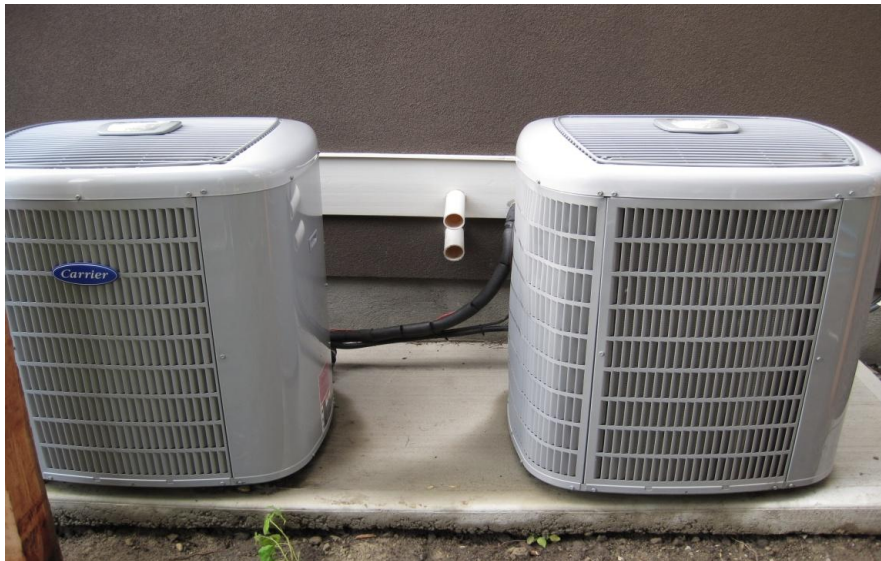


Not Cool: Central Air Conditioner Noise in Calgary's Narrow Sideyards Background and Solutions

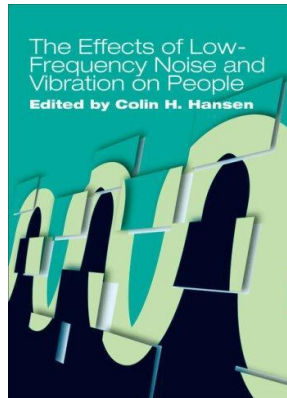
http://www.quiet.org/readings/a-c_sound%20advice.htm

For the five months from May to October each year, growing numbers of victimized families across the city are being assaulted by a next-door neighbour's improperly located central air conditioner(s). Air conditioners installed at lot lines in narrow, sound-reflective sideyards -- **sometimes only several feet from ground-floor bedroom walls, windows and living areas** -- are wreaking havoc on the health and quality of life of neighbouring families by pounding them with audible fan noise, inaudible infrasound and low frequency noise (LFN), the latter often creating vibration in the house structure which then radiates into rooms as skull- and body-piercing resonance. After one night of that abuse, you wake up feeling nauseous with brain fog for hours afterward. Daytime is no better. Shouting matches over this intolerable violation of basic human rights are now common in many neighbourhoods across the city.
<http://tinyurl.com/LFNimpact> + <http://tinyurl.com/LFN-in-Homes>



Imagine having these sideyard “twins” belting out LFN six feet from the headboard of your bed. In Calgary, it’s A-okay!

That chronic LFN abuse is no minor annoyance. The negative health effects include intolerable sleep disturbance, psychological harm and chronically elevated stress hormones which can significantly increase heart disease, blood pressure, strokes and immune problems. Some victims are actually selling up and moving out of town after being subjected to this nightmarish decibel hell. Others are avoiding affected parts of their home -- bedrooms, home offices, and living areas -- in an effort to maintain their health. During a recent summer -- one of the coldest and wettest on record in Calgary-- my family endured 85 days of that resonating abuse. Home as a peaceful sanctuary? Not anymore. I piled 80 sandbags (\$500) against my fence next to the neighbour's AC unit in a futile attempt to stop the LFN barrage and most of the noise simply flanked around the pile. **Because the City of Calgary has no required minimum sideyard setback for air conditioners and the worst residential noise bylaw in Canada (set at *industrial levels* and not enforced at the lot line), AC installers are having a field day here, placing these giant noisemakers in narrow sideyards with absolutely no consideration for the neighbours and no regulatory consequences.** **Out of the many complaints that have been made to the City regarding AC noise-vibration, virtually none have been resolved in favour of the victims.** Is justice being served? Absolutely not. Our substandard Land Use and Community Standards bylaws favour irresponsible builders and AC installers not the neighbours who suffer next door.



City council must address the AC noise issue immediately. Open houses regarding motorcycle muffler noise were undertaken to gauge public opinion on that issue but nothing has been done on the AC front -- yet it may impact people 24/7 directly in their homes and property. According to the World Health Organization, noise is the second-worst environmental cause of illness next to ultra-fine particulate matter so it certainly ranks as a valid health threat. Normally, only five to ten percent of noise victims lodge an official complaint because they aren't aware of their right to complain or how to do it, or they'd like to avoid setting off a lifetime "Hatfields and McCoys" type feud. Many victims have also stopped complaining to their elected representatives and Bylaw Services because repeated pleas for help are simply ignored due to lax regulations or disinterest. The number of impacted homes, therefore, could easily be more than 20 times the reported total. The ongoing AC problem needs to be dealt with as soon as possible or more of these throbbing machines will be dropped at lot lines, destroying the health and quality of life of the besieged neighbours. Most major municipalities around the world have addressed this serious noise issue and regulated the placement of central air conditioners. **It is ludicrous that the City of Calgary prohibits the nighttime use of small power tools outside a home -- also prohibiting open compost piles within 10 metres of an adjacent house -- yet allows your neighbour to operate two large central air conditioners with pulsing compressors in a narrow, sound-reflective sideyard less than two metres from your bedroom and living areas, day and night!**

As a knowledgeable victim who has studied and discussed this issue with bylaw and noise experts worldwide for several years and actually lived in warm climates where air conditioners are common -- in Windsor, Ontario, which is Canada's hottest, most humid city, and Melbourne, Australia where temperatures top out at 46 degrees C -- may I make some suggestions for equitable solutions (with full discussion following below)?

Proposed Action Plan:

Under the Land Use Bylaw

- 1) Prohibit, or strictly regulate by permit, the installation of air conditioners in narrow, sound-reflective sideyards (where total distance between homes is 5 metres or less).** This is a standard government and AC industry recommendation: <http://www.quiet.org/documents/Denverpermit.pdf> .
- 2) Establish a minimum required installation distance from the side lot line.** Distance should be based on noise emission not an arbitrary figure. The farther away a noisy AC fan and LFN-emitting compressor is from a neighbour, the better -- especially if two air conditioners are being installed.

Under the Community Standards Noise Bylaw

- 3) Set the "Point of Reception" for sound measurements at the property line to update enforcement to the standards of other major municipalities in Western Canada** (Edmonton, Vancouver, Victoria, etc). All sound measurements should be made in a clear, unobstructed location as close to the noise source as possible (i.e. above a fence, not in the sound shadow behind it).

4) **Daytime:** Set the maximum allowable for air conditioners to 5 decibels (dBA) above ambient background or 50 decibels (dBA), whichever is higher (as measured at any point along the property line). In noisier areas, a maximum limit cap should be established to protect residents.

5) **Nighttime:** To encourage the use of sustainable house design – especially if AC owners are adding to the problem with unshaded windows, oven use on hot days and other irresponsible behaviour – **the operation of residential air conditioners should be restricted between 10pm and 7am weekdays and 10pm and 9am weekends on a complaint basis only.** Alternatively, set the maximum allowable for air conditioners to 3 decibels (dBA) above ambient background or 45 decibels (dBA), whichever is lower (as measured at any point along the property line). **Note: Both Melbourne and Sydney, Australia -- cities which exceed 4 million in population -- prohibit the domestic use of an air conditioner overnight if any neighbour in the vicinity can hear it. In the more humid, tropical areas of Australia (Cairns and Townsville, for example), the nighttime AC noise cap is 3dBA above ambient background levels.**

6) **Cap the daytime and nighttime decibel allowables as absolute maximums,** not starting points to be added to as is current practice. By allowing three or four decibels on top of our legal maximums (bylaw officers do this routinely in the field), the sound intensity is effectively doubled, equaling the noise of two air conditioners not one: http://www.quiet.org/readings/decibel_expl.htm . The legal maximums should not be exceeded and 5dBA penalties should be added for tonality, impulsiveness or intermittency.

7) **Add a useful "General Prohibition" which will act as a second-tier mop-up for chronic noise that meets the specific lawful allowables but is still irritating** (think fingernails scratching down a chalkboard). **Also add a clause to the General Prohibition to address vibration and resonance in adjacent homes. This second-tier protection is a critical component of an effective noise bylaw.**

8) Remove the all-too-generous, discretionary powers of Testers, in order to maintain fair, replicable measurements and standards (see points 3 and 6).

9) Cap the continuous sound measurement average for air conditioners to a ten (10) minute period, not one (1) hour. Adjust the section "Continuous Sound in Residential Developments", 28. (1) and (2) to reflect the new time period.



