Sound Advice

Helpful Information from ***Stewart Acoustical Consultants*** 919-858-0899
A member firm of the National Council of Acoustical Consultants

7330 Chapel Hill Road, Suite 101, Raleigh, NC 27607 www.sacnc.com

North Carolina Noise Ordinances with Sound Level Limits

By Noral D. Stewart, PhD FASA FASTM INCE

Most North Carolina cities, towns, and counties have some kind of noise ordinance. In most cases these are subjective ordinances with language that can be hard to interpret. Some have adopted ordinances with specified sound level limits. Unfortunately most of these are very poorly written, often with many different problems. A search for ordinances with specified limits applicable to sources in general or to amplified sound yielded the attached list of 50 North Carolina localities with such ordinances. This is not intended as a complete list. It includes those with ordinances posted online by two of the major companies that do so, and some of the larger cities and counties that do not have ordinances on those websites. This list does not include ordinances that limit sound from specific sources other than amplified sound. All ordinances will contain a list of exceptions and these vary significantly. Some communities also provide for special permits to allow higher sound levels. Normal practice is to specify different limits for day and night and for Residential, Business, and Industrial uses. The limits in most cases are appropriate for sound reaching a given use. Some history will help explain how the problems in noise ordinances have come about.

History of Noise Ordinance Development Nationally

Chicago, around 1955, adopted the first known local noise ordinance containing specific measured noise limits. It followed an extensive survey of existing city sounds. These were zoning regulations aimed primarily at industry and sounds that were relatively steady in level. The limits were the same day and night, with separate limits for sounds entering residential or business areas from an industrial area. Though the regulation called these "maximum" sound levels, the interpretation of "sound level" at the time was an eyeball average of the meter reading, not the instantaneous reading. Since A-weighting had not been strongly established for regulating environmental noise, the limits were expressed in octave-bands. The equivalent A-weighted levels were 61 dBA for sound entering other business areas, and 54 dBA for sound entering residential areas. The survey showed that only one percent of the industry in the city would need to make changes to meet the limits.

In the 1960's several developments influenced the writing of ordinances. First, the standards were changed regarding how octave-bands were defined. This required changes in instruments to measure octave-band levels as the old instruments could not measure according to the new standard. However, the new instruments also could not measure according to the old standard. Thus, within a few years it was impossible to accurately assess noise for compliance with the old ordinances. A-weighting came into stronger acceptance as an easier way to express limits with simpler measurement. It was recognized that not all sounds are steady. Ordinances began to include modifiers to the limits for sounds that lasted only portions of an hour allowing higher levels in such cases.

In the 1970's instruments began to become more sophisticated adding the capability to measure average sound level over a period, though this feature was initially expensive. With that advance, the interpretation of sound level read from a meter began to change. Previously the term "sound level" had referred to an eyeball average of the meter reading and such was used in interpreting and enforcing early ordinances. The limit was applied to this average, and not to the highest instantaneous sound level. However, with the advent of averaging instruments, the term "maximum sound level" came to mean the maximum instantaneous meter reading with a "fast" or "slow" time weighting. People began to interpret limits by this standard which effectively made them more restrictive. Recognizing this problem, communities not wanting to invest in an averaging meter adopted a sampling method of measurement. Readings were made 5 or 10 seconds apart for a specified number of readings or a specified time. Most of these required 100 readings 10 seconds apart. Since it was difficult to compute the proper average of these readings in those days, limits were set based on the level exceeded by 10% of the readings (L10) combined with a higher limit to avoid extremely high sounds lasting less than 10% of the measurement period. However, many localities continued to adopt ordinances based on simple sound level.

Also in the 1970's ordinances began to recognize that sounds with certain characteristics were more noticeable and annoying than typical random noise. These sounds tend to carry "information" or have characteristics that make them instinctively more noticeable. Examples are siren-like tonal sounds, repetitive impulsive sounds like hammer blows or continuous gunshots, music, speech, and dog barks. Ordinances began to contain lower limits for sounds that have these characteristics. This introduces difficulties in carefully defining "tonal" sounds and raises questions about freedom of speech in limiting speech. However, with regard to speech, a 1988 US Supreme Court opinion (Frisby v Schultz written by Sandra Day O'Connor) held that "There simply is no right to force speech into the home of an unwilling listener." The court held that the right to peaceful enjoyment of the home outweighed restrictions on speech as long as those wishing to speak had options to speak in such ways that did not infringe on the rights of the homeowner. Clearly this applies only to residential properties.

