#1

From: John Herron <johnherron@me.com>
Sent: Friday, December 21, 2018 10:30 AM
To: Jewel Cannada-Wynn
Subject: Quiet Neighborhoods and Leaf Blower Noise
Attachments: Art_20161101_WP_LeafBlowerRuiningNeighborhood.pdf; WrittenStmnt_Herron_LeafblowerNoise_20181220.pdf

Dear Council Member Canada-Wynn,

Good morning. My name is John Herron, and I reside in East Hill, Jared Moore's district. My wife and I recently moved back to Pensacola (where we met) because we want to raise our children here. We are excited to be back, but there is a problem worthy of conversation – neighborhood noise. Often, it's just too loud. One recent weekend, we were exposed to more than eleven hours of loud leaf blower noise in our home. My wife and I and a few other neighbors had a great conversation with Jared, and he recommended I reach out to other council members to request a meeting. Would you be willing to meet with use to discuss environmental noise and ways we can work together to quiet Pensacola neighborhoods?

As to the noise, one neighbor had five hours of continuous blowing with two or more gas-powered backpack leaf blowers. Another had loud blowers and tree trimming saws operate past 7:30 at night. Another has a worker operate a blower every Sunday for hours. Please realize this isn't just a neighbor issue – it's a neighborhood issue. But more importantly it's a public health issue, because leaf blowers can be heard blaring through Pensacola neighborhoods throughout the week and it has become a norm. About 170 cities in 36 different states amended their noise ordinances to address excessive environmental noise like this and encourage quiet neighborhoods to provide a healthy learning environment for children, improve productivity for those working from home, and increase home values. Everybody deserves a quiet neighborhood. Please help us improve the community where we raise our children. They deserve to breathe freely and play, and we all deserve peace and quiet in our homes.

As a primer, first, I've attached an article from Washington Post gardening contributor Adrian Higgins titled "We know you love your leaf blower, but it's ruining the neighborhood". Second, here's a link to a 3 minute video by James Fallows of The Atlantic. Fallows was a guest speaker at CivicCon last September. On gas powered leaf blowers, he says: "They're a menace in a range of areas, from public health to environmental injustice" ... "We need to ban gas-powered leaf blowers." ... "A shift to battery power leaf blowers has community interest, worker interest, public health, and technological momentum on its side. It's time to accelerate that inevitable shift by ending the use of gas-powered leaf blowers." Third, I've attached a written statement I provided to the Mayoral Transition Team on the issue at the meeting yesterday.

I will eventually ask the city to amend its noise ordinance (PMC 8-1-16) to address the noise and other dangers associated with gas powered leaf blowers. I think we should amend the ordinance to balance the needs and ability of residents to enjoy peace and quiet in our homes with the need to maintain our landscapes in a healthy, neat and environmentally orderly way. We want your support. Please let me know if you have time to talk sometime soon. Thank you.

Sincerely,

John Herron

Pensacola, FL

(858) 699-4903; johnherron@me.com

The Washington Post

Home & Garden

We know you love your leaf blower, but it's ruining the neighborhood

By Adrian Higgins Gardening columnist November 1, 2016

There was a time when the defining sensory aspects of an afternoon in the autumn garden were the scratching sound of the leaf rake and the scent of leaf-fueled bonfires.

The bonfires have gone from most places — too polluting — and the rakes are silent, largely. Since the 1970s, the soundscape has been shaped by the leaf blower. To the landscape contractor and estate gardener, the leaf blower is a gift from God, saving hours of tedious raking and grooming. To many others, it is an abomination. When a neighbor's mow-and-blow brigade arrives, with two or three gasoline-powered blowers fully vented, it is as if the banshees are in the 'hood. Banshees, you may know, are spirits whose wailing prefigures a death, in this case the passing of the quaint idea that people should be left in peace in their own homes.

I dislike leaf blowers, but I have one, and not just a wimpy handheld device with an orange electrical cord. Mine is a gas-powered backpack blower. This may mark me as a hypocrite, but let me explain. The machine is used infrequently and for the most part at its quietest idling speed. Even throttled down, the airflow is sufficient to move debris, and the blower shifts leaves and twigs without disturbing the underlying gravel path in a way that a rake could not. If you have fallen leaves on a newly seeded lawn, the blower can be used to clear the new lawn gently without disturbing the grass seedlings in a

way that a rake would. If the blower broke tomorrow, I probably wouldn't replace it.