Sign of the times in a sideyard in Calgary

Bottom line? Central air conditioners need to be kept out of sideyards in established communities and modern noise bylaw standards adopted to govern AC sound output. An education campaign should be undertaken at the same time to reinforce the need for installation of quieter units away from neighbouring properties (along the lines of Vancouver's Soundsmart program:

<http://vancouver.ca/home-property-development/learn-what-you-can-do.aspx>). Worldwide, air conditioner noise is a growing concern in developed countries. **In Alberta, from 1990 to 2008, the number of central air**

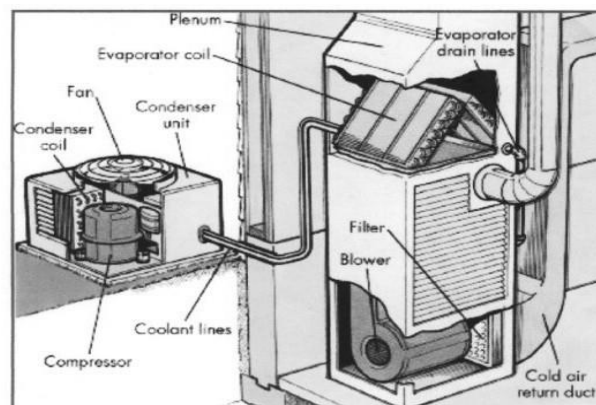
conditioners installed annually has quadrupled and will continue to increase at a fast pace

<http://tinyurl.com/Alberta-AC-growth> . Over roughly the same time period, energy used by residential air conditioners in Canada almost tripled (increasing by 266%) <http://oee.nrcan.gc.ca/publications/statistics/sheu-summary07/air-conditioning.cfm?attr=0> . If City Council is truly interested in meeting the objectives of its ambitious Community Greenhouse Gas (GHG) Plan for conservation and efficient use of energy, it should have a hard look at the current wasteful use of residential air conditioners due to poor house design and irresponsible owner behaviour. **According to one common-sense source: "Mechanical heating and cooling should never be used as a substitute for good design."** That philosophy needs to be adopted and followed in cool climate Calgary, where owners of "hot box" infills (large 2-storey, dark stucco, no extra insulation, black asphalt-shingled roof, unshaded closed windows) are running central air conditioners when outdoor temperatures are below 10 degrees C. (Carrier, the AC manufacturer, actually advises: "Do Not Operate Below 55°F/12.78°C: Your outdoor unit is not designed to operate when outdoor temperatures are lower than 55 F/12.78 C without modification.") In most climates, a drop to 10 degrees C is cause for indoor heating, not cooling. Urban sustainability? Hardly. Chronic AC use = Major Energy Consumption = Increased GHGs + Air Pollution from Alberta's fossil-fueled electricity production. For a critical look at the issue, refer to the following book: <http://tinyurl.com/Losing-Our-Cool> .

Central air conditioning offers an extremely selfish, one-sided benefit to owners: the condenser unit (with its noisy fan and pulsing, LFN-emitting compressor) is located outside the home, thus offering a much lower level of indoor noise than a free-standing interior or window air conditioning unit. That might be a boon for owners, but it's an intolerable burden to neighbours if located next to their home, especially if they live in a bungalow with ground floor bedrooms. The burden of noise and other nuisances should remain on the property of the owner/user.

"The sound of a dishwasher in the kitchen directly impacts the owner/user of that product, but the owner/user also gets the benefit of the product. But in many cases, the effects of product noise are also borne by others who do not get the benefit."

Richard Lyon, in Foreword of *Handbook of Noise and Vibration Control* (2008)



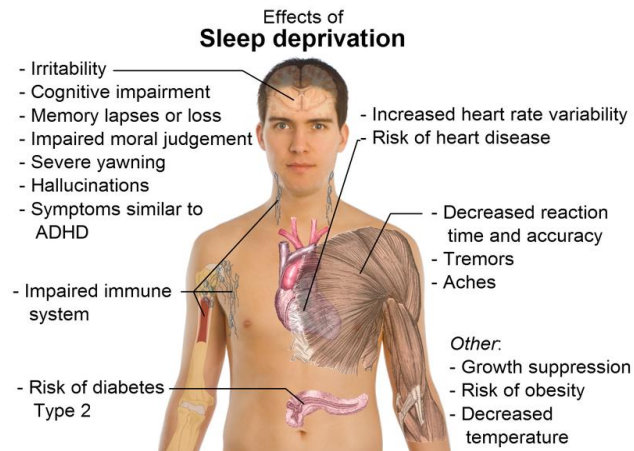
The noisy compressor is located outside the building, leaving the quiet on the inside.

ANSI/AHRI (USA) Standard 275 (2011): "Location. Outdoor [AC] units should be placed on sites chosen to minimize sound heard by building occupants and/or neighbors. This is accomplished by choosing a location that results in the lowest equipment location factor [no reflective surfaces and greatest distance between adjacent buildings], the highest barrier shielding factor [corner of owner's house as barrier or a heavy continuous masonry wall], and the greatest distance to sound sensitive areas." Note: Installation examples use no less than 15 feet or 4.6 metres to a shared property line.

AIRAH Code of Ethics (world's best practice) Australian Institute of Refrigeration, Air conditioning and Heating: <http://www.quiet.org/documents/Code2010.pdf> + <http://tinyurl.com/mgvh246>

"1. Responsibility: The welfare, health and safety of the community shall at all times take precedence over sectional, professional and private interests."

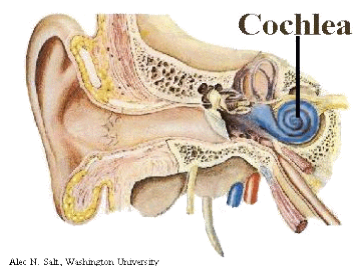
The AC code of ethics in Calgary is based solely on allowable municipal regulations. If the city allows health-destroying sideyard installations, AC installers will do them with absolutely no hesitation or thought for the neighbours, some of whom have lived peacefully in their homes for decades. A troublesome, LFN-emitting central air conditioner can be easily moved; a home cannot.



“If you sleep less than 6 hours per night and have disturbed sleep, you stand a 48% greater chance of developing or dying from heart disease, and 15% greater chance of developing or dying of stroke”—Francesco Cappuccio, MD

[Francesco Cappuccio, MD](#), is the *Cephalon Professor of Cardiovascular Medicine & Epidemiology*, University of Warwick School of Medicine (UK). He is also the Head of the World Health Organization Collaborating Centre for Nutrition, and Director of the European Centre of Excellence in Hypertension and Cardio-Metabolic Research.

LFN and infrasound from central air conditioners -- whether installed in the sideyard or backyard or anywhere else -- are major health issues, not minor annoyances. Dr. Alex Salt, of the Washington University School of Medicine, recently discovered that parts of the inner ear react visibly to infrasound. His research shows that the ear does respond to low-frequency sound even though we do not perceive it as sound. A 2010 paper by Salt demonstrated that the human ear might have more acute sensitivities to LFN, like that produced by air conditioners, than previously thought: <http://tinyurl.com/infrasound-ear>.



What you can't hear, can hurt you! I know this by firsthand experience: Ear plugs do not stop the LFN and resulting resonance from going through your body and skull. Chronic stress of this kind leads to higher levels of cortisol in the blood and higher blood pressure which can lead to heart attack and stroke. That's no surprise to **Dr. Rokho Kim, head of the World Health Organization's urban noise task force**: "I think it's fair to say that there's a higher biological plausibility for noise as a trigger of heart disease than air pollution." According to the WHO (see #5 in this link <http://tinyurl.com/noise-deaths>), each year more than 200,000 victims die from the effects of chronic noise pollution worldwide -- especially that from LFN which includes traffic noise. Chronic elevated cortisol levels also affect the brain: The rise in

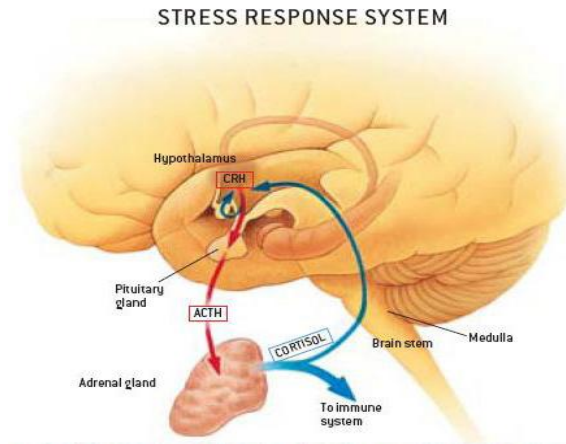
cortisol is a normal response to stress to help us cope, but when the stress is over, cortisol levels should return to normal. With chronic stress, however, this does not happen and cortisol levels stay high with disastrous consequences for the brain. Cortisol affects the hippocampus, which is the part of our brain that helps sort and store memories. It prevents it from taking up glucose; it also slows nerve impulse transmission and eventually can lead to death of brain cells. Excessive, chronic air conditioning noise -- especially the unmeasured LFN and infrasound portion -- can destroy your health.



Dr. Bengtsson (<https://sites.google.com/a/ryberg.org/www/bengtsson> pdf link, page 21) **summarizes the effect of LFN on victims in work situations including home offices:** **" 'A feeling of relief' is commonly reported when low frequency noise is turned off, even if the person was not aware of the noise when it was present** [Landström *et al.* 1991; Kjellberg and Wide 1988]. Empirical findings also suggest that a low frequency noise is more difficult to ignore or habituate to, as compared to other noises not dominated by low frequencies [Benton 1997]. Low frequency noise has also been suggested to act as a background stressor, and the result can either be direct intrusion by affecting attention or a displacement of cognitive and perceptual processes [Benton and Leventhall 1994]. These studies can be interpreted to mean that low frequency noise acts as some kind of background stressor that the central part of our auditory system tries to filter out in order for us to be unconsciously aware of the noise signals. This filtering process is however believed to be energy demanding and hence to influence our mental capacity. **People annoyed by low frequency noise have described it in terms of "it feels all around", "cannot be ignored", is "worse indoors", "cannot locate it" and also "tuned into it" [Benton 1997].**

Furthermore, low frequency noise can be perceived as annoying and causing interference even though it is not experienced as very loud. If there is little or no habituation to low frequency noise, low frequency noise will interfere with and demand a subject's attention. This can result in an impaired ability to process and perform mentally demanding tasks, due to a competition between available mental resources. As a result, the tasks may be additionally strenuous as the subject uses part of her mental capacity on the noise exposure. This may lead to lower performance capacity and/or quality. **The results from two studies indicate that the effort to cope in low frequency noise during work develops over time and, it could therefore be more demanding over time to work during exposure to low frequency noise** [Benton 1997; Persson Waye *et al.* 1997]." Regarding lingering effects of elevated blood cortisol levels, Bengtsson made the following observation on page 29: "Osguthorpe and Mills [1982] found that exposure to continuous low frequency noise at 84 dBA for 24 hours or 90 dBA for eight hours altered the circadian pattern of cortisol in plasma. The subjects usually slept or read during the exposure, as they were restricted to sedentary pursuits. The cortisol levels were still elevated 24 hours after the onset of both noises, despite the fact that the subjects exposed to 90 dBA had been in quiet conditions for 16 h."

That last point is very important: the victims next door may have rest days in between chronic AC abuse (if the temperature plummets) yet still have elevated levels of cortisol from noise stress. The impact of that LFN and infrasound abuse does not magically disappear as soon as the AC stops. The example given in that paper is of higher noise levels but I can tell you from personal experience that it applies at lower levels as well. My family had 85 days of AC abuse directly in a recent summer, but the impact stretched for more than that because of the lingering effect of elevated cortisol levels. It takes me at least two days after point blank AC noise stops before I start to feel normal again.



