ACTION

		DATE
COMMITTEE	_____	____
M.A.P.C.	_____	____
B.C.C./B. CO. C.	_____	____

DR 79-22 - Noise Control Ordinance
Grievance Office.

October 4, 1979

N&C
by 10/11

Metropolitan Area Planning Commission

Robert A. Lakin, Director of Planning

Noise Control Ordinance

The Community Grievance Office has sent us the attached material concerning a proposed ordinance dealing with noise and noise sources in the City. As indicated, the Community Grievance Board will hear comments on this proposal on October 10, which is the day before your meeting. They have asked that we furnish this information to you for your information and any comments that you may wish to make.

Because of the short time length involved, I called Mr. Linde and told him that it would be impossible for us to respond either as a department or the Commission because of the time involved. My own view is that the ordinance is much too complex to provide a quick evaluation as to its effectiveness and as to its impact on the community. At this point, I'm neither supporting or adverse to such an ordinance. It is apparent in planning activities that noise is a major problem as evidenced by the requirements to consider noise in and around airports and the related land use thereto, as well as the construction of transportation projects. In discussing this matter with me, Mr. Linde indicated that he expected no definitive answer from the Board at the October 10 meeting, but some reaction from various parties as to whether the Board should proceed further with this matter or not. It is anticipated by Mr. Linde that it would not reach the City Commission until near the end of the year, and that several additional opportunities will be had before any definitive recommendations to the City Commission are made by the Community Grievance Board. This obviously has impact on the community, both from a livability standpoint, and may also relate to several planning areas, such as Subdivision design, Transportation planning, and other land use related activities. If this matter is going to be continued, our staff will obviously need to spend some time reviewing the ordinance and assessing its impact.

Coincidently, we received in the mail, the same day, an insert to the National League of Cities publication, an environmental report directed to noise. I am xeroxing this for your information. The article on ECHO describes several community efforts across the United States concerning noise regulation.

If any of the Commissioners, upon receipt of this item, have any comments that they wish to have reported to the Community Grievance Board, please feel free to either attend at that time or pass those comments to me, and I will in turn see that they are transmitted to the Board.

Robert A. Lakin
Director of Planning

RAL:rme

cc: Fred Linde, Grievance Officer
James Aiken, Director, Environmental Health
Jack H. Galbraith, Chief Planner, Current Plans Division
Willard L. Stockwell, Chief Planner, Advance Plans Division

Wichita Community Grievance Office

Room 150
City Hall
Wichita, Kansas 67202

316-268-4547

October 1, 19

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METROPOLITAN PLANNING
ROUTE ☐ _____
☐ _____

Mr. Bob Lakin, Director
Metropolitan Area Planning Department
455 N. Main
Wichita, Kansas 67202

Dear Mr. Lakin:

The Wichita Community Grievance Advisory Board commenced reviewing a proposal for acoustics standards to be used in the control and regulation of noise and noise sources in the City of Wichita. The proposal, which at the present time is cast as a suggested City ordinance, incorporates features from the City codes of Sacramento, California, Colorado Springs, Colorado and Chicago, Illinois. All of these cities apply similar standards and regulations and we understand all of them have had from good to very good results.

The Grievance Office Advisory Board will resume its consideration of the proposal at its Wednesday, October 10 meeting. The meeting will be held in the City Commission Conference Room on the first floor of City Hall at 3:30 p.m. If the Advisory Board accepts the proposal in its present or modified form, it will then refer the proposal to the Board of City Commissioners for their consideration and possible action.

On behalf of the Advisory Board, we extend a cordial invitation to you to be present on October 10.

If you serve in the dual capacity of ex-officio to one or more appointive Boards or Commissions, we ask you to advise those groups of the current considerations.

We enclose a copy of the draft proposal currently being reviewed by the Advisory Board.

Sincerely,

Fredrick A Linde

Fredrick A. Linde,
Grievance Officer

NOISE CONTROL

Since the Grievance Office started in 1972, complaints and grievances have been made wherein the essential element of concern is noise. In certain types of complaints, such as a barking dog or aircraft operation, the element of noise is apparent and is the obvious reason for the complaint. In others, including complaints about neighborhood conditions, the role of noise as the initiating element is less apparent. However, upon analysis we have been able to isolate noise as the causative element in a large number of types of complaints. For example, for the one year period commencing September 6, 1978 and running through September 5, 1979, the following types and numbers of individual complaints were recorded:

Sources of Noise-Related Complaints to the Grievance Office
For September 6, 1978 to September 5, 1979

Animals - barking dogs and fowls -	40
Vehicles - hot rods, motorcycles and trucks -	9
Music - stereos, from homes -	9
Home auto repairs -	8
General businesses -	10
General neighbors -	8
Construction activities -	3
Early trash pickups -	5
Aircraft -	5

These clearly defined complaints constitute about five percent of the total volume received by the Grievance Office, but on a value weighted basis, probably account for twenty or thirty percent of the significant cases handled by the office.

The control of noise can be attempted either through subjective standards or through objective ones. The Wichita effort can be considered subjective since the element of discretion and opinion by the enforcing agency is implied and required. Most of the Wichita code is contained in Chapter 5.58, title "Noise." This part of the code contains such language as "loud and unnecessary noise prohibited" and prohibits the unnecessary blowing of whistles, the exhaust of steam engines, the operation of defective vehicles (without, however, specifying the types of defects), the crying and

shouting of peddlers, etc. In addition, section 5.58.010 of the code prohibits the "loud and unnecessary barking of dogs." One or two other minor sections of the code speak to noise, most particularly in Chapter 28 on home occupations and in the maintenance of effective automotive mufflers.

The essential control of noise is to prevent the escape from property and its intrusion into other property. The escape can be across property lines, inside factories or through apartment and office walls. It is not the element of noise at the source, per se - unless it occurs inside the work place where it becomes subject to control by OSHA -, but what amount of the noise leaks to a place where it is not wanted and becomes objectionable. It is not a mere trueism that "one man's music is another man's noise" - (one way to define noise is that it is unwanted sound) but rather a correct statement. It is this element, the way in which noise is perceived differently by the maker, or tolerator, and by the receiver, which makes for disputes and for grievances.

With our current ordinances not too much help is available to the unwilling hearer. It must be recognized that a certain group of persons will always be intolerant. To this group any sound will be objectionable and might become the subject of complaints if the code is carelessly constructed.

Unfortunately, a rather sophisticated amount of technical knowledge is required to properly understand the implications of noise, its control and its measurements. Noise appears to be a by-product of our urban civilization where persons live under certain amounts of continuous stress, neighbors are in close proximity and the ownership of mechanical devices capable of yielding raucous noises is common. Noise has physiological and other medical implications, not the least of which is the permanent loss of hearing through exposure to loud sound intensities and to types of noises known as "impulse" sounds.

In the following section a new, comprehensive ordinance is proposed. It sets definite criteria for:

Noise levels as physically measured in decibels
Times during which the levels apply
Removes, so far as seems reasonable, the element of subjectivity
Applies current "state of the art" concepts.

The questions of enforcement and of judicial tests come up. In some cities, such as Chicago, enforcement is entrusted to the police. Colorado Springs has a special "noise task force." Its members are commissioned as police officers but the administration of the force is separate from the police departments. Some jurisdictions employ members of their health departments while others get elements of enforcement from two or more city agencies. All cities indicate a high level of success in citations and court cases brought under their ordinances; all, apparently, with the exception of one section in the Chicago ordinance, have survived the constitutional tests.

In establishing our basic rationale for making proposals for controlling noise in Wichita, we contacted twenty cities all of approximately the same population as Wichita. More than half responded with copies of their noise ordinances and other information. Most of the ordinances have quantitative determinants, that is, the noise source is measured as the sound volume, expressed as decibles. In preparing the following ordinance proposal we have synthesized elements from the codes of Sacramento, California, Colorado Springs, Colorado, and Chicago, Illinois; we believe it represents the optimum for noise control in Wichita. This proposed ordinance follows:

A Proposed Model Ordinance for Noise Control
in Wichita, Kansas

I. Commission Findings.

(a) Excessive, unnecessary or offensive noise within the city of Wichita is found to be detrimental to the public health, safety, welfare and the peace and quiet of the inhabitants of the city and therefore is hereby declared a public nuisance; and

(b) Every person in the city is entitled to live in an environment free from excessive, unnecessary or offensive noise levels; and

(c) The establishment of maximum permissible noise levels will further the public health, safety, welfare and peace and quiet of inhabitants of the city of Wichita.

II. Declaration of Policy.

It is hereby declared to be the policy and purpose of this chapter to assess complaints of noises alleged to exceed the ambient noise levels. Further, it is declared to be the policy to contain sound levels in the city of Wichita at their present levels with the ultimate goal of reducing such levels, when and where feasible and without causing undue burdens, to meet the noise standards set forth in this chapter.

III. Liberal construction.

This chapter shall be liberally construed so as to effectuate its purposes.

IV. Severability.

If any section, subsection, sentence, clause, phrase or portion of this chapter is for any reason held invalid or unconstitutional by any court of competent jurisdiction, such portion shall be deemed as a separate, distinct and independent provision, and such holding shall not affect the validity of the remaining portions thereof.

V. Definitions.

The following words, phrases and terms as used in this chapter shall the following meanings:

(a) "Agricultural property" means a parcel of property used in part or whole for agricultural purposes.

(b) "Ambient noise level" means the all-encompassing noise level associated with a given environment, being a composite of sounds from all sources, excluding the alleged offensive noise, at the location and approximate time at which a comparison with the alleged offensive noise is to be made.

(c) "Cumulative period" means an additive period of time composed of individual time segments which may be continuous or interrupted.

(d) "Decibel" or "dB" means a unit which denotes the ratio between two quantities which are proportional to power; the number of decibels corresponding to the ratio of two amounts of power is ten times the logarithm to the base of ten of this ratio.

(e) "Emergency work" means the use of any machinery, equipment, vehicle, manpower or other activity in an effort to protect, maintain, provide or restore safe conditions in the community or for citizenry, or work by private or public utilities when restoring utility service.

(f) "Hertz" means a unit of measurement of frequency, numerically equal to cycles per second.

(g) "Impulsive noise" means a noise characterized by brief excursions of sound pressures whose peak levels are very much greater than the ambient noise level, such as might be produced by the impact of a pile driver, punch press or a drop hammer, typically with one second or less duration.

(h) "Noise level" means the "A" weighed sound pressure level in decibels obtained by using a sound level meter at slow response with a reference pressure of

twenty micropascals. The unit of measurement shall be designated as dBA.

(i) "Person" means a person, firm, association, partnership, joint venture, corporation or any entity, public or private in nature.

(j) "Residential property" means a parcel of real property which is developed and used either in part or in whole for residential purposes other than transient uses such as hotels and motels, and other than non-conforming residential uses within "AA," "A," "RB," "R-5," "R-6," and "B" zones.

(k) "Simple tone noise" or "pure tone noise" means a noise characterized by the presence of a predominant frequency or frequencies such as might be produced by whistle or hum.

(l) "Sound level meter" means an instrument that meets or exceeds American National Standard Institute's Standard S1.4-1971 for Type 2 sound level meters or an instrument and the associated recording and alalyzing equipment which will provide equivalent data.

(m) "Sound pressure level" means a sound pressure level of a sound, in decibels, as defined in ANSI Standards 51.2-1962 and 51.13-1921; that is, twenty times the logarithm to the base ten of the ratio of the pressure of the sound to a reference pressure, which reference pressure shall be 0.0002 dynes per square centimeter.

VI. Sound level measurement (general).

(a) Any noise level measurements made pursuant to the provisions of this chapter shall be performed using a sound level meter as defined in section V and in accordance with the recommendations of the manufacturer.

(b) The location selected for measuring exterior noise levels shall be at any point on the receiver's affected property. In the case of interior noise

measurements, the windows shall be in normal seasonal configuration and the measurement shall be made at a point at least four feet from the wall, ceiling or floor nearest the affect occupied area.

VII. Permissible Noise Levels.

(a) A noise measured or registered as provided above from any source other than as provided in Section V at a level which is equal to or in excess of the dBA established for the time period and zones listed in this Section, is hereby declared to be excessive and unusually loud and is unlawful.

	7:00 A.M. to Next 7:00 P.M.	7:00 P.M. to Next 7:00 A.M.
Residential	55 dBA	50 dBA
Commercial	60 dBA	55 dBA
Light Industrial	70 dBA	65 dBA
Industrial	80 dBA	75 dBA

Definitions - For purposes of this Chapter, the aforementioned zones shall be defined as in Chapter 28 of the Code of the City of Wichita.

(b) It shall be unlawful for any person at any location to create any noise which causes the noise levels when measured on agricultural or residential property to exceed for the duration of time set forth following, the specified exterior noise standards in any one hour by:

Cumulative Duration of the Intrusive Sound

		Allowance Decibels
(1)	Cumulative period of 30 minutes per hour	0
(2)	Cumulative period of 15 minutes per hour	+5
(3)	Cumulative period of 5 minutes per hour	+10
(4)	Cumulative period of 1 minute per hour	+15
(5)	Level not to be exceeded for any time per hour	+20

(c) Each of the noise limits specified in subdivision (b) shall be reduced by 5 dBA for impulsive or simple tone noises, or for noises consisting of speech or music.

(d) If the ambient noise level exceeds that permitted by any of the first four noise limit categories specified in subdivision (b), the allowable noise limit shall be increased in 5 dBA increments in each category to encompass the ambient noise level. If the ambient noise level exceeds the fifth noise level category, the maximum ambient noise level shall be the noise limit for that category.

VIII. Interior noise standards.

(a) In any apartment, condominium, town house, duplex or multiple dwelling unit it shall be unlawful for any person to create any noise from inside his unit that causes the noise level when measured in a neighboring unit during the periods 10:00 p.m. to 7:00 a.m. to exceed:

(1) 45 dBA for a cumulative period of more than 5 minutes in any hour

(2) 50 dBA for a cumulative period of more than 1 minute in any hour

(3) 55 dBA for any period of time

(b) If the ambient noise level exceeds that permitted by any of the noise level categories specified in subdivision (a), the allowable noise limit shall be increased in 5 dBA increments in each category to encompass the ambient noise level.

IX. Exemptions.

The following activities shall be exempted from the provisions of this chapter:

(a) School bands, school athletic and school entertainment events. School entertainment events shall not include events sponsored by student organizations.

(b) Outdoor gatherings, public dances, shows and sporting and entertainment events provided said events are conducted pursuant to a discretionary license or permit by the city of Wichita.

(c) Activities conducted on parks and public playgrounds, provided such parks and public playgrounds are owned and operated by a public entity.

(d) Any mechanical device, apparatus or equipment related to or connected with emergency activities or emergency work.

(e) Noise sources due to the erection (including excavation), demolition, alteration or repair of any building or structure between the hours of 7:00 a.m. and 6:00 p.m., on Monday, Tuesday, Wednesday, Thursday, Friday and Saturday, and between 9:00 a.m. and 6:00 p.m. on Sunday; provided however, that the operation of an internal combustion engine shall not be exempt pursuant to this subsection if such engine is not equipped with suitable exhaust and intake silencers which are in good working order. The superintendent of Central Inspection Division, or his designee, may permit work to be done during the hours not exempt by this subsection in the case of emergencies and in the interest of public health and welfare for a period not to exceed (3) consecutive days. Application for this exemption may be made in conjunction with the application for the work permit or during progress of the work. Only one such request shall be made during the entire construction cycle of the project.

(f) Noise sources associated with agricultural operations provided such operations take place between the hours of 7:00 a.m. and 8:00 p.m.; provided, however, that the operation of an internal combustion engine shall not be exempt pursuant to this subsection if such engine is not equipped with suitable exhaust and intake silencers which are in good working order.

(g) Any mechanical device, apparatus or equipment which are utilized for the protection or salvage of agricultural crops during periods of adverse weather conditions or when the use of mobile noise sources is necessary for pest control; provided, however, that the operation of an internal combustion engine shall not be exempt pursuant to

this subsection if such engine is not equipped with suitable exhaust and intake silencers which are in good working order.

