane of travel.

(4) Applicability. This section applies to the total noise from a vehicle and shall not be construed as limiting or precluding the enforcement of any other provisions of this chapter relating to motor vehicle mufflers for noise control.

(5) Noise abatement equipment modifications.

(a) No person shall modify the exhaust system of a motor vehicle or any other noise-abatement device of a motor vehicle operated or to be operated upon the highways of this state in such a manner that the noise emitted by the motor vehicle is above that emitted by the vehicle as originally manufactured.

(b) No person shall operate a motor vehicle upon the highways of the state with an exhaust system or noise-abatement device so modified.

(6) Exempt vehicles. The following are exempt from the operation of this act:

(a) Emergency vehicles operating as specified in s. 316.072(5)(a).

(b) Any motor vehicle engaged in a professional or amateur sanctioned, competitive sports event for which admission or entry fee is charged, or practice or time trials for such event.

(c) Any motor vehicle engaged in a manufacturer's engineering, design, or equipment test.

(d) Construction or agricultural equipment either on a job site or traveling on the highways.

< < For credits, see Historical Note field. > >

HISTORICAL NOTES

HISTORICAL AND STATUTORY NOTES

1990 Main Volume Historical and Statutory Notes

Derivation:
Laws 1979, c. 79-65, s 28.
Laws 1978, c. 78-280, s 2.
Laws 1976, c. 76-31, s 32.
Laws 1974, c. 74-110, s 4.

Laws 1976, c. 76-31, s 32, renumbered the section reference in subsec. (6) (a) from s 316.051(5) (a) to s 316.072(5) (a), effective October 1, 1977.

Laws 1978, c. 78-280, s 2, changed acceptable sound levels in reference to subsec. (2) (c) after January 1, 1979.

Laws 1979, c. 79-65, a reviser's bill, changed nomenclature and deleted provisions to reflect transfers of powers, duties and functions resulting from the Environmental Reorganization Act of 1975 (Laws 1975, c. 75-22), and to reflect the change in name of water management districts resulting from Laws 1975, c. 75-125.

West's F. S. A. s 316.293
FL ST s 316.293
END OF DOCUMENT

WEST'S FLORIDA STATUTES ANNOTATED
TITLE XXIX. PUBLIC HEALTH
CHAPTER 403. ENVIRONMENTAL CONTROL
PART I. POLLUTION CONTROL

Current through 1992 Special 'H' Session

403.415. Motor vehicle noise

(1) Short title.--This act shall be known and may be cited as the "Florida Motor Vehicle Noise Prevention and Control Act of 1974."

(2) (a) Legislative intent.--The intent of the Legislature is to implement the state constitutional mandate of s. 7, Art. II of the State Constitution to improve the quality of life in the state by limiting the noise of new motor vehicles sold in the state and the noise of motor vehicles used on the highways of the state.

(b) It is also the intent of the Legislature to recognize the proposed United States Environmental Protection Act Noise Commission Standards Regulations for medium and heavy-duty trucks as being the most comprehensive available and in the best interest of Florida's citizenry and, further, that such regulation shall preempt all state standards not identical to such regulation.

(3) Definitions.--The following words and phrases when used in this section shall have the meanings respectively assigned to them in this subsection, except where the context otherwise requires:

(a) "dB A" means the composite abbreviation for A-weighted sound level, and the unit of sound level, the decibel.

(b) "Gross combination weight rating" or "GCWR" means the value specified by the manufacturer as the loaded weight of a combination vehicle.

(c) "Gross vehicle weight rating" or "GVWR" means the value specified by the manufacturer as the loaded weight of a single vehicle.

(d) "Motor vehicle" means any vehicle which is self-propelled and any vehicle which is propelled by electric power obtained from overhead trolley wires, but not operated upon rails.

(e) "Motorcycle" means any motor vehicle having a seat or saddle for the use of the rider and designed to travel on not more than three wheels in contact with the ground, but excluding a tractor or a moped.

(f) "Moped" means any vehicle with pedals to permit propulsion by human power, having a seat or saddle for the use of the rider and designed to travel on not more than three wheels, with a motor rated not in excess of 2 brake horsepower and not capable of propelling the vehicle at a speed greater than 30 miles per hour on level ground, and with a power-drive system that functions directly or automatically without clutching or shifting gears by the operator after the drive system is engaged. If an internal combustion engine is used, the displacement may not exceed 50 cubic centimeters.

(g) "Sound level" means the A-weighted sound pressure level measured with fast response using an instrument complying with the specification for sound level meters of the American National Standards Institute, Inc., or its successor bodies, except that only A-weighting and fast dynamic response need be provided.