LFN or Infrasound = Increasing Levels of Stress Hormones = Greater Risk of Heart Failure, Strokes, High Blood Pressure + Immune Problems. All thanks to improper air conditioner installation due to inadequate municipal regulations and a lax industry code of ethics.

FULL DISCUSSION (the numbered points below match those listed above):

Installations in narrow, sound-reflective sideyards are not recommended anywhere in the world!

"Where will the air conditioner be installed? Air conditioners should not be located adjacent to neighbours windows, bedrooms or living areas." (Air Conditioning Residential Best Practice Guideline, Victoria, Australia 2003)

"The siting of the air conditioner is the most important factor to ensure noise is not going to be intrusive. Placing the unit at the side of your house close to the neighbour's house is likely to create excessive noise, as the noise is trapped and reflected between the walls and eaves of the two houses. A fence has limited value in reducing the noise in this situation, unless it is solid and is as high as the eaves of the houses. Placing the air conditioner on the rear wall facing the backyard, or on a front or side wall facing the street, reduces the noise reaching neighbours. Also, if the noise is found to be excessive, it is a simple task to construct a barrier to shield the neighbouring property from the noise." (Air Conditioner Noise in Residential Areas 2008, http://www.noise.act.gov.au/files/Air_Conditioner_Noise_in_Residential_Areas.pdf)

"When installing mechanical devices outdoors, both location and installation techniques are important. One location to avoid is your side yard, or the small narrow space between your house and your neighbours. Noise levels can be further reduced by installing a sound shield around exterior mechanical equipment." Vancouver Soundsmart Booklet 2005 p. 15

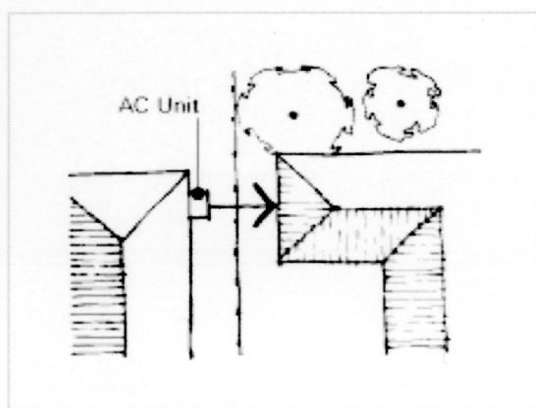
Foreword from *Air Conditioning Residential Best Practice Guideline Series*:

The use of residential air conditioning systems in Australian homes has steadily increased over the last 10 years. Currently there are over 650,000 residential air conditioners sold in Australia annually and forward estimates indicate that this figure will continue to rise. The increase in use of residential systems has generated an increase in complaints about noisy air conditioners. Noise is an integral part of our society today. No-one can escape noise completely, but **if our towns and cities are to remain liveable, it is important to manage the negative impacts of environmental noise on people within their homes.** As a supplier, installer and maintainer of residential air conditioning systems, you have a professional obligation to make sure that every practical and reasonable effort is made not to compromise our quality of life through noise related issues. AIRAH is pleased to be involved in the development of these guidelines which are aimed at improving installation practices

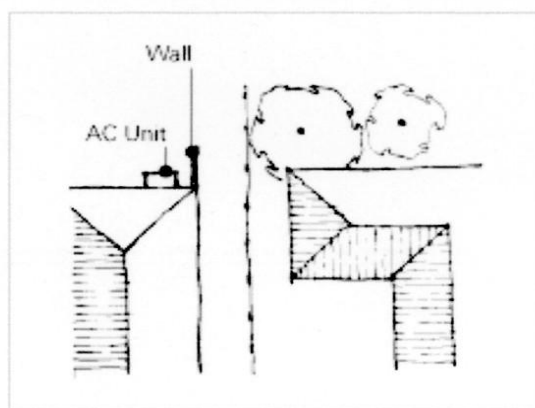
thereby minimising and reducing inappropriate noise from air conditioning systems. This document represents an important step forward in coordinating Council, community and industry action in managing environmental noise. **It contains fundamental guidelines to protect both yourself and your customer from actions that may result in fines and/or legal action.** Follow the basic steps outlined in this booklet and help "design out the problem." Jennifer Pelvin, Chief Executive AIRAH" <http://tinyurl.com/AIRAHBestPractice>

"POSITION: Finding the right position for your air conditioner is one of the most important decisions. If you place the unit close to your neighbour's house, especially the bedroom, it is likely to create more of a nuisance. For example, when houses are built close together the noise is trapped between the walls and eaves and can become louder. Try placing the air conditioner on the rear wall facing the backyard or on a wall that faces the street." (Townsville City Council <http://www.townsville.qld.gov.au/council/laws/Documents/Fact%20Sheet%20-%20Airconditioners.pdf>)

"Relocating the [AC] Outdoor Condensing Unit or Heat Pump: As the condenser units produce a continuous, steady sound while operating, the owner will most likely locate the unit as far as possible from his or her bedroom or outdoor living area. This often means that the unit is placed near the adjacent residential property which may result in noise impact and annoyance to the neighbour. Before permanently installing the unit, a location should be selected that will minimize the noise impact at nearby property lines. There are several installation locations that should be avoided due to their ability to actually increase the noise level. Described briefly, they are a) within 10 feet of a wall; b) within 10 feet of two adjacent walls (such as a corner); and, **c) within 15 feet of two opposite walls (such as between two houses).**" (*Environmental Noise Guidelines for Installation of Residential Air Conditioning Devices* 1994 Ontario page 28 <http://www.quiet.org/documents/GuidelinesAirConditioners.pdf>)



Unsuitable location for air conditioning unit



Suitable location for air conditioning unit

Under the Land Use Bylaw

1) Prohibit, or Strictly Regulate by Permit, Narrow-Sideyard Installations: **Bylaw Services will confirm that virtually all of the complaints regarding central air conditioners in Calgary are those that are installed in sound-reflective sideyards near lot lines.** A good number of the existing units need to be moved. See page 28, "Relocating the Outdoor Condensing Unit or Heat Pump", in *Environmental Noise Guidelines for Installation of Residential Air Conditioning Devices* (linked above): "Before permanently installing the unit, a location should be selected which will minimize the noise impact at nearby property lines. There are several locations which should be avoided due to their ability to actually increase the noise. Described briefly, they are...c) within 15 feet of two opposite walls (such as between two houses)." Avoided? Not in Calgary. That location is exactly where the majority of central air conditioners are currently being installed. Not only is that behaviour viewed as unprofessional worldwide, it is also seen as unethical. The good news? Those troublesome units *can be moved*. The installation

distance from the furnace ranges up to a generous 50 feet or 15 metres. Cost to relocate a unit? Approximately \$1200 based on a quote given in 2010. Cost for a professional sound enclosure (which at close range doesn't stop LFN impact) is \$6500 minimum based on a quote from acoustical engineering firm Noise Solutions Inc.

Clearly, it's cheaper to move a unit than try to properly enclose and soundproof it. Since these units are sometimes less than an inch off the lot line, there's actually no space to even build a proper enclosure. With no setback from lot lines, AC compressors are pulsing out LFN and infrasound from almost point blank range. Sound enclosures around AC units do not work well at close range because of the need for heavy material to drop the low frequency noise and infrasound coming from the compressor (and that's what's causing the problem here in Calgary). I know this because I brought in LFN experts Noise Solutions Inc to have a look at the situation: <http://tinyurl.com/ERCB-LFN> . AC units can be mounted on solid foundations -- cement pads, concrete blocks etc -- but the compressor will still create "forced vibration" if the next door neighbour's house structure happens to like the particular frequency emitted from the AC unit. **The house wall will vibrate on a small scale and radiate a resonance into affected rooms. It may seem like nothing over a short visit but like skin-burning UV rays it becomes intolerable if received on a chronic sustained basis.**

<http://www.physicsclassroom.com/class/sound/u11l4b.cfm>

Next to the rated noise output of individual units, location is the most important factor when installing central air conditioning. Unlike a window unit, central AC has a lot of leeway when it comes to placement. Most large municipalities worldwide govern the location/placement of AC units and recommend that they are kept well away from noise-sensitive locations such as a neighbour's windows, bedrooms and living areas. Vancouver's Soundsmart brochure and booklet caution: *"Mechanical Systems: Carefully consider the location of loud outdoor mechanical devices. For example, an air conditioning unit located in a sideyard, the small space between your house and your neighbour's, will create a lot of noise for the people living next door."* **Vancouver does not allow sideyard installations.** Concerned citizens of that city -- with full council and municipal support -- produced an Urban Noise Task Force report in 1997 with the following recommendations regarding air conditioners (note that the committee had no representatives from special interest groups from the building industry which cause the problem <http://former.vancouver.ca/ctyclerk/ccclerk/970513/citynoisereport/>):

"35. Air conditioning, vents and pumps

These devices represent an increasing problem, especially in new condos and mixed-use areas. They are not dealt with adequately in present by-laws. For new buildings, the building permit process should control the location of air conditioning, heat pumps and vents, but in existing units there are no effective controls.

Recommendation 35.1

The City should amend the Plumbing and/or Building By-Law to control the position of all air conditioning, pumps and vents, placing them where they will present no noise problems.

Recommendation 35.2

The City should not grandfather existing units in the by-law amendments.

Recommendation 35.3

The City should address vibration issues, where residential accommodation is affected, in a by-law."

The lesson for Calgary? Keep the units out of sideyards and away from neighbouring properties. Address obvious inadequacies by protecting neighbours with stronger land use and noise bylaws. But, most importantly, **deal with AC installation upfront at the development permit stage.** There is a myth -- one propagated by the building industry -- that central air conditioners do not create a problem if they are properly installed on cement foundations and rubber padding. The truth? LFN and infrasound emanate from the compressor through the air as well as ground and can act on the harmonics of the house

structure next door regardless of installation method. Ask any victim. Shielding the compressor with a lead blanket reduces the impact slightly but does not make the problem disappear.