(h) Noise sources associated with maintenance of street trees and residential area property provided said activities take place between the hours of 8:00 a.m. and 6:00 p.m. Mondays through Fridays inclusive.

(i) Tree and park maintenance activities conducted by the city recreation and parks department.

(j) Any activity to the extent provisions of Chapter 65 of Title 42 of the United States Code, preempts local control of noise regulations and land use regulations related to noise control of airports and their surrounding geographical areas, any noise source associated with the construction, development, manufacture, maintenance, testing or operation of any aircraft engine, or of any weapons system or subsystems which are owned, operated or under the jurisdiction of the United States, any other activity to the extent regulation thereof has been preempted by State or Federal law or regulation.

(k) Any noise sources associated with the maintenance and operation of aircraft or airports which are owned or operated by the United States.

X. Pre-existing industrial or commercial facilities--transition period.

(a) Any industrial or commercial facility in existence prior to the effective date of this chapter shall be allowed a two year period commencing on said date within which to comply with this chapter.

(b) During said two year period all such facilities shall make reasonable efforts to be in compliance and to reduce noise which exceeds the standards specified in this chapter. Commencing at the end of two years after the effective date of this chapter, any such facility shall be subject to all applicable requirements of this chapter.

(c) If any facility which is not in compliance by the end of said two year period applies for a variance pursuant to section XVII, in deciding whether to grant a variance the hearing board, Section XVIII, shall take into account the extent to which the applicant has endeavored to reduce noise during said two year period to meet the standards specified in this chapter.

(d) This section applies only to a commercial or industrial facility already in existence or for which the work of improvement had commenced prior to the effective date of this chapter.

(e) As used in this section "industrial facility" means any building, structure, factory, plant, premise or portion thereof used for manufacturing or industrial purposes, including all activities in which agricultural products serve as raw or intermediate materials, including grain elevators and grain mills and "commercial facility" means any building, structure, premise or portion thereof used for wholesale or retail commercial purposes.

Schools, hospitals and churches.

It shall be unlawful for any person to create any noise which causes the noise level at any school, hospital or church while the same is in use to exceed the noise standards specified in section VII (a) "Residential" or to create any noise which unreasonably interferes with the use of such institution or unreasonably disturbs or annoys the patrons of the facilities. In any disputed case, interfering noise which is 10 dBA or more, greater than the ambient noise level at the building, shall be deemed excessive and unlawful.

Residential pumps, fans and air conditioners.

(a) It shall be unlawful for any person to operate any residential fans, air conditioners, stationary pumps, stationary cooling towers, stationary compressors, similar mechanical device or any combination thereof installed after the effective date of

this chapter in any manner so as to create any noise which would cause the maximum noise level to exceed:

(1) 60 dBA at any point at least one foot inside the property line of the affected residential or agricultural property and three to five feet above ground level.

(c) Equipment installed before the effective date of this chapter shall not exceed a limit of 65 dBA maximum sound level, at any point at least one foot inside the property line of the affected agricultural or residential property and three to five feet above ground level after the effective date of this chapter.

Off road vehicles.

It shall be unlawful for any person to operate any motorcycle or recreational off road vehicle on or off a public road in such a manner that the noise level exceeds the exterior noise standards specified in VII (a) for the zoning district.

Waste disposal vehicles.

It shall be unlawful for any person authorized to engage in waste disposal service or garbage collection to operate any truck-mounted waste or garbage loading and/or composting equipment or similar mechanical device in any manner so as to create any noise exceeding the following level, when measured at a distance of fifty feet from the equipment or any agricultural or residential property.

(a) New equipment purchased or leased on or after a date six months from the effective date of this chapter shall not exceed a noise level of 80 dBA.

(b) New equipment purchased or leased on or after two years from the effective date of this chapter shall not exceed a noise level of 75 dBA.

(c) Present equipment shall not exceed a noise level of 80 dBA on or after five years from the effective date of this chapter.

The provisions of this section shall not abridge or conflict with the powers of the State over motor vehicle control.

XI. General noise regulations.

Notwithstanding any other provisions of this chapter and in addition thereto, it shall be unlawful for any person to make or continue or cause to be made or continued any loud, unnecessary or unusual noise which disturbs the peace and quiet of any neighborhood or which causes discomfort or annoyance to any three reasonable persons, all non related and occupying separate dwelling units of normal sensitiveness residing in the area.

The standards which may be considered in determining whether a violation of the provisions of this section exists shall include, but not be limited to, the following:

(a) The sound level of the objectionable noise.
(b) The sound level of the ambient noise.
(c) The proximity of the noise to residential sleeping facilities.
(d) The nature and zoning of the area within which the noise emanates.
(e) The density of the inhabitation of the area within which the noise emanates.
(f) The time of day or night the noise occurs.
(g) The duration of the noise and its tonal informational or musical content.
(h) Whether the noise is continuous, recurrent or intermittent.
(i) Whether the noise is produced by a commercial or non-commercial activity.

XII. Specific unlawful noises.

Notwithstanding any other provision of the chapter to the contrary, the following acts, among others, are declared to be loud, disturbing, and unnecessary noises in violation of this chapter, but such enumeration shall not be deemed to be exclusive, namely:

(a) It shall be unlawful for any person to operate any motor of a motor vehicle of a weight in excess of four tons (8,000 lbs.) for a consecutive period longer than two minutes while such vehicle is standing on private property and located within 150 feet of property zoned and used for residential purposes except where such vehicle is standing within a completely enclosed structure.

This section shall not apply to buses operated for the transportation of passengers while standing in established bus turnarounds, bus terminals, bus parking lots and bus-storage yards.

(b) No person shall sell, or offer for sale, a new motor vehicle that produces a maximum noise exceeding the following noise limit at a distance of 50 feet from the center line of travel under test procedures established by Section V of this chapter:

	Type of Vehicle	Date of Manufacture	Noise Limit
(1)	Motorcycle	before 1 Jan. 1970	92 dB(A)
	Same	after 1 Jan. 1970	88 dB(A)
	Same	after 1 Jan. 1974	86 dB(A)
	Same	after 1 Jan. 1975	84 dB(A)
	Same	after 1 Jan. 1981	75 dB(A)
(2)	Any motor vehicle with a gross vehicle weight of 8,000 pounds or more	after 1 Jan. 1968	88 dB(A)
	Same	after 1 Jan. 1973	86 dB(A)
	Same	after 1 Jan. 1975	84 dB(A)
	Same	after 1 Jan. 1981	75 dB(A)

(3) Passenger cars, motor-driven cycle and any other motor vehicle intended primarily for the transport of persons	before 1 Jan. 1973	86 dB(A)
Same	after 1 Jan. 1973	84 dB(A)
Same	after 1 Jan. 1975	80 dB(A)
Same	after 1 Jan. 1981	75 dB(A)

The manufacturer, distributor, importer, or designated agent shall certify in writing to the Chief of Police that vehicles sold by him within the City comply with provisions of this section.

(c) No person shall operate within the speed limits specified in this section either a motor vehicle or combination of vehicles of a type subject to registration at any time or under any condition of grade, load, acceleration or deceleration in such manner as to exceed the following noise limit for the category of motor vehicle, based on a distance of not less than 50 feet from the center line of travel under test procedures established by Section VI of this chapter:

	Noise Limit in Relation To Posted Speed Limit	
Type of Vehicle	35 MPH or Less	Over 35 MPH
(1) Any motor vehicle with a manufacturer's GVW rating of 8,000 lbs. or more, and any combination of vehicles towed by such motor vehicle		
before 1 Jan. 1981	88 dB(A)	90 dB(A)
after 1 Jan. 1981	86 dB(A)	90 dB(A)

(2) Any motorcycle other than a motor-driven cycle		
before 1 Jan. 1981	82 dB(A)	86 dB(A)
after 1 Jan. 1981	78 dB(A)	82 dB(A)
(3) Any other motor vehicle and any combination of motor vehicles towed by such motor vehicle		
before 1 Jan. 1981	76 dB(A)	82 dB(A)
after 1 Jan. 1981	70 dB(A)	79 dB(A)

This section applies to the total noise from a vehicle or combination of vehicles and shall not be construed as limiting or precluding the enforcement of any other provisions of the code of the City of Wichita relating to motor vehicle mufflers for noise control.

(d) No person shall modify or change the exhaust muffler, intake muffler or any other noise abatement device of a motor vehicle in a manner such that the noise emitted by the motor vehicle is increased above that emitted by the vehicle as originally manufactured. Procedures used to establish compliance with this paragraph shall be those used to establish compliance of a new motor vehicle with the requirements of this section.

(e) Horns and signaling devices: The sounding of any horn or signaling device on any automobile, motorcycle, or other vehicle on any street or public place of the city, except as a danger warning; the creation by means of any such signaling device of any unreasonably loud or harsh sound; and the sounding of any such device for an unnecessary and unreasonable period of time. The use of any signaling device except one operated by hand or electricity; the use of any horn, whistle or any other device operated by engine exhaust; and the use of any such signaling device when traffic is for any reason impeded or moving slower than the speed limit.

(f) Yelling and shouting: Yelling, shouting, hooting, whistling, singing or blowing of horns on the public streets, particularly between the hours of 10:00 p.m. and 7:00 a.m. of the following day or at any time or place so as to annoy or disturb the quiet, comfort, or repose of persons in any office, or in any dwelling, hotel, motel, apartment or other type of residence, or of any persons in the vicinity.

(g) Pile drivers, hammers, etc.: The operation between the hours of 10:00 p.m. and 7:00 a.m. of the following day of any pile driver, steam shovel, pneumatic hammer, derrick, steam or electric hoist or other appliance, the use of which is attended by loud or unusual noise.

(h) Tools: The use of or operation between the hours of 10:00 p.m. and 7:00 a.m. of the following day of any saw, planer, hammer or other tool, device or appliance, powered by any means, including but not limited to electricity, steam, air or hydraulic fluids, so as to disturb the quiet, comfort or repose of persons in any dwelling, hotel, motel apartment, hospital or nursing home or other type of residence, or of any person in the vicinity.

(i) Blowers: The operating of any noise--creating blower or power fan or any internal combustion engine the operation of which causes noise due to the explosion of operating gases or fluids, unless the noise from such blower or fan is muffled and such engine is equipped with a muffler device sufficient to deaden such noise.

(j) Exhausts: The discharge into the open air of the exhaust of any steam engine, stationary internal combustion engine, motor boat, or motor vehicle except through a muffler or other device which will effectively prevent loud or explosive noises therefrom.

(k) Loading, unloading, opening boxes: The creation of a loud and excessive noise between 10:00 p.m. and 7:00 a.m. of the following day in connection with loading or unloading any vehicle or the opening and destruction of bales, boxes, crates, and containers.

(l) Hawkers, peddlers and vendors: The shouting and crying of peddlers, hawkers and vendors which disturbs the peace and quiet of persons in the neighborhood except between 9:00 a.m. and 5:00 p.m. of the same day.

(m) Drums: The use of any drum or other instrument or device for the purpose of attracting attention by creation of noise to any performance, show or sale.

(n) Transportation of metal rails, pillars and columns: The transportation of rails, pillars or columns of iron, steel or other material, over and along streets and other public places upon carts, drays, cars, or trucks in any manner so as to cause loud noises or to disturb the peace and quiet of persons in the vicinity thereof except between 7:00 a.m. and 8:00 p.m. of the same day.

(o) Animals, birds, fowls: The keeping of any animal, fowl or bird which by causing frequent or long continued noise shall disturb the comfort or repose of persons in the vicinity: the director of Environmental Health of the Department of Community Health, subject to specific approval by a majority of the Board of City Commissioners, shall prepare, publish and enforce reasonable noise standards.

XIII. Administration.

Except for the enforcement of section XII (a), (b), (c), (d), (e) which shall be the responsibility of the chief of police, the administration of this chapter is hereby vested in the Director of the Department of Community Health; herein after referred to as health officer. The health officer shall be responsible for:

(a) Employing individuals trained in acoustical engineering or an equivalent field to assist the health officer in the administration of this chapter.

(b) Training field inspectors.

(c) Procuring measuring instruments and training inspectors in their calibration and operation.

(d) Conducting a public education program in all aspects of noise control.

(e) Coordinating the noise control program with other governmental agencies.

XIV. Noise Control Program - recommendations.

At least every third year following the effective date of this chapter, the health officer shall evaluate the effectiveness of the noise control program and shall make recommendations to the Board of Commissioners for its improvement.

XV. Rules and standards.

Within one year after the effective date of this chapter, the health officer with the advice and assistance of other appropriate governmental agencies, shall investigate and recommend to the Board of City Commissioners the following:

(a) Rules and procedures to be used in measuring noise.

(b) Noise standards for motor vehicle operation within the city. However, nothing within this ordinance shall be deemed to abridge or conflict with the powers of the state or federal governments over motor vehicle control.

(c) Noise standards governing the construction, repair or demolition of a structure including streets and other thoroughfares.

(d) Recommendations, if appropriate, for the establishment of sound levels standards for nonresidentially zoned areas within the city.

XVI. Special condition permits.

Notwithstanding any provision of this chapter, the health officer may grant special condition permits for a period not exceeding three days. At least seven days prior to the permit period, all persons

residing within 400 feet of the site for which the permit is sought shall be notified of the request and its nature, in writing and sent by first class U.S. mail. If any objections to the permit are made, a hearing shall be conducted. Based on the facts presented at the hearing from both the proponents and opponents, the health officer shall use his judgement and may grant, modify or deny the permit. The general purpose and intent of this chapter shall be carried out by the granting of the special condition permit, provided, however, that no permit shall be issued for any activity which violates any provisions of the basic purpose of this chapter. Said special condition permits shall not be renewed.

XVII. Variance procedure.

As deemed appropriate

XVIII. Hearing board.

As deemed appropriate

XIX. Appeals.

As deemed appropriate

XX. Penalties.

As deemed appropriate

We are aware that the enactment of an ordinance based on the suggested model would impose major changes in Wichita law enforcement and would create some confusion and unrest among some persons. The alternative is a less comprehensive ordinance which probably would require almost immediate amending or a do nothing policy which will fail to correct the present and growing difficulties and would leave many persons without protection against this particular annoyance.

As was mentioned above, to correctly understand noise requires some specialized information. For this purpose we include several pages of information, taken in part from the publication "Noise Measurement" by Peterson and Gross, published by the General Radio Company, and from other published sources.

General Background Information

During the past decade more and more people have become concerned with the problem of noise in everyday life. There is danger of permanent hearing loss when exposure to an intense sound field is long and protective measures are not taken. This is important to millions of workers, to most industrial corporations, labor unions and insurance companies.

The noise problem near many airports has become so serious that many people have moved out of nearby areas that were once considered pleasant. The din of high-powered trucks, motorcycles, and "hot" cars annoys nearly everyone, and one cannot so readily move away from them as from the airport, because they are almost everywhere.

The increasingly large number of people living in apartments, and the relatively light construction of most modern dwellings, has accentuated the problems of sound isolation. In addition, some of the modern appliances, for example dishwashers, are noisy for relatively long periods, which can be very vexing, if it interferes with a favorite TV program.

Lack of proper sound isolation and acoustical treatment in the classroom may lead to excessive noise levels and reverberation, with resulting difficulties in communication between teacher and class. The school teacher's job may become a nightmare because the design was inadequate or altered to save on the initial cost of the classroom.

High-power electronic amplifiers have brought deafening "music" within the reach of everyone, and many young people may eventually regret the hearing loss that is accelerated by frequent exposure to the extremely loud music they find stimulating.

Of all these problems, noise-induced hearing loss is the most serious. For this problem as well as the others mentioned, reduction of noise at its source is often essential. The further step of providing direct protection for the individual may also be needed.

Much can be done by work on noise sources to reduce the seriousness of these noise problems. It is not often so simple as turning down the volume control on the electronic

amplifier. But good mufflers are available for trucks, motorcycles and automobiles; and household appliances can be made quieter by the use of proper treatment for vibrating surfaces, adequately sized pipes and smoother channels for water flow, vibration-isolation mounts, and mufflers. The engineering techniques for dealing with noise are developing rapidly, and every designer should be alert to using them.