(h) "Vehicle" means any device in, upon, or by which any person or property is or may be transported or drawn upon a highway, except devices moved by human power or used exclusively upon stationary rails or tracks.

(i) "Department" means the Department of Environmental Regulation.

(4) New vehicle noise limits.--No person shall sell, offer for sale, or lease a new motor vehicle that produces a maximum sound level exceeding the following limits at a distance of 50 feet from the center of the lane of travel under test procedures established under subsection (5):

(a) For motorcycles:

Date of manufacture	Sound level limit
From January 1, 1973, to December 31, 1974	86 dB A
On or after January 1, 1975	83 dB A

(b) For any motor vehicle with a GVWR over 10,000 pounds, for any school bus, and for any multipurpose passenger vehicle, which is defined as a motor vehicle with motive power designed to carry 10 persons or less and constructed either on a truck chassis or with special features for occasional off-road operation:

Date of manufacture	Sound level limit
From January 1, 1973, to December 31, 1976	86 dB A
On or after January 1, 1977	83 dB A

(5) Test procedures.--The test procedures for determining compliance with this section shall be established by regulation of the Department of Environmental Regulation and in cooperation with the Department of Highway Safety and Motor Vehicles in substantial conformance with applicable standards and recommended practices established by the Society of Automotive Engineers, Inc., or its successor bodies, and the American National Standards Institute, Inc., or its successor bodies, for the measurement of motor vehicle sound levels. Regulations establishing these test procedures shall be promulgated no later than December 1, 1974.

(6) Certification.--The manufacturer, distributor, importer, or designated agent thereof shall file a written certificate with the department stating that the specific makes and models of motor vehicles described thereon comply with the provisions of this section. No new motor vehicle shall be sold, offered for sale, or leased unless such certificate has been filed.

(7) Notification of certification.--The department shall notify the Department of Highway Safety and Motor Vehicles of all makes and models of motor vehicles for which valid certificates of compliance with the provisions of this section are filed.

(8) Replacement equipment.--

(a) No person shall sell or offer for sale for use as a part of the equipment of a motor vehicle any exhaust muffler, intake muffler, or other noise abatement device which, when installed, will permit the vehicle to be operated in a manner that the emitted sound level of the vehicle is increased above that emitted by the vehicle as originally manufactured and determined by the test procedures for new motor vehicle sound levels established under this section.

(b) The manufacturer, distributor, or importer, or designated agent thereof, shall file a written certificate with the department that his products sold within this state comply with the requirements of this section for their intended applications.

(9) Operating vehicle noise measurements.--The department shall establish, with the cooperation of the Department of Highway Safety and Motor Vehicles, measurement procedures for determining compliance of operating vehicles with the noise limits of s. 316.293(2). The department shall advise the Department of Highway Safety and Motor Vehicles on technical aspects of motor vehicle noise enforcement regulations, assist in the training of enforcement officers, and administer a sound-level meter loan program for local enforcement agencies.

(10) Enactment of local ordinances limited.--The provisions of this section shall be applicable and uniform throughout this state and in all political subdivisions and municipalities therein, and no local authority shall enact or enforce any ordinance on a matter covered by this section unless expressly authorized. However, this subsection shall not prevent any local authority from enacting an ordinance when such enactment is necessary to vest jurisdiction of violation of this section in the local court.

< < For credits, see Historical Note field. > >

HISTORICAL NOTES

HISTORICAL AND STATUTORY NOTES

1993 Main Volume Historical and Statutory Notes

Derivation:
Laws 1987, c. 87-161, s 22.
Laws 1982, c. 82-49, s 1.
Laws 1980, c. 80-338, s 1.
Laws 1979, c. 79-164, s 98.

Laws 1979, c. 79-65, s 82.
Laws 1978, c. 78-280, s 1.
Laws 1976, c. 76-289, s 1.
Laws 1975, c. 75-59, ss 1, 2.
Laws 1974, c. 74-110, ss 1 to 3.

West's F. S. A. s 403.415
FL ST s 403.415
END OF DOCUMENT

Citation: ND ST 39-27-08 Rank 61

NORTH DAKOTA CENTURY CODE

TITLE 39. MOTOR VEHICLES

CHAPTER 39-27. MOTORCYCLE EQUIPMENT

39-27-08. Exhaust system -- Prevention of noise.

Motorcycles must be equipped with an exhaust system incorporating a muffler or other mechanical device for the purpose of effectively reducing engine noise. Cutouts and bypasses in the exhaust system are prohibited. The system must be leakproof and all components must be securely attached to the vehicle and located so as not to interfere with the operation of the motorcycle. Shielding must be provided to prevent inadvertent contact with the exhaust system by the operator or passenger during normal operation. In addition, all motorcycles operating on streets and highways must meet the noise decibel limitations as established by the environmental protection agency. No person may sell, offer for sale, or install any noise suppressing system or device which will produce noise in excess of the maximum allowable decibel limitations of this section.