2) Establish a Minimum Required Setback from the Lot Line. To keep mechanical equipment out of sound-sensitive sideyards, most minimum required setbacks start at 1.2 metres and go from there all the way to a suggested 25 feet (example: Los Altos, California <http://tinyurl.com/LosAltosAC>). In Calgary, there is no required setback at all: AC units are going in as close as half an inch from the lot line. Throbbing compressors are almost on top of the neighbours and are pounding through walls/windows. This is totally unacceptable. Voluntary guidelines do not work. **A permit system would be the most effective method of controlling this ingrained, unethical installation behaviour.**

In June 2008, Calgary's Land Use Bylaw was amended to address this issue. A bare minimum setback of 1.2 metres was adopted which was immediately attacked and lobbied against by special interest groups from the building industry, the same groups responsible for improperly installing AC units in narrow sideyards across the city, thus creating widespread neighbourly noise complaints (only a fraction of which reach City Hall).

Regardless of what those special interest lobbyists told council, the building industry wants to continue this health-destroying practice primarily for two simple reasons: It's cheaper to install AC in this manner and it keeps the noisy mechanical equipment out of the owner's backyard. Absolutely no thought is given to the neighbours next door. **As a result of that intense lobbying effort, on July 24, 2008, the Calgary Planning Commission put forward a recommendation to council to amend Land Use Bylaw 1P2007 for "accommodation of central air conditioning units in side setback areas in the low density residential districts"** (as documented on pages 20 and 21 in Report CPC2008-098 (M-2008-040).doc, THU Sept 04 09:25:47 2008). The timing couldn't have been worse: That ill-conceived recommendation by the Calgary Planning Commission was made at the very same time that sideyard central air conditioner noise was topping Calgary's 3-1-1 noise complaints list:

Air Conditioning Units in Side Setback Areas

Bylaw 1P2007 contains a rule preventing the location of central air conditioning units in a side setback area, reflecting a principle established by Council in 1994 that free and clear access should be provided between a front and rear garden. However, the building industry has requested that central air conditioning units be regulated in the same way as other building projections (i.e. fireplaces, etc.), and that they should be allowed provided that at least one side setback area is kept free and clear of projections. The amendment proposes that central air conditioning units be permitted to project 1.0 metres into one side setback area provided that the other is kept clear of projections from the building to allow for passage from the front of the dwelling to the rear. Items 80 through 82 address this issue.

Without this amendment, central air conditioning units would not be allowed in any side setback area.

80. Removed at the request of the Administration.			
81.	337(9)	Air conditioning equipment, <i>balconies</i> and <i>decks</i> must not project into any <i>side setback area</i> .	<i>Balconies</i> and <i>decks</i> must not project into any <i>side setback area</i> ; and
82.	337(10)	[NEW SECTION]	Central air conditioning equipment may project a maximum of 1.0 metres into a <i>side setback area</i> : (a) for a Semi-detached Dwelling , only where the <i>side setback area</i> is on the <i>street</i> side of a <i>corner parcel</i> ; and (b) for all other <i>uses</i> :

			(i) when located on a corner parcel ; or (ii) where at least one side setback area is clear of all central air conditioning equipment, window wells and portions of the building measured from grade to a height of 2.4 metres.
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In four short months -- lightning speed in a municipal bureaucracy -- the building industry overturned an amendment that would have been a first step in protecting the basic civil rights of thousands of Calgarians. Were those lobbyists working in the broader public interest? They were not. In fact, the motto of the Canadian Home Builder's Association - Calgary Branch (CHBA) -- "*We make the industry better*" -- makes no mention of better neighbourhoods, better communities or a better city. That's why Vancouver's Urban Noise Task Force was composed of average citizens, not lobbying members of the building industry. The CHBA pitched the sideyard relaxation to the Calgary Planning Commission as being along the same lines as allowing other building projections (i.e. fireplaces, etc). **Installing large, noisy outdoor mechanical equipment with LFN-emitting compressors in narrow sound-reflective sideyards between houses is NOT the same as allowing a simple building projection like a fireplace or cantilevered addition.** That amendment should never have been recommended by the planning commission and never been passed by city council as it appears in *Land Use Bylaw 1P2007 Part 5 --Division II: General Rules* (page 281).

So how do you fix this mess? Adding a short qualifying sentence to the "boxed section" above, sideyard installations can once again be prohibited in narrow sideyards, as follows: "Central air conditioning equipment may project a maximum of 1.0 metres into a **side setback area**...(ii) where at least one *side setback area* is clear of all central air conditioning equipment, window wells and portions of the *building* measured from *grade* to a height of 2.4 metres, **and distance between houses is greater than six (6) metres**. 15 feet or 5 metres is recommended by the Canadian air conditioning industry as the limiting distance between houses where AC should not be installed and is suggested as grounds for removal and relocation. Add another metre for installation allowance into the sideyard area and you're at six metres. This would be the bare minimum starting point for better installation practices and noise control in Calgary. An alternative would be adopting a zoning permit system similar to that used in Denver, CO.

Many municipalities adopt a minimum required setback based on an arbitrary distance from the lot line. **That "one size fits all" distance does not adequately address noise concerns because individual AC units vary in noise output and some may be double the audible volume of others.** For example, a "quiet" top of the line unit may be rated at 64dBA, yet another is rated at 74dBA (for normal noise, "perceived loudness" doubles with an increase of 10 decibels). The latter will sound twice as loud as the former. And then we have owners with larger infills or new homes that install two throbbing units side-by-side. Should they be allowed the same setback distance as a single quieter unit? Obviously, they shouldn't -- they should be placed farther away from the lot line and perhaps even enclosed in a sound barrier, depending on their combined noise output (with unmeasured LFN and infrasound in mind as well). So why does the average municipality adopt a "one size fits all" setback even if it isn't effective or protective? Because it's easy to use. Examples: Spruce Grove, AB = 1 m; Windsor, ON = 1.2m; Montreal, PQ = 2m; Westmount PQ = 3m/10ft (for average 45ft wide lot) and 2.5m/7ft (on old narrow French lots of 18ft width). Those are legal minimums and most ethical installers will place a unit farther away from the lot line than that: In one Etobicoke, ON townhouse project, the development company actually created its own required minimum sideyard setback that was double the municipality's legal setback (a full three metres instead of 1.5m). Why? Because after project completion, the company itself would be fielding nuisance noise complaints and have to deal with them. The developer did the right thing at the planning stage and moved the units farther away from the adjacent neighbours (p. 3 in Toronto Bylaw 1096-2006 <http://www.toronto.ca/legdocs/bylaws/2006/law1096.pdf>).

Regina and Winnipeg both limit sideyard installation by measuring the distance to a neighbour's windows (see http://www.winnipeg.ca/ppd/pdf_files/CntrlAir.pdf for Winnipeg's example of a 15-foot setback). The shortcoming with this method is that if the next door neighbour's property is redeveloped or renovated, the distance to an existing window could be reduced by more than several feet. **If a similar setback policy is adopted here in Calgary, I would recommend an equivalent (three-metre) minimum setback from the lot line and not the neighbour's house**; otherwise the AC owners may suddenly find themselves in violation after a redevelopment occurs next door. The following is a California example of a distance-to-window bylaw limiting sideyard installations which set twelve feet as the requirement:

"D. Air conditioning units. Air conditioning units may be placed in the side yard setback areas in the Single-family (R-1) Zoning District, providing that the equipment does not project more than twenty-four (24) inches into a required side yard setback area, and in no case, shall the air conditioning unit be placed closer than thirty-six inches to a side property line. The placement of the air conditioning units must also be located at least twelve (12) feet from any window of a neighboring dwelling, as measured from farthest projected edge of the equipment to closest edge of window. The placement of the air conditioning unit must comply with the provisions set forth in Chapter 17.24 – Noise. Mitigations such as block wall enclosure may be required to mitigate sound impacts at the property line."

Using world's best practice, installers would follow a dBA-distance chart to determine how far from a lot line they need to go to meet strict decibel limits set for daytime and nighttime hours. See <http://tinyurl.com/LosAltosAC> for an example. The Australian Institute of Refrigeration, Air conditioning and Heating (AIRAH) encourages the use of world's best practice and sets out a quick noise calculation method <http://www.fairair.com.au/Calculator.Noise.aspx> as well as very detailed state by state best practice manuals <http://tinyurl.com/AIRAHBestPractice> . To my knowledge, this countrywide system of modern professional codes of conduct is unmatched anywhere else in the world. At the heart of the manuals are the **Acoustic Nomograms** which are used to calculate proper legal placement or determine a suitable sound-rated unit for installation.

Moving an AC unit a mere 1.2 metres (4ft) from a lot line will result in a drop of almost 10 decibels in measured noise volume and push the throbbing (unmeasured) LFN of the compressor away as well. A **three-metre (10ft) minimum required setback** would drop the noise level by 17.5 dBA – making the audible air conditioner noise almost 4 times quieter at the property line and also reducing the impact of (unmeasured) LFN (See Table 4: Distance Factor on page 11 of the *Environmental Noise Guidelines for Installation of Residential Air Conditioning Devices* <http://www.quiet.org/documents/GuidelinesAirConditioners.pdf>).

Adequate installation distance from the lot line is crucial to limit the infiltration of LFN and infrasound from the AC compressor: Safe Setbacks = Healthy Neighbours + Happy Households!

Under the Community Standards Noise Bylaw

3) Set the "Point of Reception" for Sound Measurements at the Property Line to Update Enforcement to the Standards of other Major Municipalities in Western Canada (Edmonton, Vancouver, Victoria, etc); noise measurements should be made in an unobstructed area closest to sound source to obtain the highest possible noise reading; revoke discretionary powers of Testers and replace them with standardized measurement procedures that can be replicated by independent professional noise consultants.

Sad but true: Calgary has the worst residential noise bylaw of any major city in Canada. Currently, the City of Calgary uses industrial noise limits in residential areas and then lets standards drop even lower by *not* enforcing the law at the property line (and adding generous dB bonuses on top of that). In effect, we have no "residential" noise bylaw, we have an industrial one. That's what currently passes for liveability in our established communities.



AC Noise: Grim Reality in Calgary

There are two major problems with Calgary's noise bylaw: The first is that our noise allowables are set too high, both day and night (i.e. they are set at industrial levels) and the second is that noise measurements are not taken at the property line as standard procedure, which effectively adds 10dBA or more onto the already substandard, industrial levels in the bylaw. Virtually all of the central air conditioning units that bylaw enforcement officers have measured are within the allowable city regulations but they would be illegal in almost all major cities in Canada (and most other metro areas around the world) based on required minimum installation setbacks or stricter noise levels measured at property lines. Edmonton, which has the same substandard, industry-friendly allowables, at least has the sense to enforce its noise bylaw at the property line, not sometimes 25 feet away from the sound source which is the accepted standard practice used in Calgary.