In recent years less expensive averaging meters that can also usually report the maximum level and even in many cases the 10 percentile level (L10) have become readily available. These make it much easier to obtain measurements, but local governments in North Carolina at least have been slow to recognize this. Even worse, most localities have not recognized the difference between an acceptable limit for a sound that lasts a long time and brief intermittent sounds that do not recur regularly. Governments have apparently recognized that the typical limits intended to apply to average levels or L10 are too restrictive as limits on the level never to be exceeded even for a short period. Instead of writing ordinances to address different situations, it appears that many communities have simply increased the limits by 10 to 15 dB, making them more appropriate for occasional sounds, but totally unacceptable for continuous sounds. Another trend that leads to the same problem is to apply limits based solely on the source of the sound without regard to the use of the property that is impacted by the sound. Typically what happens is that an ordinance that included limits appropriate for sound reaching a residential, business, or industrial property is modified to say instead that the limits are interpreted as applying based on the source of the sound. By either using this interpretation or by simply raising limits, we find situations today where ordinances actually allow sound up to 75 dBA 24 hours a day continuously on residential properties. Some communities allow high sound levels every weekend at all places meaning people in those communities never can enjoy a quiet weekend.

The Better North Carolina Ordinances

Among the ordinances listed, the best are those of Apex, Cumberland County, Fayetteville, Garner, Lumberton, and Raleigh. These along with Lenoir County are based on the level exceeded for 10% of a reasonable time period which allows brief higher sound levels while limiting sound that last a long time. Each of these has some problems. The Lenoir County ordinance has had the limits for residential properties deleted from the original version so that residential properties are only protected to levels appropriate for business or industrial uses. Apex, Cumberland County, Fayetteville, and Garner fail to indicate whether the fast or slow time weighting is to be used in the measurement. This can make a significant difference with varying sounds. Apex, Lumberton, and Raleigh base the limits on the zoning of the impacted or receiving property regardless of actual use. Thus, a home that is in a non-residential zone has little protection. Some large communities in Raleigh are built in areas zoned non-residential. Cumberland County and Fayetteville impose their limits at the boundary of the source property even if it is not contiguous with the complainant. Only Apex and Lumberton among these impose an absolute maximum level on sounds lasting less than 10% of the measurement period. The Garner ordinance is a Zoning Ordinance applicable only to new sources. The night-time limits in Lumberton and Raleigh residential areas would put many air-conditioning systems in violation. Among the good features, the Garner ordinance contains lower limits if the sound is tonal, repetitive impulsive, or cyclical. Raleigh and Lumberton are unique in that they vary the limits reaching residential and business properties depending on both the source and receiver usage by averaging the limits for the different usages when they are not the same. Apex has recognized the problem of sources near a boundary so the level might exceed the limit only close to the boundary. The Apex ordinance requires measurement at least 10 feet inside the boundary of the complainant property.

The Major Problems in North Carolina Ordinances

Many problems are common to several ordinances in North Carolina.

1. Use of old Pre 1962 octave bands – Modern instruments cannot measure sound in these bands. It is possible using modern third-octave instruments in some cases to show the limits are met or exceeded, but not in all cases. Four localities, Gaston County, Lincolnton, Mount Airy, and Reidsville have such ordinances. The limits for sound reaching business areas are copied from the 1955 Chicago ordinance (though with a typographical error in three of the ordinances). However, the limits for residential areas have been increased. On the positive side, these ordinances have lower limits for night in residential areas, lower limits for tonal and impulsive sounds, and higher limits for sounds that last only a small part of an hour.

2. Failure to indicate fast or slow time weighting – When a measurement is based on a reading of a simple meter it is essential that the time weighting be specified. Meters have two standardized time-weightings or responses. "Fast" corresponds most closely to human perception, but results in a rapidly varying needle or display that can be hard to read. "Slow" averages the sound over about a second, providing a more slowly varying indication that is easier to read, though the maximum indicated level will be lower than with "fast" response. Most ordinances specify "slow" because it is easier to read. The following ordinances do not clearly specify which time-weighting to use: Apex, Boiling Springs Lakes, Charlotte, Cumberland County, Town of Davidson, City of Durham, Fairmont, Fayetteville, Garner, Gaston County, Jacksonville, Liberty, Lincolnton, Mount Airy, New Hanover County, Reidsville, Selma, and Wake Forest.

3. Failure to clarify applicable limit when the "use" of the source and receiver property differ – Limits are appropriately different for sound reaching residential, business, or industrial properties. Some ordinances show limits appropriate for sound reaching a receiving property but fail to clearly specify that the limit is based on the use of the receiving property. As long as the source and receiving property usage is the same, this is not a problem. However, most problems occur for sound coming from business or industrial properties to residential properties. Without clarity, this leaves open the possibility that the limit is interpreted as based on the source property use allowing for instance sound from an industrial plant reaching a residence to be limited only to the level appropriate for sound reaching another industrial plant. Among the locations where this is unclear are New Hanover County, Carolina Beach, Wilmington and the four localities with the ordinances based on old octave bands.

4. Using limits developed as appropriate for a receiving land use, but applying them based solely on the source land use – This often occurs when an ordinance originally developed with a table of limits based on the receiving land use is modified by inserting a sentence that says effectively that the limits are based on the source property usage. This results in a situation where a residence is allowed to put much less noise on an industrial than the industrial plant is allowed to put onto the residence. This effectively allows the industrial use to take over and use the residential property to disperse its noise as though the neighbor was an industrial property without providing appropriate buffer area or noise control. This essentially gives residents who find a major noise source built next to them no protection and in fact makes it worse since the ordinance effectively says the community finds it acceptable. This apparently occurs when the adopting organization is concerned that the ordinance will otherwise be too restrictive on industry. Among the communities where this occurs are Currituck County, Greenville, Maggie Valley, Nags Head, Thomasville, and Wilmington. Lenoir County has effectively achieved this by repealing the limits for residential properties.