Source: S.L. 1975, ch. 365, s 8; 1979, ch. 441, s 1.

N D C C 39-27-08
ND ST 39-27-08
END OF DOCUMENT

Citation: OH ST s 4513.221 Rank 63

PAGE'S OHIO REVISED CODE ANNOTATED
TITLE 45: MOTOR VEHICLES--AERONAUTICS--WATERCRAFT
CHAPTER 4513: TRAFFIC LAWS--EQUIPMENT; LOADS
[EQUIPMENT]

Current with laws passed and filed through 12-31-91

[s 4513.22.1] s 4513.221 Regulation of vehicle and engine noise in unincorporated areas.

(A) The board of county commissioners of any county, and the board of township trustees of any township subject to section 505.17 of the Revised Code, may regulate passenger car and motorcycle noise on streets and highways under their jurisdiction. Such regulations shall include maximum permissible noise limits measured in decibels, subject to the requirements of this section.

(B) Regulations establishing maximum permissible noise limits measured in decibels shall prohibit the operation, within the speed limits specified herein, of a passenger car or motorcycle of a type subject to registration at any time or under any condition of load, acceleration, or deceleration in such manner as to exceed the following maximum noise limits, based on a distance of not less than fifty feet from the center of the line of travel:

(1) For passenger cars:

(a) When operated at a speed of thirty-five miles per hour or less, a maximum noise limit of seventy decibels;

(b) When operated at a speed of more than thirty-five miles per hour, a maximum noise limit of seventy-nine decibels.

(2) For motorcycles:

(a) When operated at a speed of thirty-five miles per hour or less, a maximum noise limit of eighty-two decibels;

(b) When operated at a speed of more than thirty-five miles per hour, a maximum noise limit of eighty-six decibels.

(C) Maximum noise limits established pursuant to division (B) of this section shall be measured on the "A" scale of a standard sound level meter meeting the applicable requirements for a type 2 sound level meter as defined in American national standards institute standard S1.4 - 1983, or the most recent revision thereof. Measurement practices shall be in substantial conformity with standards and recommended practice established by the society of automotive engineers, including SAE standard J 986 A NOV81, SAE standard J 366 MAR85, SAE standard J 331 A, and such other standards and practices as may be approved by the federal government.

(D) No regulation enacted under division (B) of this section shall be effective until signs giving notice of the regulation are posted upon or at the entrance to the highway or part thereof affected, as may be most appropriate.

(E) A board of county commissioners of any county may regulate noise from passenger cars, motorcycles, or other devices using internal combustion engines in the unincorporated area of the county, and a board of township trustees may regulate such noise in the unincorporated area of the township, in any of the following ways:

(1) By prohibiting operating or causing to be operated any motor vehicle, agricultural tractor, motorcycle, all-purpose vehicle, or snowmobile not equipped with a factory-installed muffler or equivalent muffler in good working order and in constant operation;

(2) By prohibiting the removing or rendering inoperative, or causing to be removed or rendered inoperative, other than for purposes of maintenance, repair, or replacement, of any muffler; (3) By prohibiting the discharge into the open air of exhaust of any stationary or portable internal combustion engine except through a factory- installed muffler or equivalent muffler in good working order and in constant operation;

(4) By prohibiting racing the motor of any vehicle described in division (E)(1) of this section in such a manner that the exhaust system emits a loud, cracking, or chattering noise unusual to its normal operation.

(F) Whoever violates any maximum noise limit established as provided in division (B) of this section or any of the prohibitions authorized in division (E) of this section is guilty of a minor misdemeanor. Fines collected under this section by the county shall be paid into the county general fund, and such fines collected by the township shall be paid into the township general fund. No regulation adopted under this section shall apply to commercial racetrack operations.

1990 Main Volume Credit

HISTORY: 141 v H 131. Eff 6-26-86.

R. C. s 4513.221 (Page's)
OH ST s 4513.221
END OF DOCUMENT

Citation: RI ST s 31-45-1 Rank 66

GENERAL LAWS OF RHODE ISLAND ANNOTATED, 1956
REENACTMENT OF 1982
TITLE 31. MOTOR AND OTHER VEHICLES
CHAPTER 45. NOISE LIMITS FOR MOTOR VEHICLES

Current through January Session (1992), Ch. 92-497

31-45-1 Noise limits.