On top of those generous industrial noise limits, bylaw enforcement officers in Calgary use no standardized method when taking noise measurements -- everything is left to their discretionary powers. And that means that they can let AC offenders off the hook simply by "tweaking" measurement methods. (This uneven enforcement has been confirmed by independent acoustical engineering professionals hired by victims in the city.) Our noise bylaw works against victims not for them. For example, how is it that a sideyard installation of two throbbing 74dBA central air conditioners under a victim's bedroom window -- together they total 77dBA -- is legal here even in the supposed quietude of night when 50dBA is the nighttime allowable? Chalk that up to distant Point of Reception, adjustable discretionary powers and industrial noise allowances. Larry Finegold and Bennett Brooks -- accomplished acoustical analysts with decades of experience -- are currently working on a Model Community Noise Ordinance Standard that will act as a nationwide guideline in the USA. **Their recommended Point of Reception? The property line.** (See page 11, *Model Community Noise Ordinance 2001* <http://www.brooks-acoustics.com/BMB-LSF%20ASA-4aNS4%20rev%201.pdf>)

"A well-written noise ordinance must cover a number of components in a concise, clear, and precise way so as to address the local noise issues in as comprehensive a manner as possible to avoid misinterpretation and litigation. Vagueness, indefiniteness, and uncertainty should be prevented." (Community Noise Ordinances in *Handbook of Noise and Vibration Control*. 2007)

Note: Bylaw enforcement officers in Calgary can legally take noise measurements at the property line if they so wish. That option is spelled out in the noise bylaw: " 'Point of Reception' means any location at the place of work or residence where noise or Sound levels are heard by a complainant, as determined by the Tester to be appropriate in each circumstance." Knowing that LFN and infrasound are not measured under standard testing, bylaw officers should be using their discretionary powers to go to the property line for readings. They don't. I have an email from Bylaw Services which confirms that officers can go to the lot line as they have done on a number of occasions in the past. **That vague definition needs to be amended to clearly define the Point of Reception as at, or along, the property line when measuring air conditioner noise.** Homeowners pay staggering municipal taxes on their assessed lot values, starting at their property lines, not well away from them. Adding insult to injury, bylaw enforcement officers use an A-weighted sound measurement system which completely ignores the lower

end of the sound spectrum where low frequency noise and infrasound reside. Yet those wall-penetrating frequencies are precisely the ones causing the majority of the problem in Calgary. Bylaw Services should also take a page from another noise assessment manual: **“Having regard to any measurement location specified for a category of noise, the microphone will be located at a point where the highest sound pressure level of the noise under investigation will be obtained.”** In Calgary, that usually isn't the case.



By using the property line as the Point of Reception -- and taking the sound measurement in a clear, unobstructed location (several inches above a fence line so there is no sound shielding) -- the LFN and infrasound components are somewhat compensated for even though they aren't measured. Australian authorities use A-weighting but ensure that they compensate for LFN and infrasound by lowering the A-weighted daytime and nighttime allowables and also adding dBA penalties for tonality and impulsiveness. Melbourne and Sydney go one better at night and prohibit the overnight use of domestic AC to control any intrusion by LFN or infrasound. Next door in British Columbia, there are at least two commendable noise bylaws that specifically address central air conditioners and heat pumps: one in the Municipality of Saanich (<http://www.saanich.ca/living/pdf/noise7059.pdf>) and the most recent in Port Coquitlam, which was adopted in response to a lawsuit in neighbouring Coquitlam (see <http://tinyurl.com/B-C-AC-Lawsuit> ; <http://www.quiet.org/documents/ACCourtB.C.2009.pdf>). Please note that both of those bylaws use the allowables of 50dBA daytime and 45dBA nighttime (as measured at the property line) which were recommended as "reasonable" national standards in the Environmental Noise Guidelines for Installation of Residential Air Conditioning Devices (page 32). Those now-dated national recommendations were made assuming that there was at least a 1.2m (4ft) minimum sideyard setback in place already.

This leads us to the all important subject of allowable decibel levels....

How Much Noise is Too Much?

The decibel (abbreviated dB) is the unit used to measure the intensity of a sound. The “A” after dB – dBA – indicates the A-weighted measurement system is being used, which completely ignores low frequency noise. Starting at 0dB, or the threshold of human hearing, *the scale is logarithmic so a small increase in decibels actually represents a significant increase in sound intensity.* A sound 10 times more powerful than 0dB registers as 10dB. A sound 100 times more powerful than near silence is 20dB. 1000 times more powerful than silence is 30dB. For every increase of 3dB, the sound intensity doubles. The oft-quoted rule of “noise doubles with every increase of 10dB” is only a perceived doubling of loudness by ear and actually represents a 10-fold increase in sound pressure. That’s a very important point: Two AC units with the same sound output double the magnitude of noise but only register as 3dB louder on the decibel scale i.e. 69dBA unit + 69dBA unit = 72dBA, not 79dBA as you’d expect by the “10dB doubling” rule. Don’t be deceived into thinking that a few decibels are insignificant – they double noise strength!

“Words to the wise: Always wonder what a manufacturer is hiding when they use A-weighting.”

That tip comes courtesy of Rane, a professional audio products company, which revealed a very slick noise trick: “Low-cost audio equipment often list an A-weighted noise spec – not because it correlates well with our hearing – but because it helps ‘hide’ nasty low-frequency hum components that make for bad noise specs. Sometimes A-weighting can ‘improve’ a noise spec by 10dB.” Using the same trick, central air conditioners can evade more than 10dB of LFN nasties: Under A-weighting a “quiet” unit may be measured at 69dBA; with C-weighting, which includes the wall-pounding low frequency end of the sound spectrum, it may be more than 80dBC. Quiet indeed!

Note: Although A-weighted sound measurements are not ideal for AC noise because the lower frequencies are overlooked, no current AC noise bylaw uses the alternative of C-weighted measurements. **A-weighting is adequate for AC noise as long as four conditions are met: first, and foremost,** the presence of LFN and infrasound is recognized and protected against by using maximum sideyard setbacks based on noise output; **second,** noise measurements are made at the property line; **third,** additional penalties for tonality and other irritating sounds are applied as necessary; and, **fourth,** a General Prohibition is included in the noise bylaw that addresses vibration and resonance. C-weighting is more suitable for rural areas where ambient background noise levels are lower and where there is little background LFN from urban traffic and other sources to influence results. Like A-weighting, C-weighted measurements also ignore infrasound below 20Hz.

4 to 6) Maximum AC Noise Allowables for Daytime and Nighttime Hours (defined in Calgary, respectively, as 7am to 10pm -- 15 hours in total -- and 10pm to 7am -- 9 hours in total).

Calgary's daytime "residential" limit is set at the industrial level of **65dBA** (not measured at the property line) and the nighttime limit at **50dBA** (not measured at the property line). On top of those limits, however, all bylaw enforcement officers unofficially allow at least another three to four decibels as standard operating procedure in the field. Many victims become aware of this generosity to AC owners after hiring expensive, independent acoustical engineering firms to check on bylaw's shocking results. In effect, then, the City of Calgary endorses *69dBA daytime and 54dBA nighttime* -- again, not measured at the property line. At the lot line, those values translate into 79dBA+ and 64dBA+! This results in Calgary allowing in excess of **FOUR TIMES** the audible noise limits set in other major municipalities in Western Canada which enforce complaints along the property line in a clear unobstructed location. Recall that an increase of 10dBA doubles the "perceived loudness" and an increase of 20dBA quadruples it. On top of that, no penalties are made for the silent killers of LFN and infrasound (which are not measured) or other noticeable irritating sound qualities.



The City of Calgary allows up to 4 times the residential noise of other cities in Western Canada

Our supposedly "quiet" nighttime limits are set at louder levels than Vancouver and Victoria's noisy daytime limits! (Because those cities enforce at the property line and have lower limits as well). This is outrageous and totally unacceptable. Would you believe that the densely populated countries of China (a well-known abuser of human rights) and Japan both have lower noise limits than Calgary, day and night? (55dBA/45dBA with even lower limits in quieter areas). Way back in the regulatory Stone Age -- circa 1974 -- the U.S. EPA recommended that the outdoor A-weighted day-night sound pressure level should be kept below 55 dB in residential areas. *Forty years later, Calgary is still using a health-destroying, industrial 65dBA (away from the lot line) during the daytime and 50dBA (away from the lot line) overnight.*

In 2003-2004, at the very same time that our last noise bylaw review was done, the City of Victoria, B.C. completed its own noise review. The results were professional, modern and up-to-date resulting in base restrictions of 55dBA daytime and 45dBA nighttime but with additional penalties of up to 10dBA for tonal, intermittent and impulsive noises (such as those coming from air conditioners). Enforcement is at the property line. Why didn't the City of Calgary do a proper job during our review?

On page 15 of *Model Community Noise Ordinance 2001* by Larry Finegold and Bennett Brooks, are the normal expected limits for industrial and commercial/business noise intruding into residential areas (as measured at the property line): <http://www.brooks-acoustics.com/BMB-LSF%20ASA-4aNS4%20rev%201.pdf>

Model Community Noise Ordinance: Noise Limits Residential receptor

Industrial emitter : Daytime limit 61 dBA

Nighttime limit 51 dBA [At the Property Line]

Commercial emitter: Daytime limit 55 dBA

Nighttime limit 45dBA

Compare the City of Calgary's limits of 65 dBA daytime and 50 dBA nighttime (not enforced at the property line) to the **industrial limit** above.

Ambient background levels in my sideyard are those of a typical inner city residential Quiet Zone: Daytime average of roughly 45dBA and as low as 37dBA overnight.

Unmeasured LFN and Infrasound versus Normal Noise

Note: Bylaw enforcement officers DO NOT measure LFN and infrasound, only middle frequencies using A-weighted measurements.