In many instances, the quieter product can function as well as the noisier one, and the increased cost of reducing the noise may be minor. But the aircraft-noise problem is an example where the factors of safety, performance, and cost must all be considered in determining the relative benefits to the public of changes made to cut down the noise.

In any of these, sound-measuring instruments and systems can help to assess the nature of the problem, and they can help in determining what to do to subdue the troublesome noise.

The study of mechanical vibration is closely related to that of sound, because sound is produced by the transfer of mechanical vibration to air. Hence, the process of quieting a machine or device often includes a study of the vibrations involved.

Conversely, high-energy acoustical noise, such as generated by powerful jet or rocket engines, can produce vibrations that can weaken structural members of a vehicle or cause electronic components to fail.

Other important effects of vibration include: human discomfort and fatigue from excessive vibration of a vehicle, fatigue and rupture of structural members, and increased maintenance of machines, appliances, vehicles, and other devices.

Vibration, then, is a source not only of noise, annoyance, and discomfort, but often of danger as well. The present refinement of high-speed planes, ships and automobiles could never have been achieved without thorough measurement and study of mechanical vibration.

The instruments used in sound and vibration measurement are mainly electronic. Furthermore, some of the concepts and techniques developed by electronics engineers and physicists for dealing with random or interfering signals (for which they have borrowed the term "noise") are now used in sound and vibration studies.

What are Noise and Vibration?

When an object moves back and forth, it is said to vibrate. This vibration disturbs the air particles near the object and sets them vibrating, producing a variation in normal atmospheric pressure. The disturbance spreads and, when the pressure variations reach our ear drums, they too are set to vibrating. This vibration of our ear drums is translated by our complicated hearing mechanisms into the sensation we call "sound."

To put it in more general terms, sound in the physical sense is a vibration of particles in a gas, a liquid, or a solid.

A sound disturbance spreads. The speed with which it spreads depends on the mass and on the elastic properties of the material. In air the speed is about 1100 feet/second (about 750 miles/hour) or about 340 meters/second; in sea water it is about 1490 meters/second. The speed of sound has been popularized in aerodynamic concepts of the sound barrier and the supersonic transport, and its effects are commonly observed in echoes and in the apparent delay between a flash of lightning and the accompanying thunder.

The variation in normal atmospheric pressure that is a part of a sound wave is characterized by the rate at which the variation occurs and the extent of the variation. Thus, the standard tone "A" occurs when the pressure changes through a complete cycle 440 times per second. The frequency of this tone is then said to be 440 hertz, or 440 cycles per second (abbreviated "Hz" and "c/s", respectively). "Hertz" and cycles per second" are synonymous terms but most standardizing agencies have adopted "hertz" as the preferred unit of frequency.

Many prefixes are used with the unit of frequency, but the one that is common in acoustics and vibrations is "kilo-," abbreviated "k", which stands for a factor of 1000. Thus, 8000 Hz or 8000 c/s becomes 8 kHz or 8 kc/s.

The extent of the variation in pressure is measured in terms of a unit called the "microbar", which is approximately one-millionth of the normal atmospheric pressure (standard atmospheric pressure = 1,013,250 microbars), or in terms of newtons

per square meter, which is 10 microbars. Actually, these units are not often mentioned in noise measurement. Results are stated in decibels.

The Decibel - What Is It?

Although to many persons the decibel (abbreviated "dB") is uniquely associated with noise measurements, it is a term borrowed from electrical-communication engineering, and it represents a relative quantity. When it is used to express noise level, a reference quantity is implied. Usually, this reference value is a sound pressure of 20 micronewtons per square meter (abbreviated 20 uN/m^2). For the present, the reference level can be referred to as "0 decibels," the starting point of the scale of noise levels. This starting point is about the level of the weakest sound that can be heard by a person with very good hearing in an extremely quiet location. Other typical points on this scale of noise levels are:

Typical A-Weighted Sound Levels

At A Given Distance From Noise Source	Decibels RE 20 N m^2	Environmental
	140	
50 HP Siren (100')		
	130	
Jet Takeoff (200')		
	120	
Riveting Machine	110	Casting Shakeout Area
Cutoff Saw Pneumatic Peen Hammer		
	100	Electric Furnace Area
Textile Weaving Plant Subway Train (20')	90	Boiler Room Printing Press Plant

Pneumatic Drill (50')	80	Tabulating Room Inside Sport Car (50 MPH)
Freight Train (100') Vacuum Cleaner (10') Speech (1')	70	
	60	Near Freeway (Auto Traffic) Large Store Accounting Office
Large Transformer - 200'	50	Private Business Office Light Traffic (100') Average Residence
	40	Min Levels - Residential Areas in Chicago at Night
Soft Whisper (5')	30	Studio (Speech)
	20	Studio for Sound Pictures
	10	
Threshold of Hearing Youths - 1000-4000 Hz	0	

For example, the noise level in a large office usually is between 50 and 60 decibels. Among the very loud sounds are those produced by nearby airplanes, railroad trains, riveting machines, thunder, and so on, which are in the range near 100 decibels.

For some purposes it is not essential to know more about decibels than the above general statements. But when we need to modify or to manipulate the measured decibels, it is desirable to know more specifically what the term means. There is then less danger of misusing the measured values. From a strictly technical standpoint, the decibel is a logarithm of

a ratio of two values of power, and equal changes in decibels represent equal ratios.

Although decibels are used to give the results of power-level calculations, the decibel is most often used in acoustics for expressing the sound-pressure level and the sound level. These are extensions of the original use of the term, and all three expressions will be discussed in the following sections. First, however, it is worthwhile to notice that the above quantities include the word "level." Whenever level is included in the name of the quantity, it can be expected that the value of this level will be given in decibels or in some related term and that a reference power, pressure, or other quantity is stated or implied.

Power Level.

Because the range of acoustic powers that are of interest in noise measurements is about one-billion-billion to one (10^{18}:1), it is convenient to relate these powers on the decibel scale, which is logarithmic. The correspondingly smaller range of numerical values is easier to use and, at the same time, some calculations are simplified.

The decibel scale can be used for expressing the ratio between any two powers.

Sound-Pressure Level.

It is also convenient to use the decibel scale to express the ratio between any two sound pressures; tables for converting from a pressure ratio to decibels and vice versa are given in the Appendix. Since sound pressure is usually proportional to the square root of the sound power, the sound-pressure ratio for a given number of decibels is the square root of the corresponding power ratio. For example, if one sound pressure is twice another, the number of decibels is 6; if one sound pressure is 100 times another, the number is 40 decibels.

The sound pressure can also be expressed as a sound-pressure level with respect to a reference sound pressure. For airborne sounds this reference sound pressure is generally 20 uN/m^2. For some purposes a reference pressure of one microbar (0.1 N/m^2) has been used, but throughout this book the value of 20 uN/m^2 will always be used as the reference

for sound-pressure level. Then the definition of sound pressure level (SPL) is

$$SPL = 20 \log \frac{P}{.00002} \text{ dB re 20 micronewtons/meter squared}$$

where P is the root-mean-square sound pressure in newtons/meter squared for the sound in question. For example, if the sound pressure is 1 N/m^2, then the corresponding sound-pressure ratio is

$$\frac{1}{.00002} \text{ or } 50000.$$

From the tables, we find that the pressure level is 94 dB re 20 uN/m^2. If decibel tables are not available, the level can, of course, be determined from a table of logarithms.

The instrument used to measure sound-pressure level consists of a microphone, attenuator, amplifier, and indicating meter. This instrument must have an over-all response that is uniform ("flat") as a function of frequency, and the instrument is calibrated in decibels according to the above equation.

The position of the selector switch of the instrument for this measurement is often called "FLAT" or "20-k-Hz" to indicate the wide frequency range that is covered. The result of a measurement of this type is also called "over-all sound-pressure level."

Sound Level.

The apparent loudness that we attribute to a sound varies not only with the sound pressure but also with the frequency (or pitch) of the sound. In addition, the way it varies with frequency depends on the sound pressure. If this effect is taken into account to some extent for pure tones, by "weighting" networks included in an instrument designed to measure sound-pressure level, then the instrument is called a sound-level meter. In order to assist in obtaining reasonable uniformity among different instruments of this type, the American National Standards Institute (formerly, USA Standards Institute and American Standards Association), in collaboration with scientific and engineering societies, has established a standard to which sound-level meters should conform.

The current American National Standard Specification for Sound-Level Meters (ANSI S1.4-1971) requires that three alternate frequency-response characteristics be provided in instruments designed for general use. These three responses are obtained by weighting networks designated as A, B, and C. Responses A, B, and C selectively discriminate against low and high frequencies in accordance with certain equal-loudness contours, which will be described in a later section.

Whenever one of these networks is used, the reading obtained should be described as in the following examples: the "A-weighted sound level is 45 dB" "sound level (A) = 45 dB," or "SLA = 45 dB". In a table, the abbreviated form "L_A" with the unit "dB" is suggested, or where exceptional compactness is necessary, "dB(A)." The form "dBA" has also been used, but this notation implies that a new unit has been introduced and is therefore not recommended. Note that when a weighting characteristic is used, the reading obtained is said to be the "sound level." Only when the over-all frequency response of the instrument is flat are sound-pressure levels measured. Since the reading obtained depends on the weighting characteristic used, the characteristic that was used must be specified or the recorded level may be useless. A common practice is to assume A-weighting if not otherwise specified.

It is often recommended that readings on all noises be taken with all three weighting positions. The three readings provide some indication of the frequency distribution of the noise. If the level is essentially the same on all three networks, the sound probably predominates in frequencies above 600 Hz. If the level is greater on the C network than on the A and B networks by several decibels, much of the noise is probably below 600 Hz.

In the measurement of the noise produced by distribution and power transformers, the difference in readings of level C-weighting and A-weighting networks (L_C-L_A) is frequently noted. (This difference in decibels is called the "harmonic index" in that application only.) It serves, as indicated above, to give some idea of the frequency distribution of the noise. This difference is also used in other noise-rating techniques in conjunction with the A-weighted sound level.

Combining Decibels.

A number of possible situations require the combining of several noise levels stated in decibels. For example, we may want to predict the effect of adding a noisy machine in an office where there is already a significant noise level, to correct a noise measurement for some existing background noise, to predict the combined noise level of several different noise sources, or to obtain a combined total of several levels in different frequency bands.

In none of these situations should the numbers of decibels be added directly. The method that is usually correct is to combine them on an energy basis. The procedure for doing this is to convert the numbers of decibels to relative powers, to add or subtract them, as the situation may require, and then convert back to the corresponding decibels. By this procedure it is easy to see that a noise level of 80 decibels combined with a noise level of 80 decibels yields 83 decibels and not 160 dB.

Vibration.

Vibration is the term used to describe continuing or steady-state periodic motion. The motion may be simple harmonic motion like that of a pendulum, or it may be complex like a ride in the "whip" at an amusement park.

The motion may involve tiny air particles that produce sound when the rate of vibration is in the audible frequency range (20 to 20,000 Hz), or it may involve, wholly or in part, structures found in machinery, bridges, or battleships. Usually the word vibration is used to describe motions of the latter types, and is classed as solid-borne, or mechanical, vibration.

Many important mechanical vibrations lie in the frequency range of 1 to 2,000 Hz (corresponding to rotational speeds of 60 to 120,000 rpm). In some specialized fields, however, both lower and higher frequencies are important. For example, in seismological work, vibration studies may extend down to a small fraction of a Hz, while in loudspeaker-cone design, vibrations up to 20,000 Hz must be studied.

Nature of Vibratory Motion. Vibration problems occur in so many devices and operations that a listing of these would be impractical. Rather, we shall give a classification on the basis of the vibratory motion, together with numerous examples of where that motion occurs, to show the practical application. (Classes of vibratory motion are given in the following table):

NATURE OF VIBRATORY MOTION

Torsional or twisting vibration
Examples:
- Reciprocating devices
- Gasoline and diesel engines
- Valves
- Compressors
- Pumps
- Rotating devices
- Electric motors
- Fans
- Turbines
- Gears
- Turntables
- Pulleys
- Propellers

Bending vibration
Examples:
- Shafts in motors, engines
- String instruments
- Springs
- Belts
- Chains
- Tape in recorders
- Pipes
- Bridges
- Propellers
- Transmission lines
- Aircraft wings
- Reeds on reed instruments
- Rails
- Washing machines

Flexural and plate-mode vibration
Examples:
- Aircraft
- Circular saws
- Loudspeaker cones
- Sounding boards
- Ship hulls and decks
- Turbine blades
- Gears
- Bridges
- Floors
- Walls

Translational, axial, or rigid-body vibration
Examples:
- Reciprocating devices
- Gasoline and diesel engines
- Compressors
- Air hammers
- Tamping machines
- Shakers
- Punch presses

Autos
Motors
Devices on vibration mounts

Extensional and shear vibration
Examples:
- Transformer hum

Hum in electric motors and generators
Moving tapes

Belts
Punch presses
Tamping machines

Intermittent vibration
(mechanical shock)
Examples:
Blasting
Gun shots
Earthquakes
Drop forges
Heels impacting floors
Typewriters
Ratchets
Geneva mechanisms
Stepping motors
Autos
Catapults
Planers
Shapers
Chipping hammers
Riveters
Impact wrenches

Random and miscellaneous motions
Examples:
Combustion
Ocean waves
Tides
Tumblers
Turbulence
Earthquakes
Gas and fluid motion and
their interaction with
mechanisms

Environmental Report

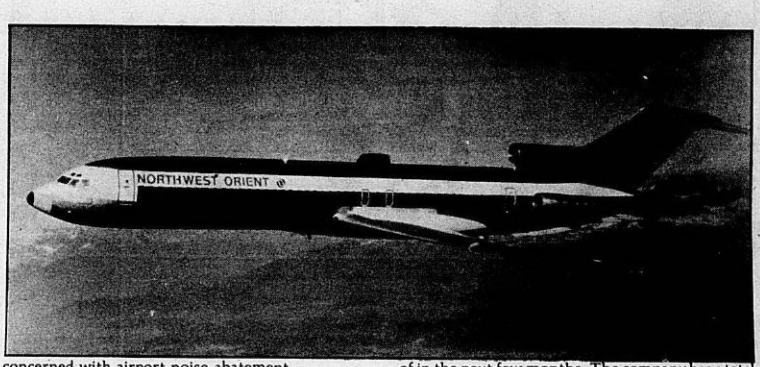
National League of Cities October 1, 1979

The Big Airline That Could: A Study in Quiet

by Lisa Wogan

"An airplane will never look nor sound like a butterfly," goes the airline refrain. Aircraft noise has been a noticeable and irritating problem for 30 years and currently affects some 6 million people living around U.S. airports. Airport owners and operators have paid out hundreds of millions of dollars in noise damages. The Council on Wage and Price Stability estimates that aircraft noise results in a loss of more than $3 billion per year in property value appreciation. Measures must be taken to abate aircraft related noise in the U.S.

Northwest Airlines quietly began in 1977 a program for retrofitting the noisiest aircraft in its fleets; that is, modifying the planes and engines so they make less noise. Northwest's anti-noise program includes purchase of more efficient and quieter aircraft and adoption of operating procedures that cut noise. In return, the airline was presented an award by a group of local officials concerned with airport noise abatement.



Benjamin G. Griggs Jr., vice-president of Northwest, says, "Northwest Airlines has, through purchase of a fleet of the most modern, quietest aircraft, through noise reducing modifications to that fleet and through leadership in developing and implementing noise abatement operating procedures, produced a record of which we are sincerely proud." An analysis of Northwest's fleet shows that only 19 of their approximately 90 jets do not comply with Federal Aviation Administration (FAA) regulations. These aircraft are up for sale, and 3 of them are already committed to be disposed of in the next few months. The company has a total of 25 Boeing 747 wide-body jets; and four more 747s should be part of the fleet in 1980 when the firm will have invested approximately $1 billion in 747 aircraft. Seventeen of the 747s were retrofitted in 1977, four were delivered meeting Stage 2 Federal Aviation Regulation (FAR) Part 36 noise levels, and the last eight planes are even quieter, meeting the stricter Stage 3 FAR 36 noise levels because Northwest's contract with the Boeing company specifies modifications to produce the quietest aircraft possible.