No person shall operate a motor vehicle, nor shall the owner of any vehicle, allow such vehicle to be operated, at any time, or under any condition of grade, load, acceleration or deceleration, in such a manner as to exceed the following noise limit based on a distance of fifty (50) feet from the center of the lane of travel within the speed limit. For the purposes of this section, dbA means decibels measured with a calibrated sound level meter weighted to the "A" scale.

In speed zones of thirty-five (35) miles per hour or less not more than eighty-six (86) dbA. In speed zones of more than thirty-five (35) miles per hour not more than ninety (90) dbA.

History of Section.

As enacted by P.L. 1976, ch. 197, s 1.

Gen. Laws, 1956, s 31-45-1
RI ST s 31-45-1
END OF DOCUMENT

1995 POCKET SUPPLEMENT

ISSUED IN DECEMBER, 1994

COVERING LEGISLATION THROUGH
THE 1994 SESSION OF THE 1993–94 LEGISLATURE

DEERING'S VEHICLE CODE

ANNOTATED

OF THE STATE OF CALIFORNIA

§§ 22348–31599

Annotated and Indexed by the Publisher's Editorial Staff

Note—An updated analysis of the Vehicle Code appears at the beginning of the supplement to the first volume.

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(c) At the first scheduled overhaul for any refuse or garbage truck, the operator shall consider equipping the refuse or garbage truck not equipped in accordance with the requirements of subdivision (b), with the alarm or device required under subdivision (b).

Amended Stats 1982 ch 926 § 1, effective September 13, 1982; Stats 1983 ch 1144 § 8, effective September 28, 1983.

Amendments:

1982 Amendment: (1) Designated the former section to be subd (a); and (2) added subds (b) and (c).

1983 Amendment: (1) Made technical changes in subd (a); and (2) amended subd (b) by substituting (a) "on backing more than 36 inches" for "immediately on backing"; and (b) "100" for "200".

Collateral References:

Witkin Summary (9th ed) Torts § 826.

§ 27001. Use of horns

Collateral References:

Witkin Summary (9th ed) Torts § 826.

SUGGESTED FORMS

Defense in Answer—Failure to Sound Horn

Plaintiff was guilty of the following acts of negligence:

(a) Plaintiff, when overtaking and attempting to pass the motor vehicle of the defendant, failed to sound the horn or other signaling device of his automobile, and negligently sought to pass the motor vehicle of the defendant at an intersection.

(b) Plaintiff, when overtaking and attempting to pass the motor vehicle of the defendant, failed to pass to the left of the motor vehicle so overtaken.

§ 27002. Sirens

Cross References:

Inapplicability to ambulances and firetrucks used for demonstration: Veh C § 25806.

§ 27007. Audible sound system outside vehicle

No driver of a vehicle shall operate, or permit the operation of, any sound amplification system which can be heard outside the vehicle from 50 or more feet when the vehicle is being operated upon a highway, unless that system is being operated to request assistance or warn of a hazardous situation.

This section does not apply to authorized emergency vehicles or vehicles operated by gas, electric, communications, or water utilities. This section does not apply to the sound systems of vehicles used for advertising, or in parades, political or other special events, except that the use of sound systems on those vehicles may be prohibited by a local authority by ordinance or resolution.

Amended Stats 1989 ch 538 sec 1.

Amendments:

1989 Amendment: Substituted the section for the former section which read: "No driver of a vehicle shall operate or permit operation of any radio system intended to make sound audible outside the vehicle when the vehicle is being operated upon a highway, unless such system is being operated to request assistance or warn of a hazardous situation. This section shall not apply to authorized emergency vehicles or vehicles operated by gas, electric, communications, or water utilities. This section shall not apply to the radio systems of vehicles used for advertising, or in parades, political or other special events, except that use of radio systems on such vehicles may be prohibited by a local authority by ordinance or resolution."

ARTICLE 2

Exhaust Systems

Collateral References:

Witkin Summary (9th ed) Real Property § 78.

§ 27150. Adequate muffler required

Collateral References:

Witkin & Epstein, Criminal Law (2d ed) Ch I Introduction to Crimes § 51.

Cal Jur 3d (Rev) Criminal Law § 2549.

§ 27150.1. Sale of exhaust systems

Cross References:

Violation as an infraction: Pen C § 19.8.

Collateral References:

Witkin & Epstein, Criminal Law (2d ed) §§ 78, 1058.

Cal Jur 3d (Rev) Criminal Law § 71.

§ 27151. Modification of exhaust systems

No person shall modify the exhaust system of a motor vehicle in a manner which will amplify or increase the noise emitted by the motor of such vehicle so that the vehicle is not in compliance with the provisions of Section 27150 or exceeds the noise limits established for the type of vehicle in Article 2.5 (commencing with Section 27200) of this chapter. No person shall operate a motor vehicle with an exhaust system so modified.