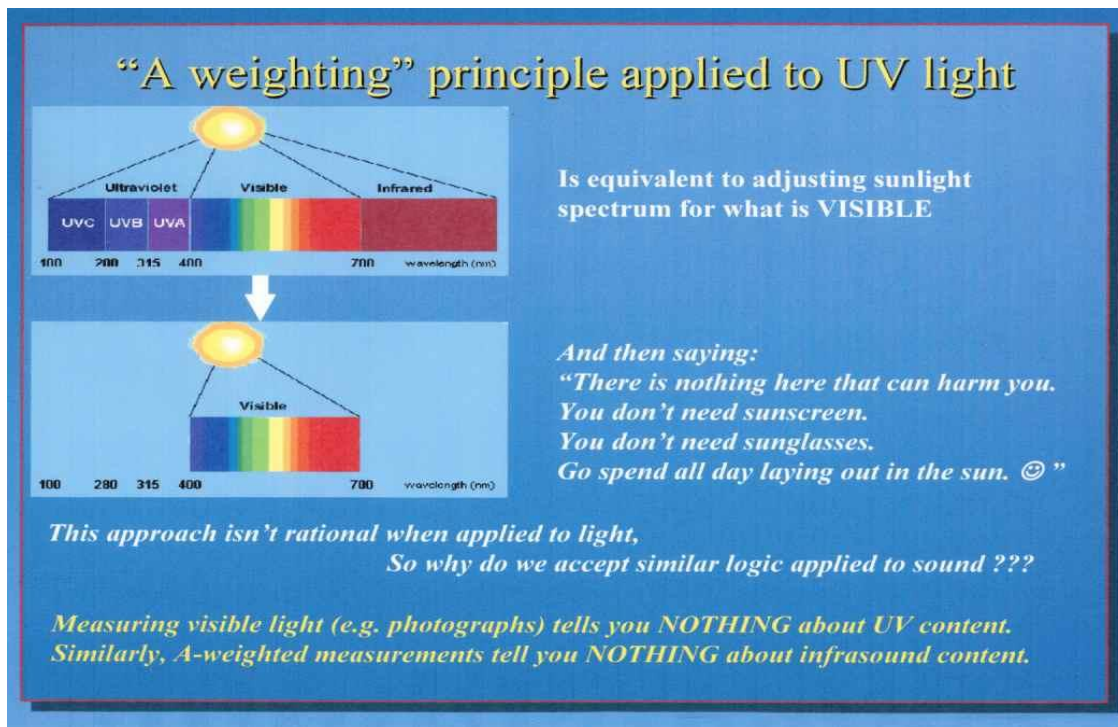
Clearly, the City of Calgary needs to update and modernize its residential noise bylaw, not just to address LFN and infrasound from air conditioners but to deal with everyday normal noise. The current limits in place are more appropriate for industrial zones. On the topic of LFN versus normal noise, Dr. Bengtsson had this to say (<https://sites.google.com/a/ryberg.org/www/bengtsson> pdf link):

Page 13: "One important factor in comparing low frequency noise to other noises not dominated by low frequencies is the presence of different sound characteristics. One sound characteristic is perceived loudness. An increase of as little as 5-6 dB in low frequencies is perceived as a two-fold increase in the subjective loudness, while 10 dB is required for the same change in sensation for higher frequencies [ISO 226, 1987]." That's why LFN and infrasound need special consideration.

Page 26: "The results showed that low frequency noises at comparable A-weighted sound pressure levels (range 48-66 dB) were rated as more annoying than broadband noises without a dominant content of low frequency components. Kjellberg *et al.* [1984] reported that, when 24 subjects adjusted the sound pressure level of two noises containing a high or low proportion of low frequencies in order to achieve the same level of annoyance, the A-weighted sound pressure level underestimated the disturbance of a low frequency noise by 5 dB at 50 dBA and by 8 dB at 86 dBA. This means that a noise containing low frequencies could have a noticeably lower A-weighted sound pressure level than a noise not containing low frequencies and still be equally annoying. Similarly, Byström *et al.* [1991] found that, when two groups of 24 subjects were instructed to tune in the "highest level at which it was possible to maintain the performance level without extra effort" of a noise with a middle frequency of 100 Hz or a noise with a middle frequency at 1000 Hz, the acceptable level for work performance was about 6 dB lower for the low frequency noise. **In summary, low frequency noise may cause other subjective symptoms and higher ratings of annoyance than noises at comparable A-weighted sound pressure levels that are not dominated by low frequencies."**

Those two factors are prime reasons why AC noise -- and other LFN and infrasound related to mechanical equipment with compressors or pumps -- should be treated differently than normal noise, with additional penalties and/or lower dBA limits especially at night. They are also the reason why noise measurements should be made at the property line and not be padded with three or four decibel bylaw

officer "bonuses" as is current practice in Calgary. Restrictions for AC noise under a bylaw should be absolute maximums.



A-weighted noise measurements made by Bylaw Services completely ignore LFN and infrasound

In its *Guidelines for Community Noise* of 1999, the World Health Organization (WHO) recommended outside A-weighted daytime limits of **50dBA** (as protection against moderate annoyance) and **55dBA** (as protection against serious annoyance). Further, it chose the lower value as the preferred daytime standard: "Where it is practical and feasible, the lower outdoor sound level [50dBA] should be considered the maximum desirable sound level for new development." No mention was made of 65dBA because that limit is used for industrial purposes, not residential or community noise:
<http://www.bvsde.paho.org/bvsci/i/fulltext/noise/noise.pdf> .

The WHO defines health as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity, and recognizes the enjoyment of the highest attainable standard of health as one of the fundamental rights of every human being. In 2009, the WHO's *Night Noise Guidelines for Europe* upgraded the outside nighttime standard of 45dBA to a more protective **40dBA**. Where LFN is a problem, the WHO recommends lowering the outside limits even further i.e. less than 50dBA daytime and less than 40dBA nighttime.

****Recommended AC Noise Bylaw Limits for Calgary (Daytime and Nighttime)** as measured at the property line:**

Daytime: 5dBA above ambient background or 50dBA, whichever is higher. In noisier areas, establish maximum limit caps to protect residents.

Nighttime: Prohibit nighttime domestic use of outside AC if any neighbour can hear it. Portable, free-standing indoor AC units could still be used. Alternatively, use 3dBA above ambient background or 45dBA, whichever is lower.

Day/Night: Add 5dBA penalties for tonality, impulsiveness or intermittency and increase fines.

To protect Calgary's citizens against chronic LFN and infrasound pulsing from central air conditioners, heat pumps and other outdoor mechanical equipment, noise restrictions should be set no higher than the now out-of-date "reasonable" Canadian national standards recommended in the *Environmental Noise Guidelines for Installation of Residential Air Conditioning Devices* (1994): Maximums of 50dBA daytime and 45dBA nighttime (as measured at the lot line). The latter nighttime value, however, should be adjusted lower to follow the 2009 WHO *Night Noise Guidelines* of 40dBA and as a penalty for LFN content. Hence the call for no more than 3dBA above ambient background levels at the property boundary – a standard used in tropical regions of Australia – or, more equitably in a cool climate, an outright prohibition at nighttime on a complaint basis only.

In Melbourne and Sydney, Australia, the use of a domestic, outside air conditioner is prohibited at night if any neighbour in the vicinity can hear it. The average summer minimum overnight temperature in Calgary – **a very cool eight degrees above freezing** -- is roughly 10 degrees C less than Sydney's average minimum overnight and 6 degrees C less than Melbourne's. And both of those cities have average summer daily highs well above ours. Calgary's highest summer temperature ever recorded is 36 degrees C set in 1917. Melbourne's record summer high is 46.4 degrees C and Sydney is not far behind with 45.3 degrees C. Could coolish Calgary do without AC noise overnight, based on those two sweltering examples from Down Under? Absolutely. We have no humidity to worry about, only poor house design and irresponsible owner behaviour (including leaving closed windows unshaded in the daytime which lets in our abundant, "overheat-the-house-interior" sunshine).

In northern Australia's humid tropical centres of Cairns and Townsville -- where average overnight lows exceed Calgary's summer maximums -- the noise limits are set at 5dBA and 3dBA above background levels, daytime and nighttime respectively. The latter is more protective than the 45dBA nighttime recommended as a Canadian national standard and should be adopted here as a maximum nighttime cap i.e. 3dBA above ambient background or 45dBA, whichever is lower (as measured at the property line). In similar fashion, to allow for more urban daytime background noise, our maximum daytime allowable could be capped at 5dBA above average daily ambient background or 50dBA, whichever is higher. As added protection in noisier areas where traffic or industrial lands abut residential zones, maximum limit caps should be applied.

If the City of Calgary will not follow Melbourne and Sydney in prohibiting nighttime AC noise – which is the easiest and most effective enforcement route -- it should ensure that the lowest allowable is adopted at night and enforced at the property line. If outdoor central air conditioning was prohibited overnight *on a complaint basis only*, residents could still use indoor portable AC units which keep the noise inside the house where it belongs. Ceiling fans are also effective and the first and primary line of defense in Australia. (Ceiling fans use about 1/10th the energy of central air conditioners.)

AC Noise Bylaw Examples (measured at property boundary and assuming adequate sideyard setbacks):

- Canadian "reasonable" standard for various levels of government: 50dBA daytime and 45dBA nighttime (used in Western Canada by Municipality of Saanich and Port Coquitlam, B.C.).
- Cote Saint-Luc, PQ (early bylaw, dated 1991): 50dB "at any point along the property line of the lot on which it is situated". Applies to heat pump, air conditioning or refrigeration equipment.
- Victoria, B.C.: General noise restrictions of 55dBA daytime and 45dBA nighttime with up to 10dB penalties for tonality, intermittency or impulsiveness of mechanical equipment = as low as 45dBA daytime and 35dBA nighttime = Australian AC industry recommendation.
- Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI) Guideline for Ontario:

“Many municipalities regulate noise control of air conditioning devices through the Model Municipal Noise Control By-law using guidelines that were developed by the Ontario Ministry of the Environment. These guidelines basically state that the sound generated by an air conditioning device should not intrude significantly in neighbouring residential property.

In general, the acceptable noise level for an air conditioner is the existing background sound level (due to road traffic noise, etc.) plus 5 dBA. If the background noise level is low, the sound level should not exceed 45 dBA and 50 dBA for locations in rural and urban areas respectively."

However, Dr. Sheela Basrur, who dealt with the SARS epidemic in Toronto and was later made Ontario's Chief Medical Officer, did NOT agree with the HRAI's ambient background level + 5dB rule (Toronto Staff Report 2001 Harmonization of the Noise By-Law, p.4 <http://www.toronto.ca/legdocs/2001/agendas/committees/hl/hl011029/it002b.pdf>):

"(b) Air Conditioning Units

The report dated March 23, 2000 on the Health Effects of Noise adopted at the Board of Health meeting on May 1, 2000 noted that the Noise By-Laws in the former municipalities attempt to address the localized nature of particular problems in the community. It noted as well that, in the former Toronto, there are more stringent rules in place to govern Heating Ventilation and Air Conditioning systems and other equipment noises due to the close proximity of residences and other conflicting land uses.