See p. 8, col. 1

Lisa Wogan is a staff assistant with the NLC urban noise project.

ECHO Aids Community Research on Noise

To date, well over 1,200 hours of work have been contributed to the U.S. Environmental Protection Agency's (EPA) Each Community Helps Others (ECHO) program. Through this program, over 50 communities have received technical assistance from more than 25 community noise advisors (CNAs). The program continues to engender a tremendous amount of enthusiasm among participants and the concepts of volunteerism, peer matching and a minimization of the federal presence remain active concepts.

Assistance received has been varied and has included evaluation of existing ordinances, training of police officers on use of sound level meters and developing land-use planning strategies and public education programs. Advisors have helped draft ordinances, develop enforcement programs and identify specific community noise problems. In the next year, more than 30 more communities interested in noise control will participate, and NLC recently received a contract from EPA to assume operation of the program.

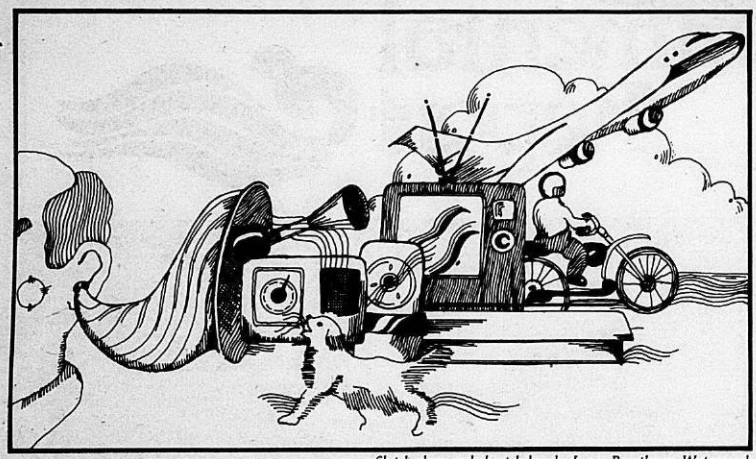
As part of the ECHO contract, NLC will hold two national meetings where participants will exchange ideas and develop a sense of unity and identification with the program. New CNAs will be oriented to ECHO at the meetings, and participants will discuss ways to improve the program. Also, an information network will be established to inform ECHO communities of new program developments, other ECHO exchanges and general news in noise control.

Through ECHO, five communities have adopted noise control ordinances. In Anchorage, Alaska, a noise ordinance had been previously proposed and rejected by the municipal assembly. Then, through ECHO, Patrick Welch, an environmental specialist from Anchorage, traveled to Portland, Ore., to learn how that city's program operated. He was briefed on how to present a piece of legislation to a city government and received information on noise related equipment and EPA policy on noise abatement. Later, the EPA regional noise office in Seattle held an environmental noise workshop, which Welch attended using ECHO funds. Here he was provided a forum for discussion of ordinance development and enforcement and received comments on his proposed noise ordinance.

During the four-and-one-half-hour public hearing on the measure in Anchorage, Paul Herman, a noise specialist from Portland, presented facts on noise and ordinance enforcement in his city, which allayed the fears the Anchorage Assembly had about an ordinance shutting down the construction or trucking industry. A representative from the Acoustical Society of America, whom Welch met through ECHO, testified that the levels in the proposed ordinance were readily enforceable. And the EPA Seattle branch noise officer Debbie Yamamoto defended the levels established for trucks engaged in interstate commerce. After minor amendments, the ordinance passed the assembly, 7 to 3. Welch says, "I firmly believe that the ordinance would not have passed if the contacts I made through ECHO had not been available for comment at the public hearing." He further describes his experiences through ECHO as "a gold mine of information which helped me expand my consciousness about noise control. . . . It provided a

See p. 8, col. 1

Polls Find Accord on City Noise



Sketch above and chart below by Lynne Branthover, Watermark.

by Lloyd Chaisson

Do city officials and city residents share the same attitudes about noise? NLC decided to answer this very question and what we found out was an emphatic, "Yes they do!"

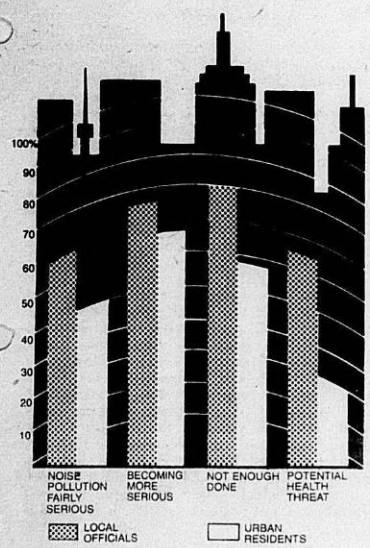
Last year the Gallup Organization of Princeton, N.J., polled urban residents on their attitudes toward a whole range of environmental issues of which noise was one. Those results revealed that the typical city resident thinks noise is at least a fairly serious problem in his community—one that is progressively growing worse to the point where some feel it represents a serious health concern. He or she also thought not enough was being done about it.

We felt that an assessment to see whether or not city officials shared the same attitudes as their constituents would be of value. We principally wanted to see if these public attitudes were being conveyed to city hall.

Thus in July of this year the NLC Urban Noise Project ran a similar questionnare in the July 23 edition of Nation's Cities Weekly . . . same questions . . . different audience. What we found out was surprising. Not only do city officials share the same viewpoints on noise as their constituents, but the degree was significantly greater—more than half of all respondents thought noise was at least a fairly serious problem that had grown worse over the past five years. Fifty-five percent thought noise presented a health threat to their local citizens and 80 percent thought not enough was being done to control noise in their city. The last statistic is remarkable in a sense. While local officials know noise is primarily a pollutant that must be dealt with locally, they acknowledge the fact that not enough is being done. It's an indication that local officials just aren't quite sure of how they should approach the noise problem. How do you handle barking dogs and motorcycle noise? How do you handle them effectively? City officials want to know. Sixty-two percent of them said they needed technical assistance. Forty-nine percent said they would like some form of federal assistance through demonstration grants, and a third thought that there was a value to federal product regulations.

It's clear that local citizen's attitudes toward noise are translated into concerns at city hall. And in some respects those concerns are intensified. Clearest of all concerns is that not enough is being done and the local official knows this all too well.

In the future the NLC Urban Noise Project will be providing you with current technical and policy developments in local noise control, with the specific goal of helping you apply abatement and control techniques locally. Technical assistance was the one item which you expressed the most need and desire to obtain. Through NLC sponsored activities, such as the ECHO city peer exchange program, a local consultation committee and regular special features in Nation's Cities Weekly, we will provide you with the types of information you need to meet your own local needs. Please write us at the League if you need help or are just curious about what might be available in the way of assistance for your city. Remember, even if your city doesn't have a noise problem today, but is on a rapid growth track, you could be creating a noise problem for tomorrow. Prevention is the least costly thing to do today.



Lloyd Chaisson is director of urban noise programs for the National League of Cities.

NLC Will Manage EPA's ECHO Program

Over the past two years, the National League of Cities has worked with the Environmental Protection Agency and local officials to create an awareness of the country's noise pollution problem and of ways to combat it. That effort continues with a new contract from the EPA Office of Noise Abatement and Control (ONAC) under which NLC will assume management and promotional responsibilities for EPA's national local officials peer match program, Each Community Helps Others (ECHO) (see story p. 5). Additionally, NLC will survey local elected officials for current information on state and local noise abatement progress, help ONAC integrate the views of city officials within its urban noise strategy and disseminate information to local officials.

As a result of the contract, NLC has expanded its urban noise program staff. Lloyd Chaisson, who worked to develop the noise project at NLC over the past two years, will be assisted by Craig Caywood, an expert in computers and financial management, and Lisa Wogan, who has a background in urban planning.

For further information on cities and noise control, contact NLC's Urban Noise Project, National League of Cities, 1620 Eye Street NW, Washington, D.C. 20006.

ECHO To Offer Help To Officials at Vegas

ECHO will be heard from at the Congress of Cities in Las Vegas, Nov. 25-27.

A session on drafting an enforceable municipal noise ordinance will be part of the environmental program workshop track on Tuesday, Nov. 27 (See your convention program for exact time and location). You'll hear ECHO cities explain how they got involved in local noise control and how they went about finding solutions. The NLC Urban Noise Programs team and the EPA's noise office will also have four booths in the Las Vegas Convention Center's East Exhibit Halls B and C (booths 949, 951, 963 and 850, adjacent to the sidewalk cafe). You'll be able to get your hearing tested free, pick up some valuable consumer information, learn more about President Carter's initiatives in urban noise and talk with city officials and NLC staff members about ECHO and how your city can get involved.

You'll see demonstrations of noise level meters and quiet products. You'll be able to learn about a new quiet communities street sign being posted in communities all across the country.

Don't miss this opportunity to get a thorough education in developments in municipal noise control. You'll leave the convention with the necessary tools and knowledge to begin an effective noise control program in your community. We look forward to seeing you in Las Vegas.—*Lloyd Chaisson.*

This report has been prepared by the National League of Cities under contract number 68-01-5822 from the Office of Noise Abatement and Control of the Environmental Protection Agency. The viewpoints expressed herein do not necessarily reflect those of the EPA Noise Office.

The President's Noise Initiative. . .

On August 2 of this year, President Carter submitted his second message on the environment to Congress, and it established fighting urban noise as one of the administration's priorities for the 96th Congress. Excerpts follow.

Our cities give us diversity and enjoyment, occupations and avocations, shopping and services, recreation and culture. By strengthening the health of our urban environment, we broaden the range of opportunities open to all of our citizens, as I emphasized in my National Urban Policy Message last year. The investments we make in maintaining and improving urban quality—particularly those involving federal taxpayer dollars—must be designed to meet environmental objectives, such as safe, convenient, well-planned public transportation, quieter communities and assistance in mediating potential conflicts between healthy urban economies and environments. The initiatives I am proposing today will help to achieve these goals . . .

A certain level of urban noise is tolerable or even agreeable, reflecting the multitude of activities that make a city thrive. However, most of our cities suffer from too much noise. Excessive noise is a serious disturbance in city dwellers' lives and degrades the urban environment.

Since World War II, there has been a dramatic increase in the number of noise sources in our cities. There are more cars, trucks, motorcycles and other vehicles on our streets and highways than ever before. There is more industrial and new construction activity.

The Annual Housing Survey conducted by the Bureau of the Census for HUD shows noise to be the most frequently identified undesirable characteristic of neighborhoods, even more than crime. When compared with other neighborhood conditions, noise ranked second only to crime as a reason for moving out of a neighborhood.

Recent Gallup surveys conducted for the National League of Cities found that "quiet" was an important condition that people desire in their neighborhoods, and that noise pollution ranked on par with air pollution and water pollution as important environmental problems.

Most noise abatement actions are taken by state and local governments, but there is an important role for the federal government. There are a number of federal programs that could be used to aid noise abatement efforts, even though their main purpose is to achieve other goals such as energy conservation or better planning and design of particular types of projects.

I am initiating today a program to reduce urban noise by directing the Departments of Commerce, Defense, Energy, Housing and Urban Development, Transportation and the Environmental Protection Agency and General Services Administration, in consultation with other federal agencies, to take a number of actions to improve existing noise abatement programs, including:

§ Initiate programs to achieve soundproofing and weatherization of noise-sensitive buildings such as schools and hospitals.

This will set up programs, including demonstrations, which will improve our understanding of how we can use existing programs to enhance soundproofing of noise-sensitive buildings. For example, DOE has a $900 million allocation over a three-year period to provide funding assistance to states to weatherize the nation's schools and hospitals. Weatherization of buildings will also make them more soundproof. DOT expects requests from states for over $15 million to assist the states in soundproofing of public-use buildings near highways. The administration has submitted legislation to make soundproofing of schools, hospitals and publicly owned health facilities near airports an allowable cost under the airport trust fund.

President Carter makes announcement in White House east room. White House photo.

§ Promote the use of quiet-design features in the planning, design and operation of proposed urban transportation projects.

This initiative is intended to promote considerations of noise into initial planning and design of urban transportation projects, in order to avoid noise problems after facilities are built. Opportunities to reduce and avoid the noise problems resulting from the development of transportation projects will be identified and promoted. This cooperation will be extended to the transportation projects planned under the DOT urban initiatives program.

§ Encourage noise sensitive developments, such as housing, to be located away from major noise sources.

This initiative is designed to consolidate federal assistance to states and localities for incorporation of noise considerations in local development planning and site review operations. This will involve the consolidation of federal guidance and the coordination of direct technical assistance. The housing programs of HUD, VA and FmHA will be reviewed by the committee to consolidate their noise abatement policies, procedures and guidance.

§ Help federal, state and local agencies buy quiet equipment and products.

This initiative is a "Buy Quiet" program in which the federal government and participating states and local governments will purchase quiet models of products and equipment they use. This program enhances the development of new technology for the commercial development of quiet products. Participants include the National League of Cities and the National Institute of Governmental Purchasing. In this program, the federal government and a consortium of states and local governments will spearhead the effort through buy quiet procurements of individual products. Other federal agencies, states and local governments which follow their lead will increase the market and provide an additional incentive for industry to produce and market these quiet products.

§ Support neighborhood self-reliance efforts seeking to address local noise problems.

This initiative is a Quiet Neighborhood Self-Help Program in which local action-oriented neighborhood organizations undertake self-help noise reduction activities in their neighborhoods and assist in the development and implementation of local noise programs. The program is being conducted in cooperation with the National Association of Neighborhoods, EPA and HUD.

§ Implementation

The Federal Interagency Committee on Noise, chaired by the administrator of EPA, shall coordinate the implementation of this program. The chairman of my Interagency Coordinating Council will assist the interagency committee and other intergovernmental cooperative efforts to assure that this program is carried out fully and promptly, including consultation with state and local governments.

The administrator of EPA will report to the chairman of CEQ and the director of OMB on the progress of this new program in six months (due February 2, 1980) and in one year (due August 2, 1980).

. . . and A Senator's Response

by John C. Culver

I applaud the president's recognition in his environmental message of noise as a serious environmental problem and the actions he is recommending to reduce excessive levels of noise.

As chairman of the Senate resource protection subcommittee, I believe we need to enhance our community assistance programs such as ECHO and the assistance grants under the Quiet Communities Act of 1978. This legislation, which I introduced in 1978, helped to re-focus our noise control efforts on community programs.

We are just now learning how noise affects both our insidious effects of unacceptable noise levels will be more adequately understood as additional studies are done.

In addition, the efforts of the federal government to control noise levels around airports should be strengthened. Aircraft noise is a major source of psychological and physiological stress, and we should continue to examine ways to reduce it.

John C. Culver is a U.S. Senator from Iowa.

Sen. John Culver

ECHO from p. 5

forum for information exchange with other noise professionals who all share the common goal of reducing noise pollution." He found ECHO to be an outstanding program which was "definitely instrumental in the passage of the Anchorage ordinance, no doubt about it."

In Norfolk, Va., a study of the acoustical environment of the city's school classrooms was conducted with the assistance of a CNA from the Metropolitan Washington Council of Governments. As a result, Norfolk has now become an advisor to emerging noise programs in the Tidewater area of Virginia and a two-day workshop on land use planning techniques has been held for Tidewater cities. The agenda included sessions on federal regulations relating to noise and land use planning, physical and administrative techniques for noise planning, as well as the physiological and physical effects of noise.

In another ECHO match, CNA Bob Jones from Tampa, Fla., has been assisting the Chatham County-Savannah, Ga., area in development of noise control and abatement measures. Jones has provided on-site assistance to Savannah to help with a survey to assess day and evening noise problems on a neighborhood-by-neighborhood basis. He has provided training on operation of sound-level meters to four persons employed through the CETA program specifically to gather data for the survey. Jones states, "I think ECHO is a valuable program in which people who have been in the noise program long enough to get their feet wet can share their expertise with those who are just dipping in their toes."