5. Specifying the same limit for all property uses, either too high for residences or too low for business and industrial areas – Clearly residential areas need and expect lower sound levels than industrial areas. However, some communities set one set of levels for all uses. Among those with limits the same for all uses and too high for residential areas when applied to steady continuous sounds are Boiling Springs Lakes, Charlotte, Greensboro, Havelock, and Hendersonville. Among those with limits the same for all uses and too low for but applied to situations where there is an industrial uses adjacent to the source are Chatham County, Creedmoor, Durham, Mount Olive, and Waynesville.

6. Specifying the same limits day and night – The same limit in residential areas in particular is going to be either too restrictive in daytime or not restrictive enough at night. Among the localities that do this for residential areas are Cary, Charlotte, Mecklenburg County, Monroe, Red Springs, and Selma.

7. Specifying limits appropriate for continuous sounds without an appropriate measurement method or any options for higher levels for brief events, meaning that brief events that are not a problem become violations – This is very common as the commonly referenced limits were established for continuous sounds yet the most common measurement method is simple sound level. This occurs in Camden County, Cary, Chapel Hill, Chatham County, Creedmoor, Currituck County, Mecklenburg County, Monroe, Mount Olive,

Nags Head, Orange County, Red Springs, Thomasville and Waynesville. Depending on interpretation of unclear measurement methods, this could occur in Town of Davidson, Durham, Fairmont, Kill Devil Hills, Selma, and Wake Forest. While the Wake County general ordinance is based on an L10 measurement, the number of samples is so small that it effectively becomes a maximum level limit.

8. Specifying limits appropriate for the maximum level of brief events without any lower limit for continuous sounds, meaning that continuous sounds are allowed at unacceptably high levels – This is similar to the previous problem except the limits in this case are too high for continuous sounds. This applies to Boiling Springs Lakes, Charlotte, Greensboro, Havelock, Hendersonville, Jacksonville, and Liberty.

9. Specifying night-time limits so low that everyone's air-conditioning condenser is in violation – Typical night-time limits for residential area are in the range of 45 to 55 dBA for continuous sounds such as an air-conditioning condenser, the outdoor unit with a fan on top that sits outside the house. However, these are often so close to the boundary that they often exceed 45 dBA at the boundary and will sometimes even exceed 55 dBA at the boundary. However, at these close distances the sound is decreasing fairly strongly with distance so it would not be above the limit once you get a few feet from the boundary. While 45 dBA can be a reasonable night-time limit for rural and suburban areas with large lots, it is inappropriate for more densely populated areas. While a 50 or 55 dBA limit is more reasonable in densely populated areas, even that may be exceeded in areas near a boundary by nearby equipment. Raising the limit creates problems by allowing excessive noise over the whole property when the source is far away. One way to handle this is to make the limit applicable some distance 10 to 20 feet inside the complainant boundary. The town of Apex has done this. The lowest night-time limits of 45 dBA are in Chapel Hill, Lumberton, Raleigh, and the Wake County zoning code.

10. Specifying higher limits for every Friday and Saturday evening without any permits required – Weekends and weekend evenings in particular are times when people want to be able to enjoy the peace and quiet of their homes. It is also a time when other people wish to engage in noisy activities such as outdoor music and automobile racing. Balancing these conflicting desires can be difficult. The concept of allowing higher levels on weekend evenings up to a point, with even higher levels allowed with a permit for special occasions, seems to have originated in Chapel Hill due to fraternity parties. This was copied by other towns with a strong college presence. In recent years, this practice has spread as way to allow businesses extra sound for entertainment on weekends without considering specific situations on a case by case basis or limiting it to an "entertainment district." This creates a situation where no one in the jurisdiction can have any assurance that they will ever have a quiet weekend. Neighbors could dominate their property every weekend. Some of these ordinances only allow the increased sound from non-residential sources which helps those homes not near business or industrial areas. Some limit it to "commercial establishments" and in some cases specifically to those that seat at least 1000 people. The communities that allow increased weekend sound from any source include Camden County, Chatham County, Maggie Valley, and Thomasville

11. Failing to recognize that some sounds that contain information content and are designed to get attention (music, speech, siren-like sounds from some mechanical equipment, impulsive sounds like gunshots, dog barks) are more intrusive and disruptive than random noises and thus can justify lower limits – Only the Garner zoning code, the Wake County zoning code, and the ordinances based on the old octave bands currently include any more stringent restrictions on some such sounds though none of these address music or speech. Lenoir County originally had lower limits for tonal and impulsive sounds and speech and music, but these have been removed. Many ordinances allow higher sound from amplification systems than from other sources.