The report also noted that noise has been reported to lessen the quality and duration of sleep. Susceptible persons may be affected by noise occurring during sleep with night noise being a significant problem for night workers, mothers with babies, elderly persons, persons who are especially vulnerable to physical or mental disorders and other individuals who experience sleeping difficulty. Nocturnal noise has been indicated as a health risk because of the disturbance to the distribution of sleep stages resulting in direct immunosuppressive effects. These findings are of particular relevance to air conditioning units because, especially in urban areas, and especially during the summer months, they run both night and day and are the source of many public complaints.

The proposed harmonized by-law proposes a standard for the amalgamated city based on the provincial guideline set out in Publication NPC-216 "Residential Air Conditioning Devices." **This is a lower standard than is presently in effect in the former City of Toronto. The proposed standard permits air conditioning units to be five decibels louder than ambient levels; the current Toronto by-law permits units to be only two decibels louder. Since sound levels are logarithmic, a small increase in decibels represents a large increase in sound energy. A difference of three decibels is significant.** As noted above, it is the settlement patterns of the former City of Toronto that gave rise to the current standards, which, for this reason, appear to be the most appropriate.

Maintaining the current City of Toronto standard will help protect the health of residents in the densely-settled old City of Toronto and other parts of the new City undergoing urban intensification. Maintaining the existing standard will ensure consistency with policies to eliminate noise at its source and improve the overall soundscape of Toronto."

For the safeguarding of health, who do you believe: the future Chief Medical Officer of Ontario or a self-interested industry group? Publication NPC-216 does not address LFN or infrasound or reasonable setbacks. **If measurements are to be made with no adequate required setbacks from the lot line, then Dr. Basrur's recommendation of ambient background noise level + 2dBA should be followed.**

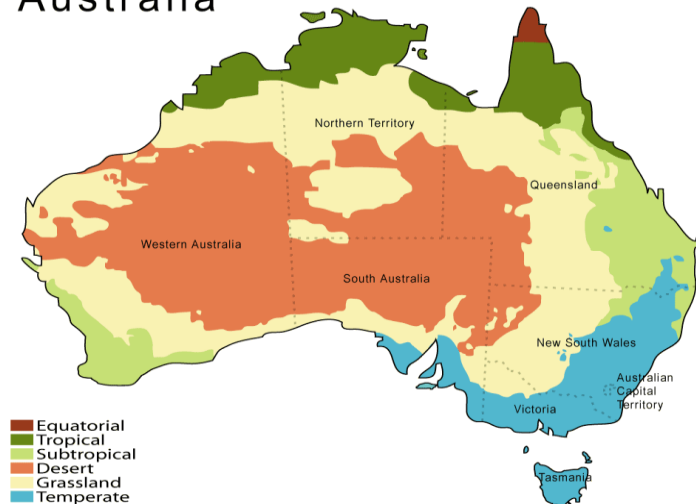
To find the world's best AC regulations you go Down Under, where this growing problem has been handled on a countrywide basis...with lawsuits, fines and eventually widespread government regulations and compliance.

Australia: World's Best Practice AC Noise Control (Coordinated Countrywide Regulations)

- Australian AC industry (AIRAH) recommended noise levels at property boundary: **45dBA daytime and 35dBA nighttime**: <http://www.fairair.com.au/Calculator.Noise.aspx> . Installation of outside AC requires a permit in many jurisdictions to match installation location with rated noise output.

- Melbourne, Australia: 5dBA above ambient background during daytime at property boundary and prohibited overnight on a complaint basis. Additional daytime noise penalties totaling 7dB. Permit required for installation. <http://sound.sial.mit.edu.au/ADR/FactSheets/AirConditioners.pdf>
- Sydney, Australia: 5dBA above ambient background during daytime at property boundary and prohibited overnight on a complaint basis. Additional daytime noise penalty of 5dB. <http://www.cityofsydney.nsw.gov.au/live/report-local-issues/noise>

Australia



General rule: The farther south in Australia you go -- i.e. the cooler the climate is -- the stricter the regulations. There's a lesson in that for cool Calgary and other temperate locations. The following are from the air conditioning best practice guides <http://tinyurl.com/AIRAHBestPractice> :

Allowable Noise Levels (State of Victoria, Australia, which contains Melbourne where I lived for 5 years)

The *Environment Protection (Residential Noise) Regulations 1997* include time restrictions for the use of domestic air conditioners.

The **restricted times** are as follows:

Monday to Friday: **10pm to 7am** Weekends and public holidays: **10pm to 9am**

These prohibited times apply when the noise can be heard from inside a habitable room of another premises. A habitable room is defined as any room other than a kitchen, storage area, bathroom, laundry, toilet, pantry, garage or garden shed. Further Environment Protection Authority (EPA) information has indicated that the level of **40dB(A) at night** might be an appropriate level to use as a guide for calculation purposes. As a guideline, the EPA recommends that during the day, air conditioner noise does not exceed the background noise level by more than **5dB(A)** sound pressure level, as measured at the property boundary. Additional penalties of 5dB and 2dB are applied for tonality and impulsiveness, respectively.

Complaints about air conditioner noise are dealt with by local councils. If councils receive a complaint from a neighbour, they can contact the owner of the air conditioner and undertake mediation between the owner and neighbours. They can also issue the owner with a notice, and if the owners do not comply councils can issue them with fines.

Therefore it is important to select the quietest air conditioner possible and have it installed as far away from any surrounding dwellings / houses.

Allowable Noise Levels (State of New South Wales, which contains Sydney)

The *Protection of the Environment Operations Act 2000* includes noise limits and time restrictions for usage of air conditioners. City councils are responsible for enforcing these limits at houses and units. If an air conditioner exceeds these limits, councils may issue the owner or operator with a warning or notice. If the air conditioner continues to be used in excess of the limits, councils are able to issue an on-the-spot fine.

The allowable noise level as a guideline is no more than 5 dB(A) sound pressure level above background noise. This is measured at the boundary between the owner and the neighbours' properties. Local city councils may impose specific maximum limits. Additional 5dB penalty for tonality may also be applied.

Air conditioners can be used during the following times:

Weekdays **7am to 10pm**

Weekends and public holidays **8am to 10pm**

At other times air conditioners must be turned off, unless they are inaudible from neighbours' homes.

Therefore it is important to select the quietest air conditioner possible and have it installed as far away from any surrounding dwellings / houses as possible.

Allowable Noise Levels (State of Tasmania, the island state south of Melbourne -- as near as a Canadian climate as it gets in Australia)

The *Environmental Protection (Noise) Regulations 1977* include noise limits for domestic air conditioners. Local city councils are responsible for enforcing these limits.

The allowable noise levels are:

Time average sound pressure level (dB(A))

Operating Times

	Sleeping Areas	Recreation and Study Areas	Working Areas
7am until 10pm	45	50	52
10pm until 7am	40	45	47

The above limits must be adjusted as follows:

- if tonal noise is present, subtract 5dB(A)
- if impulsive noise is present, subtract 2dB(A)

If an air conditioner exceeds these noise limits, the council may issue the owner or operator with a notice or an on-the-spot fine.

Therefore it is important to select the quietest air conditioner possible and have it installed as far away from any surrounding dwellings / houses.

Allowable Noise Levels (Australian Capital Territory including Canberra which is the government equivalent of Ottawa -- another temperate area of Australia)

The *Environment Protection Act 1997* and the *Environment Protection Regulations 2005* include noise limits for air conditioners. The Environment Protection Authority (EPA) is responsible for enforcing these limits at houses and units.

The allowable noise levels are:

Area	Time	Noise level (dB(A))
Residential Areas	7am* to 10pm	45
	10pm to 7am*	35
Flats or townhouses in	7am* to 10pm	40
multi-unit complexes	10pm to 7am*	30

*8am on Sundays and public holidays

Noise levels are measured at the boundary of the property emitting the noise. In multi-unit complexes the measurement is taken inside the neighbours' unit. If an air conditioner exceeds these limits, the EPA can issue an Environment Protection Order, and if the order is not adhered to an on-the-spot fine may be issued. 5dB penalty may also be applied for tonality.

Therefore it is important to select the quietest air conditioner possible and have it installed as far away from any surrounding dwellings / houses as possible.

Allowable Noise Levels (Townsville, Queensland Humid + Tropical)

<http://www.townsville.qld.gov.au/council/laws/Documents/Fact%20Sheet%20-%20Airconditioners.pdf>

An occupier must not use air conditioning equipment:

- Before 7am or after 10pm if it makes noise of more than **3 dB(A)** above background levels; or
- From 7am to 10pm if it makes a noise of more than **5 dB(A)** above background levels.

In Australia, all levels of government -- with the full support and cooperation of the AC industry -- are dealing with the ongoing, escalating problem of AC noise.

"The ordinance must also refer to impulsive, narrow-band, or other relevant acoustical characteristics and establish any corresponding corrections to the rating index." (Community Noise Ordinances in *Handbook of Noise and Vibration Control* 2007, attached.)

The City of Victoria, B.C. uses three specific noise characteristics -- tonality, intermittency and impulsiveness -- to add as much as 10dBA penalties to an irritating sound:

<http://www.victoria.ca/assets/City-Hall/Bylaws/bylaw-03-012.pdf> .

7) Add a Useful "General Prohibition" Clause to the Noise Bylaw.

There are two ways to measure nuisance noise-vibration: Qualitative (subjective, based on hearing or feeling) and quantitative (objective, based on dBA measurements).

There is one glaring problem with using quantitative dBA measurements on their own. If a noise or resulting vibration/resonance is extremely irritating, yet in the low frequency range or not that loud, it will be deemed acceptable by bylaw enforcement officers. A sound meter doesn't measure what you actually hear or experience; it measures the energy of the sound pressure. It doesn't measure annoyance, only loudness. It doesn't measure quality – or any of the low frequencies or very high frequencies under A-weighting. And it certainly can't register the abusive nature of being on the receiving end of LFN, infrasound or an irritating noise for months on end.