As in many other communities, a noise ordinance had been previously proposed in Savannah and met opposition because of the city's inability to make judgments on quantitative noise levels and because residents were unsure of what impact the ordinance would have on the community. But the intensity of noise in Savannah has continued to escalate, and more and more of Savannah's citizens want action.

Through ECHO, Savannah has received assistance from the Atlanta regional office of EPA as well as from Tampa. The regional noise office provided expertise in acoustical engineering and analysis of measurements. But ECHO has not solved all of Savannah's noise problems. Howard Bellinger, director of the city's Metropolitan Planning Commission, had expected ECHO to provide a comprehensive once-and-for-all end to Savannah's noise nuisances. This expectation stemmed from the fact that Savannah wants a comprehensive ordinance that will emphasize legal controls available to abate the more subtle types of neighborhood noise; however, most cities, including advisor Tampa, have been concentrating their efforts on specific controls for noise sources such as automobiles, trucks and motorcycles. Bellinger believes his particular problem stems from the fact that the information on the state of the art is still in the formative stages, especially in the area of nuisance noise law.

In Bellinger's opinion, ECHO is definitely a useful program in that it provides money to cover travel costs as well as an opportunity for his community to explore its tentative program with someone who has implemented a successful program. ECHO provides another resource of experience for Savannah to draw on; but Savannah, as well as many other communities in the U.S., still finds it has many obstacles to overcome in order to develop and enforce a successful noise abatement and control program. ECHO's goal is to help cities make informed decisions about noise; its provision for interchange and information sharing is invaluable to the local official combatting noise. □

Northwest from p. 5

Northwest's fleet includes 22 DC-10s which are exceptionally quiet aircraft, far exceeding the Stage 2 FAR noise standards which are applicable to it, 23 Boeing 727-200A aircraft with engines equipped with sound absorbent materials and meeting Stage 2 levels, and 23 early model 727-200s which are being retrofitted and should be completed by 1981.

In total, Northwest's fleet represents a substantial investment in new, quiet aircraft and retrofit programs to meet the provisions of rules applicable to aircraft noise. Griggs states that "the fleet is as environmentally compatible as the state of the art today will permit." This modernization and quieting effort has benefitted the passengers and shippers who use the airline, made the airline a better neighbor to communities near the airport and has created thousands of jobs in the aircraft manufacturing and related industries.

Northwest is not typical of the airlines industry's reaction to present federal noise regulations. Most airline companies are lobbying Congress for a rollback of federal aircraft noise deadlines. Unlike Northwest, many airlines have chosen not to comply, despite the ample lead time provided for retrofit or replacement of noncomplying aircraft.

The focus of industry's lobbying efforts in Congress are waivers from noise compliance deadlines. These waivers, if enacted, will leave aircraft in service after 1985 that do not meet any noise standards. The industry's objection to the regulation is that the standards are technologically impossible to meet at this time and would cause them financial distress. Alderman Walter Rockenstein of Minneapolis says, "In adopting the fleet noise rule that requires all aircraft to meet FAR Part 36 standards, the Federal Aviation Administration had to demonstrate that the regulation was technologically feasible and economically reasonable. Presently there are a number of airline companies such as Northwest that are acting in the public interest and confirming the FAA's judgement by putting the technology in place. Other airline companies should follow suit."

In addition to source controls for noise abatement, Northwest has been successful in development and implementation of operating procedures designed to achieve the greatest possible reduction in noise for those in the heaviest population concentration area around airports. Through these efforts the airline has been able to achieve a maximum potential fuel savings of more than 8¼ million gallons of fuel per year, or about 1½ percent of Northwest's annual fuel consumption. This savings provides the airport with some of the funds necessary for fleet modernization as well as being a substantial aid in an area of national concern—the energy shortage.

The Northwest procedures are designed to attain the maximum separation between the aircraft and populated areas. In Minneapolis, the airline's homebase, a preferential runway system is used that effectively puts all possible traffic over the least populated areas, particularly the river bottoms to the southeast of the airport. The procedures specify a reduction to the least amount of thrust on take-off and landing; maximum climb and flap retraction must occur as early as possible on take-off. On landing, the least amount of flaps necessary, consistent with safety regulations, must be used.

Northwest's efforts have been recognized on the national level by the FAA, the Department of Transportation and the Environmental Protection Agency, and by state and local authorities such as the Minnesota Pollution Control Agency. This agency has taken extensive noise measurements around the Minneapolis-St. Paul International Airport and has verified the effectiveness of Northwest's operational procedures as compared to those of other aircraft operators.

The FAA has established and operated fixed noise monitoring points around the Washington National and Dulles International Airports in the D.C. area. Published results of this monitoring have shown that Northwest's 727 operations were approximately 10 decibels quieter than the noisiest 727 operations, a factor which is generally agreed as meaning about half the noise. The duration of the noise from Northwest's flights has been measured as approximately one-half the number of seconds as the duration of noise from the noisiest operations. Northwest's Griggs says, "Half the noise for half the duration is a most impressive record, in our opinion, and points out the tremendous significance of operating procedures properly developed and consistently carried out by Northwest's pilots. . . ."

In the Minneapolis-St. Paul area, Northwest's noise abatement efforts are being carried out through an organization called the Metropolitan Aircraft Sound Abatement Council (MASAC) at the Twin Cities. This group includes an equal number of representatives of the general public, some of the communities surrounding the airport, representatives of the airlines, general aviation and the airport operator, and has the active participation of the FAA. Benjamin Griggs says, "Through MASAC we have what I consider to be the most effective, yet essentially voluntary, noise abatement program in the country. The Minneapolis-St. Paul situation is a good example of what can be accomplished through voluntary cooperation. We have developed a thorough understanding of the problem by all concerned and have received and acted upon suggestions for noise abatement from all the participants."

What is the future of aircraft noise abatement? Griggs predicts that there will be an increase in U.S. air traffic, but that introduction of new, larger aircraft that carry more passengers than their predecessors will, in many cases, actually reduce the number of flights necessary when they replace smaller, older aircraft. Northwest officials believe that land-use planning will continue to be essential to noise abatement since there will always be areas close to airports for which no relief is technologically possible. They also predict that federal action will continue to force quieter aircraft and improve the assistance to local communities for land-use planning and implementation.

Finally, Northwest officials think there will be few, if any, major new airports built because their costs would be prohibitive, and because environmental regulations make it possible for people to keep an airport out of their backyards unless they happen to want it. For those cities with airports in their backyards, efforts by airlines such as Northwest show that an airport can be an accommodating neighbor—if it cares enough and recognizes its responsibilities.

WICHITA-SEDGWICK COUNTY

METROPOLITAN AREA PLANNING DEPARTMENT

DATE October 4, 1979

TO Metropolitan Area Planning Commission

FROM Robert A. Lakin, Director of Planning

SUBJECT Noise Control Ordinance

The Community Grievance Office has sent us the attached material concerning a proposed ordinance dealing with noise and noise sources in the City. As indicated, the Community Grievance Board will hear comments on this proposal on October 10, which is the day before your meeting. They have asked that we furnish this information to you for your information and any comments that you may wish to make.

Because of the short time length involved, I called Mr. Linde and told him that it would be impossible for us to respond either as a department or the Commission because of the time involved. My own view is that the ordinance is much too complex to provide a quick evaluation as to its effectiveness and as to its impact on the community. At this point, I'm neither supporting or adverse to such an ordinance. It is apparent in planning activities that noise is a major problem as evidenced by the requirements to consider noise in and around airports and the related land use thereto, as well as the construction of transportation projects. In discussing this matter with me, Mr. Linde indicated that he expected no definitive answer from the Board at the October 10 meeting, but some reaction from various parties as to whether the Board should proceed further with this matter or not. It is anticipated by Mr. Linde that it would not reach the City Commission until near the end of the year, and that several additional opportunities will be had before any definitive recommendations to the City Commission are made by the Community Grievance Board. This obviously has impact on the community, both from a livability standpoint, and may also relate to several planning areas, such as Subdivision design, Transportation planning, and other land use related activities. If this matter is going to be continued, our staff will obviously need to spend some time reviewing the ordinance and assessing its impact.

Coincidently, we received in the mail, the same day, an insert to the National League of Cities publication, an environmental report directed to noise. I am xeroxing this for your information. The article on ECHO describes several community efforts across the United States concerning noise regulation.

If any of the Commissioners, upon receipt of this item, have any comments that they wish to have reported to the Community Grievance Board, please feel free to either attend at that time or pass those comments to me, and I will in turn see that they are transmitted to the Board.

Robert A. Lakin
Director of Planning

RAL:rme

cc: Fred Linde, Grievance Officer
James Aiken, Director, Environmental Health
Jack H. Galbraith, Chief Planner, Current Plans Division
Willard L. Stockwell, Chief Planner, Advance Plans Division

Wichita Community Grievance Office

Room 150
City Hall
Wichita, Kansas 67202

316-268-4547

October 1, 19

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METROPOLITAN PLANNING
ROUTE ☐ _____
☐ _____

Mr. Bob Lakin, Director
Metropolitan Area Planning Department
455 N. Main
Wichita, Kansas 67202

Dear Mr. Lakin:

The Wichita Community Grievance Advisory Board commenced reviewing a proposal for acoustics standards to be used in the control and regulation of noise and noise sources in the City of Wichita. The proposal, which at the present time is cast as a suggested City ordinance, incorporates features from the City codes of Sacramento, California, Colorado Springs, Colorado and Chicago, Illinois. All of these cities apply similar standards and regulations and we understand all of them have had from good to very good results.

The Grievance Office Advisory Board will resume its consideration of the proposal at its Wednesday, October 10 meeting. The meeting will be held in the City Commission Conference Room on the first floor of City Hall at 3:30 p.m. If the Advisory Board accepts the proposal in its present or modified form, it will then refer the proposal to the Board of City Commissioners for their consideration and possible action.

On behalf of the Advisory Board, we extend a cordial invitation to you to be present on October 10.

If you serve in the dual capacity of ex-officio to one or more appointive Boards or Commissions, we ask you to advise those groups of the current considerations.

We enclose a copy of the draft proposal currently being reviewed by the Advisory Board.

Sincerely,

Fredrick A Linde

Fredrick A. Linde,
Grievance Officer

NOISE CONTROL

Since the Grievance Office started in 1972, complaints and grievances have been made wherein the essential element of concern is noise. In certain types of complaints, such as a barking dog or aircraft operation, the element of noise is apparent and is the obvious reason for the complaint. In others, including complaints about neighborhood conditions, the role of noise as the initiating element is less apparent. However, upon analysis we have been able to isolate noise as the causative element in a large number of types of complaints. For example, for the one year period commencing September 6, 1978 and running through September 5, 1979, the following types and numbers of individual complaints were recorded:

Sources of Noise-Related Complaints to the Grievance Office
For September 6, 1978 to September 5, 1979

Animals - barking dogs and fowls -	40
Vehicles - hot rods, motorcycles and trucks -	9
Music - stereos, from homes -	9
Home auto repairs -	8
General businesses -	10
General neighbors -	8
Construction activities -	3
Early trash pickups -	5
Aircraft -	5

These clearly defined complaints constitute about five percent of the total volume received by the Grievance Office, but on a value weighted basis, probably account for twenty or thirty percent of the significant cases handled by the office.

The control of noise can be attempted either through subjective standards or through objective ones. The Wichita effort can be considered subjective since the element of discretion and opinion by the enforcing agency is implied and required. Most of the Wichita code is contained in Chapter 5.58, title "Noise." This part of the code contains such language as "loud and unnecessary noise prohibited" and prohibits the unnecessary blowing of whistles, the exhaust of steam engines, the operation of defective vehicles (without, however, specifying the types of defects), the crying and

shouting of peddlers, etc. In addition, section 5.58.010 of the code prohibits the "loud and unnecessary barking of dogs." One or two other minor sections of the code speak to noise, most particularly in Chapter 28 on home occupations and in the maintenance of effective automotive mufflers.

The essential control of noise is to prevent the escape from property and its intrusion into other property. The escape can be across property lines, inside factories or through apartment and office walls. It is not the element of noise at the source, per se - unless it occurs inside the work place where it becomes subject to control by OSHA -, but what amount of the noise leaks to a place where it is not wanted and becomes objectionable. It is not a mere trueism that "one man's music is another man's noise" - (one way to define noise is that it is unwanted sound) but rather a correct statement. It is this element, the way in which noise is perceived differently by the maker, or tolerator, and by the receiver, which makes for disputes and for grievances.

With our current ordinances not too much help is available to the unwilling hearer. It must be recognized that a certain group of persons will always be intolerant. To this group any sound will be objectionable and might become the subject of complaints if the code is carelessly constructed.

Unfortunately, a rather sophisticated amount of technical knowledge is required to properly understand the implications of noise, its control and its measurements. Noise appears to be a by-product of our urban civilization where persons live under certain amounts of continuous stress, neighbors are in close proximity and the ownership of mechanical devices capable of yielding raucous noises is common. Noise has physiological and other medical implications, not the least of which is the permanent loss of hearing through exposure to loud sound intensities and to types of noises known as "impulse" sounds.

In the following section a new, comprehensive ordinance is proposed. It sets definite criteria for:

Noise levels as physically measured in decibels
Times during which the levels apply
Removes, so far as seems reasonable, the element of subjectivity
Applies current "state of the art" concepts.

The questions of enforcement and of judicial tests come up. In some cities, such as Chicago, enforcement is entrusted to the police. Colorado Springs has a special "noise task force." Its members are commissioned as police officers but the administration of the force is separate from the police departments. Some jurisdictions employ members of their health departments while others get elements of enforcement from two or more city agencies. All cities indicate a high level of success in citations and court cases brought under their ordinances; all, apparently, with the exception of one section in the Chicago ordinance, have survived the constitutional tests.

In establishing our basic rationale for making proposals for controlling noise in Wichita, we contacted twenty cities all of approximately the same population as Wichita. More than half responded with copies of their noise ordinances and other information. Most of the ordinances have quantitative determinants, that is, the noise source is measured as the sound volume, expressed as decibles. In preparing the following ordinance proposal we have synthesized elements from the codes of Sacramento, California, Colorado Springs, Colorado, and Chicago, Illinois; we believe it represents the optimum for noise control in Wichita. This proposed ordinance follows:

A Proposed Model Ordinance for Noise Control in Wichita, Kansas

I. Commission Findings.

(a) Excessive, unnecessary or offensive noise within the city of Wichita is found to be detrimental to the public health, safety, welfare and the peace and quiet of the inhabitants of the city and therefore is hereby declared a public nuisance; and

(b) Every person in the city is entitled to live in an environment free from excessive, unnecessary or offensive noise levels; and

(c) The establishment of maximum permissible noise levels will further the public health, safety, welfare and peace and quiet of inhabitants of the city of Wichita.

II. Declaration of Policy.

It is hereby declared to be the policy and purpose of this chapter to assess complaints of noises alleged to exceed the ambient noise levels. Further, it is declared to be the policy to contain sound levels in the city of Wichita at their present levels with the ultimate goal of reducing such levels, when and where feasible and without causing undue burdens, to meet the noise standards set forth in this chapter.

III. Liberal construction.

This chapter shall be liberally construed so as to effectuate its purposes.

IV. Severability.

If any section, subsection, sentence, clause, phrase or portion of this chapter is for any reason held invalid or unconstitutional by any court of competent jurisdiction, such portion shall be deemed as a separate, distinct and independent provision, and such holding shall not affect the validity of the remaining portions thereof.

V. Definitions.

The following words, phrases and terms as used in this chapter shall the following meanings:

(a) "Agricultural property" means a parcel of property used in part or whole for agricultural purposes.

(b) "Ambient noise level" means the all-encompassing noise level associated with a given environment, being a composite of sounds from all sources, excluding the alleged offensive noise, at the location and approximate time at which a comparison with the alleged offensive noise is to be made.

(c) "Cumulative period" means an additive period of time composed of individual time segments which may be continuous or interrupted.

(d) "Decibel" or "dB" means a unit which denotes the ratio between two quantities which are proportional to power; the number of decibels corresponding to the ratio of two amounts of power is ten times the logarithm to the base of ten of this ratio.