Imagine a sound that approximates fingernails scratching down a chalkboard coming from next door – that goes on for hours and hours every day and night. Then imagine your shock and surprise when a bylaw enforcement officer says it's perfectly acceptable under the city's one-sided regulations which only go by quantitative measurement of dBA levels. Would you be impressed? The same thing is going on with LFN and room-filling resonance caused by too-close central air conditioner compressors. The enforcement officers can clearly hear the compressor noise pulsating through a bedroom wall or living space but won't do anything about it because it's a "qualitative" annoyance and not covered under our dBA-based bylaw. They simply shrug their shoulders, shuffle their feet, hum and haw for a few minutes and then depart – leaving the suffering victims no further ahead. That needs to change. **The majority of AC noise victims in Calgary are complaining about vibration and resonance which could be restricted under General Prohibition.**

“Noise in a community must be addressed in terms of quantity and of quality. Once the quantity of noise is reduced, the quality becomes important. People usually have an expectation for the way different noise sources in the environment should sound. In quieter communities or in those where noise has already been reduced, this expected sound quality assumes a higher importance.”

(Community Noise Ordinances in *Handbook of Noise and Vibration Control* 2007.)

The best, and fairest, method of enforcement is a combination of both subjective and objective measures:

“Qualitative and quantitative ordinances are both valuable, although a composition of both features usually prove to lead to the most effective noise ordinance contents.” (Community Noise Ordinances in *Handbook of Noise and Vibration Control* 2007.)

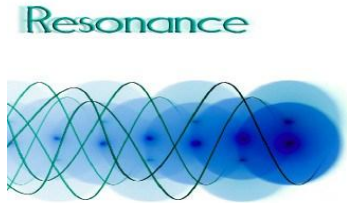
To address the all-important subjective aspect of noise, a useful General Prohibition needs to be added to Calgary's noise bylaw along the lines of the City of Toronto's (which includes a provision for vibration as do many other municipalities in Ontario):

“ ARTICLE II

General Provisions § 591-2. General prohibition.

No person shall make, cause or permit noise or vibration, at any time, which is likely to disturb the quiet, peace, rest, enjoyment, comfort or convenience of the inhabitants of the City. ”

The City of Calgary should use the same General Prohibition but also add the word "resonance": **"No person shall make, cause or permit noise, vibration or resonance, at any time, which is likely to disturb the quiet, peace, rest, enjoyment, comfort or convenience of the inhabitants of the City."**



According to the City of Calgary's website on Noise Regulations, "You have the right not to be disturbed by noise. You have the responsibility to not make noise that disturbs others." **As a growing legion of AC victims across Calgary well know, those claims ring completely hollow.** In the city's narrow view, "Noise can include, but is not limited to, yelling, shouting, loud music, horns, power tools and air conditioners." Absolutely no mention is made of vibration, resonance or LFN.
<http://www.calgary.ca/CSPS/ABS/Pages/Bylaws-by-topic/Noise-residential.aspx>

In theory, then, sideyard central air conditioners are supposed to be regulated. In practice? They aren't. That's why there are hundreds of next door neighbours with unresolved complaints. As I've already explained, only a very slim slice of the sound spectrum is measured by bylaw enforcement officers and, most often, that measurement is done in such a way as to favour the offenders, not the victims. For the nitty gritty on how that is possible (also keeping in mind the unofficial "bonuses" doled out in the field to AC owners), turn to page 12 of *Community Standards Bylaw 5M 2004, Part 9 – Regulation of Noise*: <http://www.calgary.ca/CA/city-clerks/Documents/Legislative-services/Bylaws/5M2004-CommunityStandards.pdf>. Within that startling revelation of acceptable "community standards" lies our 65dBA daytime limit (the one that's actually bumped up to 69dBA or more out in the real world). Not surprisingly, one Australian jurisdiction uses that industrial-strength noise cap around railway lines: "The A-weighted equivalent sound pressure levels in front of the most exposed facades of noise-sensitive buildings must not exceed 65 dB ...near railways." (p.1530 of *Community Noise Ordinances in Handbook of Noise and Vibration Control* 2007)

Protective? No, merely accommodating to industry and residential offenders.

In effect, what the City of Calgary is doing is abdicating its responsibility to "pass bylaws respecting the safety, health and welfare of people and protection of people" and offloading it onto AC victims scattered across the city. That way the municipality doesn't have to go to provincial court with a Nuisance charge, the victims do. But even assuming an AC victim wins the case, every other abused family has to pursue a separate case against *their* neighbours...and on and on it goes. Cost of all that to the public at large? A lot of money, not to mention the accumulated waste of court time. In theory, that's why we have municipal bylaws – to avoid all that neighbourly conflict.

In 2009, in a precedent-setting case in Coquitlam, B.C. in which the noise victims won, the AC owners had to pick up a legal tab of close to \$140,000. If you lose a case, you pay legal fees for both sides. Was that fair? Shouldn't the municipality have already had regulations in place to protect both parties, using bylaws that addressed proper installation location and noise levels?

Naïve homeowners assume that their central air conditioner is being installed in a professional, ethical manner and that its noise output is acceptable to society at large. Imagine their big surprise (\$\$\$\$) when they find out that it might be acceptable at a poorly managed municipal level but not in a higher court.



Of course, legal action is wishful thinking because most victims don't have tens of thousands of dollars lying around to launch a lawsuit and pursue justice (which ties up the courts unnecessarily at any rate). As Supreme Court Justice Beverley McLachlin admitted herself a few years ago: "Access to justice is quite simply critical. Unfortunately, many Canadian men and women find themselves unable, mainly for financial reasons, to access the Canadian justice system...Hard hit are average middle-class Canadians."

A person of normal means may have to consider remortgaging their home, gambling their retirement savings or pillaging their kid's college fund to seek justice. So AC victims continue to be bullied and abused by both their neighbours and the City of Calgary. Or they can move – which then costs them a bucketful of money in moving, realty and legal fees. And, if the move is within this city, they could potentially end up with AC units installed in sideyards on both sides of them anyway. If you move, it might as well be out of town. Alas, a good many victims also hold a moral compass that prevents them from dumping their house and noise problem on an unsuspecting buyer. In other words, they're stuck between a rock and a hard place. Property value of a house where you can't sleep in your own bed, relax in your own living room (or backyard) and work in your home office? Priceless!

Examining that successful AC noise lawsuit from Coquitlam, a few things pop out as notable

<http://www.quiet.org/documents/ACCourtB.C.2009.pdf> :

- 1) Compliance with local municipal bylaws does not mean that the activity complained of cannot be deemed a nuisance in a higher court of law (and eventually cost a deluded, self-righteous AC owner in excess of \$140,000 in legal fees).
- 2) According to that judgment: "One of the factors to be considered in deciding whether a nuisance exists is the social utility of the activity complained of. Here, the air conditioning was installed by the [owners] in order to enhance the comfort of their own home. Their enhanced comfort should not come at the expense of significantly reduced comfort for their neighbours. Nor should the [victimized neighbours] be required to close up their windows and acquire an air conditioner in what might be considered self-defence."
- 3) Sound measurements used for the court case were made along the property line. The judge stated that the required noise restrictions had to be met as "measured at any point along the [shared] property line."
- 4) The distance between houses was only 13 feet or two feet less than the recommended minimum requirement of 15 feet for sideyard installations. The victims and their lawyer missed that key distance recommendation because they weren't aware of the Canadian code of conduct for installation: *Environmental Noise Guidelines for Installation of Residential Air Conditioning Devices*. Had they known about that minimum sideyard distance, they could have forced a removal of the unit to the backyard. The distance between my home and the neighbour next door with the throbbing AC unit? Nine feet. The unit itself originally sat *two metres* from the headboard of our bed!
- 5) Due to the "sound alley" effect of the narrow sideyard, the judge declared that "the bylaw standards should be considered absolute maximums." In Calgary, they are starting points, with as much as four decibels being added on as "buffer" even for nighttime values.
- 6) In the presiding judge's view: "most people would consider an air conditioning unit operating in excess of 50 decibels only a few feet from one's bedroom window as being a serious and substantial interference with one's enjoyment of property."
- 7) Again, not knowing about the *Environmental Noise Guidelines for Installation of Residential Air Conditioning Devices*, the victims and their lawyer overlooked the reasonable national standard for AC noise of 50dBA daytime and 45dBA nighttime (as measured at the property line). They were also unaware that the Municipality of Saanich, B.C. had adopted those

- restrictions for their noise bylaw years before. If the victims had known that, the unit would have been legally removed and relocated to the backyard (and perhaps enclosed).
- 8) The AC unit was installed by a "reputable contractor" who placed the unit in the sound-reflective sideyard because it was the optimal location for the owners. Like the thousands of central air conditioners that are being improperly installed in Calgary, that installation complied with all applicable municipal bylaws but took no notice of the impact on the adjacent neighbours. In Western Australia, fines of up to \$5,000 are doled out to AC contractors who pull the same kind of unethical stunts: <http://tinyurl.com/5000Fine>.
 - 9) The installer claimed that moving the unit was not feasible. Nonsense! It is standard practice to install or move an outdoor AC unit up to 50 feet or 15 metres from the furnace connection. Action Furnace in Calgary has a standard form for such relocation.
 - 10) Without the homemade sound enclosure on, the AC unit operated at 56.9dBA as measured at the property line. That was deemed too loud, day and night. The throbbing unit next door to me? It was originally measured independently at 58dBA yet was legal in Calgary 24/7 due to lax regulations. In a recent summer – one of the coolest on record -- my family endured 85 days of abuse with nighttime use as well. The Coquitlam victims withstood consecutive summers of only 68 and 73 days of AC assault.

What isn't emphasized enough, beyond the obvious negative health impacts of this issue, is the poisonous effect on neighbourly relations. In the case of the Coquitlam victims – especially the medicated wife – the stress of constant personal conflict with the neighbours was destroying their lives. Inadequate regulations regarding the growing menace of central air conditioner noise is pitting neighbour against neighbour in many communities worldwide. Installers of these noisy, LFN-emitting machines are not operating under adequate codes of ethics and are doing whatever a municipality lets them get away with.

It's time for standards to improve and for this form of assault and abuse to end. Let's not pit neighbour against neighbour in expensive lawsuits to sort this out.

If you have any questions or comments, please feel free to contact me.

Quietly yours,
Wayne Wegner
Victim of Sideyard Central Air Conditioning LFN & Resonance

High-Efficiency Air Conditioners
Designed with Your Comfort in Mind



But not the Neighbour's Health & Comfort!