(e) "Emergency work" means the use of any machinery, equipment, vehicle, manpower or other activity in an effort to protect, maintain, provide or restore safe conditions in the community or for citizenry, or work by private or public utilities when restoring utility service.

(f) "Hertz" means a unit of measurement of frequency, numerically equal to cycles per second.

(g) "Impulsive noise" means a noise characterized by brief excursions of sound pressures whose peak levels are very much greater than the ambient noise level, such as might be produced by the impact of a pile driver, punch press or a drop hammer, typically with one second or less duration.

(h) "Noise level" means the "A" weighed sound pressure level in decibels obtained by using a sound level meter at slow response with a reference pressure of

twenty micropascals. The unit of measurement shall be designated as dBA.

(i) "Person" means a person, firm, association, partnership, joint venture, corporation or any entity, public or private in nature.

(j) "Residential property" means a parcel of real property which is developed and used either in part or in whole for residential purposes other than transient uses such as hotels and motels, and other than non-conforming residential uses within "AA," "A," "RB," "R-5," "R-6," and "B" zones.

(k) "Simple tone noise" or "pure tone noise" means a noise characterized by the presence of a predominant frequency or frequencies such as might be produced by whistle or hum.

(l) "Sound level meter" means an instrument that meets or exceeds American National Standard Institute's Standard S1.4-1971 for Type 2 sound level meters or an instrument and the associated recording and alalyzing equipment which will provide equivalent data.

(m) "Sound pressure level" means a sound pressure level of a sound, in decibels, as defined in ANSI Standards 51.2-1962 and 51.13-1921; that is, twenty times the logarithm to the base ten of the ratio of the pressure of the sound to a reference pressure, which reference pressure shall be 0.0002 dynes per square centimeter.

VI. Sound level measurement (general).

(a) Any noise level measurements made pursuant to the provisions of this chapter shall be performed using a sound level meter as defined in section V and in accordance with the recommendations of the manufacturer.

(b) The location selected for measuring exterior noise levels shall be at any point on the receiver's affected property. In the case of interior noise

measurements, the windows shall be in normal seasonal configuration and the measurement shall be made at a point at least four feet from the wall, ceiling or floor nearest the affect occupied area.

VII. Permissible Noise Levels.

(a) A noise measured or registered as provided above from any source other than as provided in Section V at a level which is equal to or in excess of the dBA established for the time period and zones listed in this Section, is hereby declared to be excessive and unusually loud and is unlawful.

	7:00 A.M. to Next 7:00 P.M.	7:00 P.M. to Next 7:00 A.M.
Residential	55 dBA	50 dBA
Commercial	60 dBA	55 dBA
Light Industrial	70 dBA	65 dBA
Industrial	80 dBA	75 dBA

Definitions - For purposes of this Chapter, the aforementioned zones shall be defined as in Chapter 28 of the Code of the City of Wichita.

(b) It shall be unlawful for any person at any location to create any noise which causes the noise levels when measured on agricultural or residential property to exceed for the duration of time set forth following, the specified exterior noise standards in any one hour by:

Cumulative Duration of the Intrusive Sound

		Allowance Decibels
(1)	Cumulative period of 30 minutes per hour	0
(2)	Cumulative period of 15 minutes per hour	+5
(3)	Cumulative period of 5 minutes per hour	+10
(4)	Cumulative period of 1 minute per hour	+15
(5)	Level not to be exceeded for any time per hour	+20

(c) Each of the noise limits specified in subdivision (b) shall be reduced by 5 dBA for impulsive or simple tone noises, or for noises consisting of speech or music.

(d) If the ambient noise level exceeds that permitted by any of the first four noise limit categories specified in subdivision (b), the allowable noise limit shall be increased in 5 dBA increments in each category to encompass the ambient noise level. If the ambient noise level exceeds the fifth noise level category, the maximum ambient noise level shall be the noise limit for that category.

VIII. Interior noise standards.

(a) In any apartment, condominium, town house, duplex or multiple dwelling unit it shall be unlawful for any person to create any noise from inside his unit that causes the noise level when measured in a neighboring unit during the periods 10:00 p.m. to 7:00 a.m. to exceed:

(1) 45 dBA for a cumulative period of more than 5 minutes in any hour

(2) 50 dBA for a cumulative period of more than 1 minute in any hour

(3) 55 dBA for any period of time

(b) If the ambient noise level exceeds that permitted by any of the noise level categories specified in subdivision (a), the allowable noise limit shall be increased in 5 dBA increments in each category to encompass the ambient noise level.

IX. Exemptions.

The following activities shall be exempted from the provisions of this chapter:

(a) School bands, school athletic and school entertainment events. School entertainment events shall not include events sponsored by student organizations.

(b) Outdoor gatherings, public dances, shows and sporting and entertainment events provided said events are conducted pursuant to a discretionary license or permit by the city of Wichita.

(c) Activities conducted on parks and public playgrounds, provided such parks and public playgrounds are owned and operated by a public entity.

(d) Any mechanical device, apparatus or equipment related to or connected with emergency activities or emergency work.

(e) Noise sources due to the erection (including excavation), demolition, alteration or repair of any building or structure between the hours of 7:00 a.m. and 6:00 p.m., on Monday, Tuesday, Wednesday, Thursday, Friday and Saturday, and between 9:00 a.m. and 6:00 p.m. on Sunday; provided however, that the operation of an internal combustion engine shall not be exempt pursuant to this subsection if such engine is not equipped with suitable exhaust and intake silencers which are in good working order. The superintendent of Central Inspection Division, or his designee, may permit work to be done during the hours not exempt by this subsection in the case of emergencies and in the interest of public health and welfare for a period not to exceed (3) consecutive days. Application for this exemption may be made in conjunction with the application for the work permit or during progress of the work. Only one such request shall be made during the entire construction cycle of the project.

(f) Noise sources associated with agricultural operations provided such operations take place between the hours of 7:00 a.m. and 8:00 p.m.; provided, however, that the operation of an internal combustion engine shall not be exempt pursuant to this subsection if such engine is not equipped with suitable exhaust and intake silencers which are in good working order.

(g) Any mechanical device, apparatus or equipment which are utilized for the protection or salvage of agricultural crops during periods of adverse weather conditions or when the use of mobile noise sources is necessary for pest control; provided, however, that the operation of an internal combustion engine shall not be exempt pursuant to

this subsection if such engine is not equipped with suitable exhaust and intake silencers which are in good working order.

(h) Noise sources associated with maintenance of street trees and residential area property provided said activities take place between the hours of 8:00 a.m. and 6:00 p.m. Mondays through Fridays inclusive.

(i) Tree and park maintenance activities conducted by the city recreation and parks department.

(j) Any activity to the extent provisions of Chapter 65 of Title 42 of the United States Code, preempts local control of noise regulations and land use regulations related to noise control of airports and their surrounding geographical areas, any noise source associated with the construction, development, manufacture, maintenance, testing or operation of any aircraft engine, or of any weapons system or subsystems which are owned, operated or under the jurisdiction of the United States, any other activity to the extent regulation thereof has been preempted by State or Federal law or regulation.

(k) Any noise sources associated with the maintenance and operation of aircraft or airports which are owned or operated by the United States.

X. Pre-existing industrial or commercial facilities--transition period.

(a) Any industrial or commercial facility in existence prior to the effective date of this chapter shall be allowed a two year period commencing on said date within which to comply with this chapter.

(b) During said two year period all such facilities shall make reasonable efforts to be in compliance and to reduce noise which exceeds the standards specified in this chapter. Commencing at the end of two years after the effective date of this chapter, any such facility shall be subject to all applicable requirements of this chapter.

(c) If any facility which is not in compliance by the end of said two year period applies for a variance pursuant to section XVII, in deciding whether to grant a variance the hearing board, Section XVIII, shall take into account the extent to which the applicant has endeavored to reduce noise during said two year period to meet the standards specified in this chapter.

(d) This section applies only to a commercial or industrial facility already in existence or for which the work of improvement had commenced prior to the effective date of this chapter.

(e) As used in this section "industrial facility" means any building, structure, factory, plant, premise or portion thereof used for manufacturing or industrial purposes, including all activities in which agricultural products serve as raw or intermediate materials, including grain elevators and grain mills and "commercial facility" means any building, structure, premise or portion thereof used for wholesale or retail commercial purposes.

Schools, hospitals and churches.

It shall be unlawful for any person to create any noise which causes the noise level at any school, hospital or church while the same is in use to exceed the noise standards specified in section VII (a) "Residential" or to create any noise which unreasonably interferes with the use of such institution or unreasonably disturbs or annoys the patrons of the facilities. In any disputed case, interfering noise which is 10 dBA or more, greater than the ambient noise level at the building, shall be deemed excessive and unlawful.

Residential pumps, fans and air conditioners.

(a) It shall be unlawful for any person to operate any residential fans, air conditioners, stationary pumps, stationary cooling towers, stationary compressors, similar mechanical device or any combination thereof installed after the effective date of

this chapter in any manner so as to create any noise which would cause the maximum noise level to exceed:

(1) 60 dBA at any point at least one foot inside the property line of the affected residential or agricultural property and three to five feet above ground level.

(c) Equipment installed before the effective date of this chapter shall not exceed a limit of 65 dBA maximum sound level, at any point at least one foot inside the property line of the affected agricultural or residential property and three to five feet above ground level after the effective date of this chapter.

Off road vehicles.

It shall be unlawful for any person to operate any motorcycle or recreational off road vehicle on or off a public road in such a manner that the noise level exceeds the exterior noise standards specified in VII (a) for the zoning district.

Waste disposal vehicles.

It shall be unlawful for any person authorized to engage in waste disposal service or garbage collection to operate any truck-mounted waste or garbage loading and/or composting equipment or similar mechanical device in any manner so as to create any noise exceeding the following level, when measured at a distance of fifty feet from the equipment or any agricultural or residential property.

(a) New equipment purchased or leased on or after a date six months from the effective date of this chapter shall not exceed a noise level of 80 dBA.

(b) New equipment purchased or leased on or after two years from the effective date of this chapter shall not exceed a noise level of 75 dBA.

(c) Present equipment shall not exceed a noise level of 80 dBA on or after five years from the effective date of this chapter.

The provisions of this section shall not abridge or conflict with the powers of the State over motor vehicle control.

XI. General noise regulations.

Notwithstanding any other provisions of this chapter and in addition thereto, it shall be unlawful for any person to make or continue or cause to be made or continued any loud, unnecessary or unusual noise which disturbs the peace and quiet of any neighborhood or which causes discomfort or annoyance to any three reasonable persons, all non related and occupying separate dwelling units of normal sensitiveness residing in the area.

The standards which may be considered in determining whether a violation of the provisions of this section exists shall include, but not be limited to, the following:

(a) The sound level of the objectionable noise.
(b) The sound level of the ambient noise.
(c) The proximity of the noise to residential sleeping facilities.
(d) The nature and zoning of the area within which the noise emanates.
(e) The density of the inhabitation of the area within which the noise emanates.
(f) The time of day or night the noise occurs.
(g) The duration of the noise and its tonal informational or musical content.
(h) Whether the noise is continuous, recurrent or intermittent.
(i) Whether the noise is produced by a commercial or non-commercial activity.

XII. Specific unlawful noises.

Notwithstanding any other provision of the chapter to the contrary, the following acts, among others, are declared to be loud, disturbing, and unnecessary noises in violation of this chapter, but such enumeration shall not be deemed to be exclusive, namely:

(a) It shall be unlawful for any person to operate any motor of a motor vehicle of a weight in excess of four tons (8,000 lbs.) for a consecutive period longer than two minutes while such vehicle is standing on private property and located within 150 feet of property zoned and used for residential purposes except where such vehicle is standing within a completely enclosed structure.

This section shall not apply to buses operated for the transportation of passengers while standing in established bus turnarounds, bus terminals, bus parking lots and bus-storage yards.

(b) No person shall sell, or offer for sale, a new motor vehicle that produces a maximum noise exceeding the following noise limit at a distance of 50 feet from the center line of travel under test procedures established by Section V of this chapter:

	Type of Vehicle	Date of Manufacture	Noise Limit
(1)	Motorcycle	before 1 Jan. 1970	92 dB(A)
	Same	after 1 Jan. 1970	88 dB(A)
	Same	after 1 Jan. 1974	86 dB(A)
	Same	after 1 Jan. 1975	84 dB(A)
	Same	after 1 Jan. 1981	75 dB(A)
(2)	Any motor vehicle with a gross vehicle weight of 8,000 pounds or more	after 1 Jan. 1968	88 dB(A)
	Same	after 1 Jan. 1973	86 dB(A)
	Same	after 1 Jan. 1975	84 dB(A)
	Same	after 1 Jan. 1981	75 dB(A)

(3) Passenger cars, motor-driven cycle and any other motor vehicle intended primarily for the transport of persons	before 1 Jan. 1973	86 dB(A)
Same	after 1 Jan. 1973	84 dB(A)
Same	after 1 Jan. 1975	80 dB(A)
Same	after 1 Jan. 1981	75 dB(A)

The manufacturer, distributor, importer, or designated agent shall certify in writing to the Chief of Police that vehicles sold by him within the City comply with provisions of this section.

(c) No person shall operate within the speed limits specified in this section either a motor vehicle or combination of vehicles of a type subject to registration at any time or under any condition of grade, load, acceleration or deceleration in such manner as to exceed the following noise limit for the category of motor vehicle, based on a distance of not less than 50 feet from the center line of travel under test procedures established by Section VI of this chapter:

	Noise Limit in Relation To Posted Speed Limit	
Type of Vehicle	35 MPH or Less	Over 35 MPH
(1) Any motor vehicle with a manufacturer's GVW rating of 8,000 lbs. or more, and any combination of vehicles towed by such motor vehicle		
before 1 Jan. 1981	88 dB(A)	90 dB(A)
after 1 Jan. 1981	86 dB(A)	90 dB(A)

(2) Any motorcycle other than a motor-driven cycle		
before 1 Jan. 1981	82 dB(A)	86 dB(A)
after 1 Jan. 1981	78 dB(A)	82 dB(A)
(3) Any other motor vehicle and any combination of motor vehicles towed by such motor vehicle		
before 1 Jan. 1981	76 dB(A)	82 dB(A)
after 1 Jan. 1981	70 dB(A)	79 dB(A)

This section applies to the total noise from a vehicle or combination of vehicles and shall not be construed as limiting or precluding the enforcement of any other provisions of the code of the City of Wichita relating to motor vehicle mufflers for noise control.

(d) No person shall modify or change the exhaust muffler, intake muffler or any other noise abatement device of a motor vehicle in a manner such that the noise emitted by the motor vehicle is increased above that emitted by the vehicle as originally manufactured. Procedures used to establish compliance with this paragraph shall be those used to establish compliance of a new motor vehicle with the requirements of this section.

(e) Horns and signaling devices: The sounding of any horn or signaling device on any automobile, motorcycle, or other vehicle on any street or public place of the city, except as a danger warning; the creation by means of any such signaling device of any unreasonably loud or harsh sound; and the sounding of any such device for an unnecessary and unreasonable period of time. The use of any signaling device except one operated by hand or electricity; the use of any horn, whistle or any other device operated by engine exhaust; and the use of any such signaling device when traffic is for any reason impeded or moving slower than the speed limit.

(f) Yelling and shouting: Yelling, shouting, hooting, whistling, singing or blowing of horns on the public streets, particularly between the hours of 10:00 p.m. and 7:00 a.m. of the following day or at any time or place so as to annoy or disturb the quiet, comfort, or repose of persons in any office, or in any dwelling, hotel, motel, apartment or other type of residence, or of any persons in the vicinity.

(g) Pile drivers, hammers, etc.: The operation between the hours of 10:00 p.m. and 7:00 a.m. of the following day of any pile driver, steam shovel, pneumatic hammer, derrick, steam or electric hoist or other appliance, the use of which is attended by loud or unusual noise.

(h) Tools: The use of or operation between the hours of 10:00 p.m. and 7:00 a.m. of the following day of any saw, planer, hammer or other tool, device or appliance, powered by any means, including but not limited to electricity, steam, air or hydraulic fluids, so as to disturb the quiet, comfort or repose of persons in any dwelling, hotel, motel apartment, hospital or nursing home or other type of residence, or of any person in the vicinity.

(i) Blowers: The operating of any noise--creating blower or power fan or any internal combustion engine the operation of which causes noise due to the explosion of operating gases or fluids, unless the noise from such blower or fan is muffled and such engine is equipped with a muffler device sufficient to deaden such noise.

(j) Exhausts: The discharge into the open air of the exhaust of any steam engine, stationary internal combustion engine, motor boat, or motor vehicle except through a muffler or other device which will effectively prevent loud or explosive noises therefrom.

(k) Loading, unloading, opening boxes: The creation of a loud and excessive noise between 10:00 p.m. and 7:00 a.m. of the following day in connection with loading or unloading any vehicle or the opening and destruction of bales, boxes, crates, and containers.

(l) Hawkers, peddlers and vendors: The shouting and crying of peddlers, hawkers and vendors which disturbs the peace and quiet of persons in the neighborhood except between 9:00 a.m. and 5:00 p.m. of the same day.

(m) Drums: The use of any drum or other instrument or device for the purpose of attracting attention by creation of noise to any performance, show or sale.

(n) Transportation of metal rails, pillars and columns: The transportation of rails, pillars or columns of iron, steel or other material, over and along streets and other public places upon carts, drays, cars, or trucks in any manner so as to cause loud noises or to disturb the peace and quiet of persons in the vicinity thereof except between 7:00 a.m. and 8:00 p.m. of the same day.

(o) Animals, birds, fowls: The keeping of any animal, fowl or bird which by causing frequent or long continued noise shall disturb the comfort or repose of persons in the vicinity: the director of Environmental Health of the Department of Community Health, subject to specific approval by a majority of the Board of City Commissioners, shall prepare, publish and enforce reasonable noise standards.

XIII. Administration.

Except for the enforcement of section XII (a), (b), (c), (d), (e) which shall be the responsibility of the chief of police, the administration of this chapter is hereby vested in the Director of the Department of Community Health; herein after referred to as health officer. The health officer shall be responsible for:

(a) Employing individuals trained in acoustical engineering or an equivalent field to assist the health officer in the administration of this chapter.

(b) Training field inspectors.

(c) Procuring measuring instruments and training inspectors in their calibration and operation.

(d) Conducting a public education program in all aspects of noise control.

(e) Coordinating the noise control program with other governmental agencies.

XIV. Noise Control Program - recommendations.

At least every third year following the effective date of this chapter, the health officer shall evaluate the effectiveness of the noise control program and shall make recommendations to the Board of Commissioners for its improvement.

XV. Rules and standards.

Within one year after the effective date of this chapter, the health officer with the advice and assistance of other appropriate governmental agencies, shall investigate and recommend to the Board of City Commissioners the following:

(a) Rules and procedures to be used in measuring noise.

(b) Noise standards for motor vehicle operation within the city. However, nothing within this ordinance shall be deemed to abridge or conflict with the powers of the state or federal governments over motor vehicle control.

(c) Noise standards governing the construction, repair or demolition of a structure including streets and other thoroughfares.

(d) Recommendations, if appropriate, for the establishment of sound levels standards for nonresidentially zoned areas within the city.

XVI. Special condition permits.

Notwithstanding any provision of this chapter, the health officer may grant special condition permits for a period not exceeding three days. At least seven days prior to the permit period, all persons

residing within 400 feet of the site for which the permit is sought shall be notified of the request and its nature, in writing and sent by first class U.S. mail. If any objections to the permit are made, a hearing shall be conducted. Based on the facts presented at the hearing from both the proponents and opponents, the health officer shall use his judgement and may grant, modify or deny the permit. The general purpose and intent of this chapter shall be carried out by the granting of the special condition permit, provided, however, that no permit shall be issued for any activity which violates any provisions of the basic purpose of this chapter. Said special condition permits shall not be renewed.

XVII. Variance procedure.

As deemed appropriate

XVIII. Hearing board.

As deemed appropriate

XIX. Appeals.

As deemed appropriate

XX. Penalties.

As deemed appropriate

We are aware that the enactment of an ordinance based on the suggested model would impose major changes in Wichita law enforcement and would create some confusion and unrest among some persons. The alternative is a less comprehensive ordinance which probably would require almost immediate amending or a do nothing policy which will fail to correct the present and growing difficulties and would leave many persons without protection against this particular annoyance.

As was mentioned above, to correctly understand noise requires some specialized information. For this purpose we include several pages of information, taken in part from the publication "Noise Measurement" by Peterson and Gross, published by the General Radio Company, and from other published sources.

General Background Information

During the past decade more and more people have become concerned with the problem of noise in everyday life. There is danger of permanent hearing loss when exposure to an intense sound field is long and protective measures are not taken. This is important to millions of workers, to most industrial corporations, labor unions and insurance companies.

The noise problem near many airports has become so serious that many people have moved out of nearby areas that were once considered pleasant. The din of high-powered trucks, motorcycles, and "hot" cars annoys nearly everyone, and one cannot so readily move away from them as from the airport, because they are almost everywhere.

The increasingly large number of people living in apartments, and the relatively light construction of most modern dwellings, has accentuated the problems of sound isolation. In addition, some of the modern appliances, for example dishwashers, are noisy for relatively long periods, which can be very vexing, if it interferes with a favorite TV program.

Lack of proper sound isolation and acoustical treatment in the classroom may lead to excessive noise levels and reverberation, with resulting difficulties in communication between teacher and class. The school teacher's job may become a nightmare because the design was inadequate or altered to save on the initial cost of the classroom.

High-power electronic amplifiers have brought deafening "music" within the reach of everyone, and many young people may eventually regret the hearing loss that is accelerated by frequent exposure to the extremely loud music they find stimulating.

Of all these problems, noise-induced hearing loss is the most serious. For this problem as well as the others mentioned, reduction of noise at its source is often essential. The further step of providing direct protection for the individual may also be needed.

Much can be done by work on noise sources to reduce the seriousness of these noise problems. It is not often so simple as turning down the volume control on the electronic

amplifier. But good mufflers are available for trucks, motorcycles and automobiles; and household appliances can be made quieter by the use of proper treatment for vibrating surfaces, adequately sized pipes and smoother channels for water flow, vibration-isolation mounts, and mufflers. The engineering techniques for dealing with noise are developing rapidly, and every designer should be alert to using them.

In many instances, the quieter product can function as well as the noisier one, and the increased cost of reducing the noise may be minor. But the aircraft-noise problem is an example where the factors of safety, performance, and cost must all be considered in determining the relative benefits to the public of changes made to cut down the noise.

In any of these, sound-measuring instruments and systems can help to assess the nature of the problem, and they can help in determining what to do to subdue the troublesome noise.

The study of mechanical vibration is closely related to that of sound, because sound is produced by the transfer of mechanical vibration to air. Hence, the process of quieting a machine or device often includes a study of the vibrations involved.

Conversely, high-energy acoustical noise, such as generated by powerful jet or rocket engines, can produce vibrations that can weaken structural members of a vehicle or cause electronic components to fail.

Other important effects of vibration include: human discomfort and fatigue from excessive vibration of a vehicle, fatigue and rupture of structural members, and increased maintenance of machines, appliances, vehicles, and other devices.

Vibration, then, is a source not only of noise, annoyance, and discomfort, but often of danger as well. The present refinement of high-speed planes, ships and automobiles could never have been achieved without thorough measurement and study of mechanical vibration.

The instruments used in sound and vibration measurement are mainly electronic. Furthermore, some of the concepts and techniques developed by electronics engineers and physicists for dealing with random or interfering signals (for which they have borrowed the term "noise") are now used in sound and vibration studies.

What are Noise and Vibration?

When an object moves back and forth, it is said to vibrate. This vibration disturbs the air particles near the object and sets them vibrating, producing a variation in normal atmospheric pressure. The disturbance spreads and, when the pressure variations reach our ear drums, they too are set to vibrating. This vibration of our ear drums is translated by our complicated hearing mechanisms into the sensation we call "sound."

To put it in more general terms, sound in the physical sense is a vibration of particles in a gas, a liquid, or a solid.

A sound disturbance spreads. The speed with which it spreads depends on the mass and on the elastic properties of the material. In air the speed is about 1100 feet/second (about 750 miles/hour) or about 340 meters/second; in sea water it is about 1490 meters/second. The speed of sound has been popularized in aerodynamic concepts of the sound barrier and the supersonic transport, and its effects are commonly observed in echoes and in the apparent delay between a flash of lightning and the accompanying thunder.

The variation in normal atmospheric pressure that is a part of a sound wave is characterized by the rate at which the variation occurs and the extent of the variation. Thus, the standard tone "A" occurs when the pressure changes through a complete cycle 440 times per second. The frequency of this tone is then said to be 440 hertz, or 440 cycles per second (abbreviated "Hz" and "c/s", respectively). "Hertz" and cycles per second" are synonymous terms but most standardizing agencies have adopted "hertz" as the preferred unit of frequency.

Many prefixes are used with the unit of frequency, but the one that is common in acoustics and vibrations is "kilo-," abbreviated "k", which stands for a factor of 1000. Thus, 8000 Hz or 8000 c/s becomes 8 kHz or 8 kc/s.

The extent of the variation in pressure is measured in terms of a unit called the "microbar", which is approximately one-millionth of the normal atmospheric pressure (standard atmospheric pressure = 1,013,250 microbars), or in terms of newtons

per square meter, which is 10 microbars. Actually, these units are not often mentioned in noise measurement. Results are stated in decibels.

The Decibel - What Is It?

Although to many persons the decibel (abbreviated "dB") is uniquely associated with noise measurements, it is a term borrowed from electrical-communication engineering, and it represents a relative quantity. When it is used to express noise level, a reference quantity is implied. Usually, this reference value is a sound pressure of 20 micronewtons per square meter (abbreviated 20 uN/m^2). For the present, the reference level can be referred to as "0 decibels," the starting point of the scale of noise levels. This starting point is about the level of the weakest sound that can be heard by a person with very good hearing in an extremely quiet location. Other typical points on this scale of noise levels are:

Typical A-Weighted Sound Levels

At A Given Distance From Noise Source	Decibels RE 20 N m^2	Environmental
	140	
50 HP Siren (100')		
	130	
Jet Takeoff (200')		
	120	
Riveting Machine	110	Casting Shakeout Area
Cutoff Saw Pneumatic Peen Hammer		
	100	Electric Furnace Area
Textile Weaving Plant Subway Train (20')	90	Boiler Room Printing Press Plant

Pneumatic Drill (50')		
	80	Tabulating Room Inside Sport Car (50 MPH)
Freight Train (100') Vacuum Cleaner (10') Speech (1')	70	
	60	Near Freeway (Auto Traffic) Large Store Accounting Office
Large Transformer - 200'	50	Private Business Office Light Traffic (100') Average Residence
	40	Min Levels - Residential Areas in Chicago at Night
Soft Whisper (5')	30	Studio (Speech)
	20	Studio for Sound Pictures
	10	
Threshold of Hearing Youths - 1000-4000 Hz	0	

For example, the noise level in a large office usually is between 50 and 60 decibels. Among the very loud sounds are those produced by nearby airplanes, railroad trains, riveting machines, thunder, and so on, which are in the range near 100 decibels.

For some purposes it is not essential to know more about decibels than the above general statements. But when we need to modify or to manipulate the measured decibels, it is desirable to know more specifically what the term means. There is then less danger of misusing the measured values. From a strictly technical standpoint, the decibel is a logarithm of

a ratio of two values of power, and equal changes in decibels represent equal ratios.

Although decibels are used to give the results of power-level calculations, the decibel is most often used in acoustics for expressing the sound-pressure level and the sound level. These are extensions of the original use of the term, and all three expressions will be discussed in the following sections. First, however, it is worthwhile to notice that the above quantities include the word "level." Whenever level is included in the name of the quantity, it can be expected that the value of this level will be given in decibels or in some related term and that a reference power, pressure, or other quantity is stated or implied.

Power Level.

Because the range of acoustic powers that are of interest in noise measurements is about one-billion-billion to one (10^{18}:1), it is convenient to relate these powers on the decibel scale, which is logarithmic. The correspondingly smaller range of numerical values is easier to use and, at the same time, some calculations are simplified.

The decibel scale can be used for expressing the ratio between any two powers.

Sound-Pressure Level.

It is also convenient to use the decibel scale to express the ratio between any two sound pressures; tables for converting from a pressure ratio to decibels and vice versa are given in the Appendix. Since sound pressure is usually proportional to the square root of the sound power, the sound-pressure ratio for a given number of decibels is the square root of the corresponding power ratio. For example, if one sound pressure is twice another, the number of decibels is 6; if one sound pressure is 100 times another, the number is 40 decibels.

The sound pressure can also be expressed as a sound-pressure level with respect to a reference sound pressure. For airborne sounds this reference sound pressure is generally 20 uN/m^2. For some purposes a reference pressure of one microbar (0.1 N/m^2) has been used, but throughout this book the value of 20 uN/m^2 will always be used as the reference

for sound-pressure level. Then the definition of sound pressure level (SPL) is

$$SPL = 20 \log \frac{P}{.00002} \text{ dB re 20 micronewtons/meter squared}$$

where P is the root-mean-square sound pressure in newtons/meter squared for the sound in question. For example, if the sound pressure is 1 N/m^2, then the corresponding sound-pressure ratio is

$$\frac{1}{.00002} \text{ or } 50000.$$

From the tables, we find that the pressure level is 94 dB re 20 uN/m^2. If decibel tables are not available, the level can, of course, be determined from a table of logarithms.

The instrument used to measure sound-pressure level consists of a microphone, attenuator, amplifier, and indicating meter. This instrument must have an over-all response that is uniform ("flat") as a function of frequency, and the instrument is calibrated in decibels according to the above equation.

The position of the selector switch of the instrument for this measurement is often called "FLAT" or "20-k-Hz" to indicate the wide frequency range that is covered. The result of a measurement of this type is also called "over-all sound-pressure level."

Sound Level.

The apparent loudness that we attribute to a sound varies not only with the sound pressure but also with the frequency (or pitch) of the sound. In addition, the way it varies with frequency depends on the sound pressure. If this effect is taken into account to some extent for pure tones, by "weighting" networks included in an instrument designed to measure sound-pressure level, then the instrument is called a sound-level meter. In order to assist in obtaining reasonable uniformity among different instruments of this type, the American National Standards Institute (formerly, USA Standards Institute and American Standards Association), in collaboration with scientific and engineering societies, has established a standard to which sound-level meters should conform.

The current American National Standard Specification for Sound-Level Meters (ANSI S1.4-1971) requires that three alternate frequency-response characteristics be provided in instruments designed for general use. These three responses are obtained by weighting networks designated as A, B, and C. Responses A, B, and C selectively discriminate against low and high frequencies in accordance with certain equal-loudness contours, which will be described in a later section.

Whenever one of these networks is used, the reading obtained should be described as in the following examples: the "A-weighted sound level is 45 dB" "sound level (A) = 45 dB," or "SLA = 45 dB". In a table, the abbreviated form "LA" with the unit "dB" is suggested, or where exceptional compactness is necessary, "dB(A)." The form "dBA" has also been used, but this notation implies that a new unit has been introduced and is therefore not recommended. Note that when a weighting characteristic is used, the reading obtained is said to be the "sound level." Only when the over-all frequency response of the instrument is flat are sound-pressure levels measured. Since the reading obtained depends on the weighting characteristic used, the characteristic that was used must be specified or the recorded level may be useless. A common practice is to assume A-weighting if not otherwise specified.

It is often recommended that readings on all noises be taken with all three weighting positions. The three readings provide some indication of the frequency distribution of the noise. If the level is essentially the same on all three networks, the sound probably predominates in frequencies above 600 Hz. If the level is greater on the C network than on the A and B networks by several decibels, much of the noise is probably below 600 Hz.

In the measurement of the noise produced by distribution and power transformers, the difference in readings of level C-weighting and A-weighting networks (L_C-L_A) is frequently noted. (This difference in decibels is called the "harmonic index" in that application only.) It serves, as indicated above, to give some idea of the frequency distribution of the noise. This difference is also used in other noise-rating techniques in conjunction with the A-weighted sound level.

Combining Decibels.

A number of possible situations require the combining of several noise levels stated in decibels. For example, we may want to predict the effect of adding a noisy machine in an office where there is already a significant noise level, to correct a noise measurement for some existing background noise, to predict the combined noise level of several different noise sources, or to obtain a combined total of several levels in different frequency bands.

In none of these situations should the numbers of decibels be added directly. The method that is usually correct is to combine them on an energy basis. The procedure for doing this is to convert the numbers of decibels to relative powers, to add or subtract them, as the situation may require, and then convert back to the corresponding decibels. By this procedure it is easy to see that a noise level of 80 decibels combined with a noise level of 80 decibels yields 83 decibels and not 160 dB.

Vibration.

Vibration is the term used to describe continuing or steady-state periodic motion. The motion may be simple harmonic motion like that of a pendulum, or it may be complex like a ride in the "whip" at an amusement park.

The motion may involve tiny air particles that produce sound when the rate of vibration is in the audible frequency range (20 to 20,000 Hz), or it may involve, wholly or in part, structures found in machinery, bridges, or battleships. Usually the word vibration is used to describe motions of the latter types, and is classed as solid-borne, or mechanical, vibration.

Many important mechanical vibrations lie in the frequency range of 1 to 2,000 Hz (corresponding to rotational speeds of 60 to 120,000 rpm). In some specialized fields, however, both lower and higher frequencies are important. For example, in seismological work, vibration studies may extend down to a small fraction of a Hz, while in loudspeaker-cone design, vibrations up to 20,000 Hz must be studied.

Nature of Vibratory Motion. Vibration problems occur in so many devices and operations that a listing of these would be impractical. Rather, we shall give a classification on the basis of the vibratory motion, together with numerous examples of where that motion occurs, to show the practical application. (Classes of vibratory motion are given in the following table):

NATURE OF VIBRATORY MOTION

Torsional or twisting vibration
Examples:
- Reciprocating devices
- Gasoline and diesel engines
- Valves
- Compressors
- Pumps
- Rotating devices
- Electric motors
- Fans
- Turbines
- Gears
- Turntables
- Pulleys
- Propellers

Bending vibration
Examples:
- Shafts in motors, engines
- String instruments
- Springs
- Belts
- Chains
- Tape in recorders
- Pipes
- Bridges
- Propellers
- Transmission lines
- Aircraft wings
- Reeds on reed instruments
- Rails
- Washing machines

Flexural and plate-mode vibration
Examples:
- Aircraft
- Circular saws
- Loudspeaker cones
- Sounding boards
- Ship hulls and decks
- Turbine blades
- Gears
- Bridges
- Floors
- Walls

Translational, axial, or rigid-body vibration
Examples:
- Reciprocating devices
- Gasoline and diesel engines
- Compressors
- Air hammers
- Tamping machines
- Shakers
- Punch presses

Autos
Motors
Devices on vibration mounts

Extensional and shear vibration
Examples:
- Transformer hum

Hum in electric motors and generators
Moving tapes

Belts
Punch presses
Tamping machines

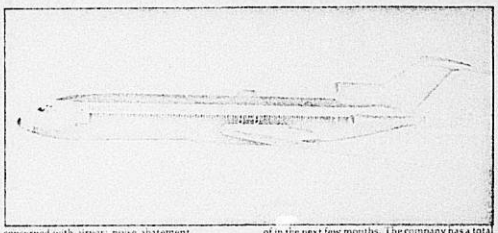
Intermittent vibration
(mechanical shock)
Examples:
Blasting
Gun shots
Earthquakes
Drop forges
Heels impacting floors
Typewriters
Ratchets
Geneva mechanisms
Stepping motors
Autos
Catapults
Planers
Shapers
Chipping hammers
Riveters
Impact wrenches

Random and miscellaneous motions
Examples:
Combustion
Ocean waves
Tides
Tumblers
Turbulence
Earthquakes
Gas and fluid motion and
their interaction with
mechanisms

Environmental Report

National League of Cities October 1, 1979

The Big Airline That Could: A Study in Quiet



by Lisa Wogan

"An airplane will never look nor sound like a butterfly," goes the airline refrain. Aircraft noise has been a noticeable and irritating problem for 30 years and currently affects some 6 million people living around U.S. airports. Airport owners and operators have paid out hundreds of millions of dollars in noise damages. The Council on Wage and Price Stability estimates that aircraft noise results in a loss of more than $3 billion per year in property value appreciation. Measures must be taken to abate aircraft related noise in the U.S.

Northwest Airlines quietly began in 1977 a program for retrofitting the noisiest aircraft in its fleets; that is, modifying the planes and engines so they make less noise. Northwest's anti-noise program includes purchase of more efficient and quieter aircraft and adoption of operating procedures that cut noise. In return, the airline was presented an award by a group of local officials concerned with airport noise abatement.

Lisa Wogan is a staff assistant with the NLC urban noise project.

Benjamin G. Gaines Jr., vice-president of Northwest, says, "Northwest Airlines has, through purchase of a fleet of the most modern, quietest aircraft, through noise reducing modifications to that fleet and through leadership in developing and implementing noise abatement operating procedures, produced a record of which we are sincerely proud." An analysis of Northwest's fleet shows that only 19 of their approximately 90 jets do not comply with Federal Aviation Administration (FAA) regulations. These aircraft are up for sale, and 3 of them are already committed to be disposed of in the next few months. The company has a total of 25 Boeing 747 wide-body jets, and four more 747s should be part of the fleet in 1980 when the firm will have invested approximately $1 billion in 747 aircraft. Seventeen of the 747s were retrofitted in 1977, four were delivered meeting Stage 2 Federal Aviation Regulation (FAR) Part 36 noise levels, and the last eight planes are even quieter, meeting the stricter Stage 3 FAR 36 noise levels because Northwest's contract with the Boeing company specifies modifications to produce the quietest aircraft possible.

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ECHO Aids Community Research on Noise

To date, well over 1,200 hours of work have been contributed to the U.S. Environmental Protection Agency's (EPA) Each Community Helps Others (ECHO) program. Through this program, over 50 communities have received technical assistance from more than 25 community noise advisors (CNAs). The program continues to engender a tremendous amount of enthusiasm among participants and the concepts of volunteerism, peer matching and a minimization of the federal presence remain active concepts.

Assistance received has been varied and has included evaluation of existing ordinances, training of police officers on use of sound level meters and developing land-use planning strategies and public education programs. Advisors have helped draft ordinances, develop enforcement programs and identify specific community noise problems. In the next year, more than 30 more communities interested in noise control will participate, and NLC recently received a contract from EPA to assume operation of the program.

As part of the ECHO contract, NLC will hold two national meetings where participants will exchange ideas and develop a sense of unity and identification with the program. New CNAs will be oriented to ECHO at the meetings, and participants will discuss ways to improve the program. Also, an information network will be established to inform ECHO communities of new program developments, other ECHO exchanges and general news in noise control.

Through ECHO, five communities have adopted noise control ordinances. In Anchorage, Alaska, a noise ordinance had been previously proposed and rejected by the municipal assembly. Then, through ECHO, Patrick Welch, an environmental specialist from Anchorage, traveled to Portland, Ore., to learn how that city's program operated. He was briefed on how to present a piece of legislation to a city government and received information on noise related equipment and EPA policy on noise abatement. Later, the EPA regional noise office in Seattle held an environmental noise workshop, which Welch attended using ECHO funds. Here he was provided a forum for discussion of ordinance development and enforcement and received comments on his proposed noise ordinance.

During the four-and-one-half-hour public hearing on the measure in Anchorage, Paul Herman, a noise specialist from Portland, presented facts on noise and ordinance enforcement in his city, which allayed the fears the Anchorage Assembly had about an ordinance shutting down the construction or trucking industry. A representative from the Acoustical Society of America, whom Welch met through ECHO, testified that the levels in the proposed ordinance were readily enforceable. And the EPA Seattle branch noise officer Debbie Yamamoto defended the levels established for trucks engaged in interstate commerce. After minor amendments, the ordinance passed the assembly, 7 to 3. Welch says, "Firmly believe that the ordinance would not have passed if the contacts I made through ECHO had not been available for comment at the public hearing." He further describes his experiences through ECHO as "a gold mine of information which helped me expand my consciousness about noise control. . . . It provided a

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ECHO from p. 5

forum for information exchange with other noise professionals who all share the common goal of reducing noise pollution." He found ECHO to be an outstanding program which was "definitely instrumental in the passage of the Anchorage ordinance, no doubt about it."

In Norfolk, Va., a study of the acoustical environment of the city's school classrooms was conducted with the assistance of a CNA from the Metropolitan Washington Council of Governments. As a result, Norfolk has now become an advisor to emerging noise programs in the Tidewater area of Virginia and a two-day workshop on land use planning techniques has been held for Tidewater cities. The agenda included sessions on federal regulations relating to noise and land use planning, physical and administrative techniques for noise planning, as well as the physiological and physical effects of noise.

In another ECHO match, CNA Bob Jones from Tampa, Fla., has been assisting the Chatham County-Savannah, Ga., area in development of noise control and abatement measures. Jones has provided on-site assistance to Savannah to help with a survey to assess day and evening noise problems on a neighborhood-by-neighborhood basis. He has provided training on operation of sound-level meters to four persons employed through the CETA program specifically to gather data for the survey. Jones states, "I think ECHO is a valuable program in which people who have been in the noise program long enough to get their feet wet can share their expertise with those who are just dipping in their toes."

As in many other communities, a noise ordinance had been previously proposed in Savannah and met opposition because of the city's inability to make judgements on quantitative noise levels and because residents were unsure of what impact the ordinance would have on the community. But the intensity of noise in Savannah has continued to escalate, and more and more of Savannah's citizens want action.

Through ECHO, Savannah has received assistance from the Atlanta regional office of EPA as well as from Tampa. The regional noise office provided expertise in acoustical engineering and analysis of measurements. But ECHO has not solved all of Savannah's noise problems. Howard Bellinger, director of the city's Metropolitan Planning Commission, had expected ECHO to provide a comprehensive once-and-for-all end to Savannah's noise nuisances. This expectation stemmed from the fact that Savannah wants a comprehensive ordinance that will emphasize legal controls available to abate the more subtle types of neighborhood noise; however, most cities, including advisor Tampa, have been concentrating their efforts on specific controls for noise sources such as automobiles, trucks and motorcycles. Bellinger believes his particular problem stems from the fact that the information on the state of the art is still in the formative stages, especially in the area of nuisance noise law.

In Bellinger's opinion, ECHO is definitely a useful program in that it provides money to cover travel costs as well as an opportunity for his community to explore its tentative program with someone who has implemented a successful program. ECHO provides another resource of experience for Savannah to draw on; but Savannah, as well as many other communities in the U.S., still finds it has many obstacles to overcome in order to develop and enforce a successful noise abatement and control program. ECHO's goal is to help cities make informed decisions about noise; its provision for interchange and information sharing is invaluable to the local official combatting noise. □

Northwest from p. 5

Northwest's fleet includes 22 DC-10s which are exceptionally quiet aircraft, far exceeding the Stage 2 FAR noise standards which are applicable to it; 23 Boeing 727-200A aircraft with engines equipped with sound absorbent materials and meeting Stage 2 levels, and 23 early model 727-200s which are being retrofitted and should be completed by 1981.

In total, Northwest's fleet represents a substantial investment in new, quiet aircraft and retrofit programs to meet the provisions of rules applicable to aircraft noise. Griggs states that "the fleet is as environmentally compatible as the state of the art today will permit." This modernization and quieting effort has benefitted the passengers and shippers who use the airline, made the airline a better neighbor to communities near the airport and has created thousands of jobs in the aircraft manufacturing and related industries.

Northwest is not typical of the airlines industry's reaction to present federal noise regulations. Most airline companies are lobbying Congress for a rollback of federal aircraft noise deadlines. Unlike Northwest, many airlines have chosen not to comply, despite the ample lead time provided for retrofit or replacement of noncomplying aircraft.

The focus of industry's lobbying efforts in Congress are waivers from noise compliance deadlines. These waivers, if enacted, will leave aircraft in service after 1985 that do not meet any noise standards. The industry's objection to the regulation is that the standards are technologically impossible to meet at this time and would cause them financial distress. Alderman Walter Ruckenstein of Minneapolis says, "In adopting the fleet noise rule that requires all aircraft to meet FAR Part 36 standards, the Federal Aviation Administration had to demonstrate that the regulation was technologically feasible and economically reasonable. Presently there are a number of airline companies such as Northwest that are acting in the public interest and confirming the FAA's judgement by putting the technology in place. Other airline companies should follow suit."

In addition to source controls for noise abatement, Northwest has been successful in development and implementation of operating procedures designed to achieve the greatest possible reduction in noise for those in the heaviest population concentration areas around airports. Through these efforts the airline has been able to achieve a maximum potential fuel savings of more than 84½ million gallons of fuel per year, or about 1½ percent of Northwest's annual fuel consumption. This savings provides the airport with some of the funds necessary for fleet modernization as well as being a substantial aid in an area of national concern—the energy shortage.

The Northwest procedures are designed to attain the maximum separation between the aircraft and populated areas. In Minneapolis, the airline's home-base, a preferential runway system is used that effectively puts all possible traffic over the least populated areas, particularly the river bottoms to the southeast of the airport. The procedures specify a reduction to the least amount of thrust on take-off and landing; maximum climb and flap retraction must occur as early as possible on take-off. On landing, the least amount of flaps necessary, consistent with safety regulations, must be used.

Northwest's efforts have been recognized on the national level by the FAA, the Department of Transportation and the Environmental Protection Agency, and by state and local authorities such as the Minnesota Pollution Control Agency. This agency has taken extensive noise measurements around the Minneapolis-St. Paul International Airport and has verified the effectiveness of Northwest's operational procedures as compared to those of other aircraft operators.

The FAA has established and operated fixed noise monitoring points around the Washington National and Dulles International Airports in the D.C. area. Published results of this monitoring have shown that Northwest's 727 operations were approximately 10 decibels quieter than the noisiest 727 operations, a factor which is generally agreed as meaning about half the noise. The duration of the noise from Northwest's flights has been measured as approximately one-half the number of seconds as the duration of noise from the noisiest operations. Northwest's Griggs says, "Half the noise for half the duration is a most impressive record, in our opinion, and points out the tremendous significance of operating procedures properly developed and consistently carried out by Northwest's pilots . . ."

In the Minneapolis-St. Paul area, Northwest's noise abatement efforts are being carried out through an organization called the Metropolitan Aircraft Sound Abatement Council (MASAC) at the Twin Cities. This group includes an equal number of representatives of the general public, some of the communities surrounding the airport, representatives of the airlines, general aviation and the airport operator, and has the active participation of the FAA. Benjamin Griggs says, "Through MASAC we have what I consider to be the most effective, yet essentially voluntary, noise abatement program in the country. The Minneapolis-St. Paul situation is a good example of what can be accomplished through voluntary cooperation. We have developed a thorough understanding of the problem by all concerned and have received and acted upon suggestions for noise abatement from all the participants."

What is the future of aircraft noise abatement? Griggs predicts that there will be an increase in U.S. air traffic, but that introduction of new, larger aircraft that carry more passengers than their predecessors will, in many cases, actually reduce the number of flights necessary when they replace smaller, older aircraft. Northwest officials believe that land-use planning will continue to be essential to noise abatement since there will always be areas close to airports for which no relief is technologically possible. They also predict that federal action will continue to force quieter aircraft and improve the assistance to local communities for land-use planning and implementation.

Finally, Northwest officials think there will be few, if any, major new airports built because their costs would be prohibitive, and because environmental regulations make it possible for people to keep an airport out of their backyards unless they happen to want it. For those cities with airports in their backyards, efforts by airlines such as Northwest show that an airport can be an accommodating neighbor—if it cares enough and recognizes its responsibilities.