But we are getting stuck in the weeds.

There is a weird human phenomenon at work here: Sound is far less irritating to its creator than to its recipient. Erica Walker, a doctoral student at Harvard University's Chan School of Public Health, seems to have hit on one reason for this: Recipients of nuisance noise have no power over it.

In a survey of 1,050 residents of more than a dozen Boston area neighborhoods, she reported that the overwhelming majority of respondents said they could not control noise or get away from it. "That's a very vulnerable place to be in," Walker said. Almost as many — 79 percent — believed that no one cared that it bothered them.

Walker, armed with a bicycle and a sound level meter, spent a year recording noise levels at 400 locations across the city. The aural irritants go far beyond the leaf blower: Airplanes, buses, trains, loud-talkers, barking dogs, blaring music — all form ingredients in the sour stew. But the leaf blower is a major culprit. The most powerful models can create a stream of air exceeding 200 mph and with noise levels as high as an ear-piercing 112 decibels.

Industry groups say the gasoline blower is getting a bum rap — that modern technology has made them far cleaner and quieter than they used to be.

One facet of this problem is that as residents have turned over care of their yards to landscapers, what was once a weekend phenomenon from a gadget-minded homeowner is now a weekday, day-long assault on neighborhoods. Another gripe: A tool thought of as an instrument of the fall has become a three-season mainstay for crews who equate a speck-free lawn, patio and flower bed with a job well done.

The two-stroke blowers are also highly polluting, said Ruth Caplan, a civic activist in Cleveland Park and a member of a group lobbying against them, Quiet Clean D.C.

"We are concerned not only about the impact on neighbors but also on workers and feel this hasn't been given the attention that it needs," she said.

In a recent paper written with Jamie Banks, of an organization named Quiet Communities in Lincoln, Mass., Walker measured the sound from a commercial-grade gasoline blower at various distances. Even from 800 feet away, the noise was above the 55-decibel threshold at which sound is considered harmful by the World Health Organization, she said. Another problem is that the machines emit a low-frequency sound that is not measured conventionally but which travels long distances and penetrates building walls.

Some jurisdictions have laws banning or restricting leaf blowers. In the District, council member Mary M. Cheh of Ward 3 has introduced a bill that would outlaw the noisiest and most polluting blowers after 2021.

Most cities and counties don't address blowers specifically but have noise ordinances that ostensibly establish when and how much noise can be made before running afoul of the law. You will find if you put it to the test that local authorities as a rule are unable to effectively enforce the laws. Assuming a city even had a squad ready to show up at a moment's notice equipped with sound sensors, "by the time the police or someone would come, the noise would be long gone," Caplan said.

Fueling this ineffectiveness is a mind-set that if you live in an urban environment, you put up with noise. The other fallacy, said Walker, is that noise is a simple annoyance. She rejects both assertions. Cities don't have to be cacophonous, she said, and noise isn't just an irritant; it harms one's health. Studies have shown that tens of millions of Americans are at risk of hypertension and heart disease from the effects of noise.

"We are blind to the fact it's most likely causing significant health effects," Walker said.

What has to change to make America quieter?

Caplan and others are hoping the new technology of quieter, battery-

powered leaf blowers will become the norm. "We are moving quickly in that direction," she said. Legislation such as Cheh's will help make it a reality, she said.

Walker says beyond these steps, we need a fundamental shift in how we regard noise so that society sees it on the same plane as the environmental imperatives of recycling and reducing air pollution.

She was drawn to this field of study after living in an apartment building where small children were running on the floor above, night and day. "One of the ways that made it tolerable was my landlord saying, 'I understand. I'm going to install carpet above you.' It changed the noise level, but not by much, but it helped," she said. "People want to know you're hearing them, and taking their voice seriously."

More from Lifestyle:

Why the Japanese maple is a must-have for any foliage-loving gardener

Once barely surviving, the grass on the Mall gets a serious makeover

Meadows-in-a-can are a myth. Real ones take a lot of planning and patience.

Knowing what types of weeds grow in your garden can help you improve it

Adrian Higgins has been writing about gardening, landscape design and related environmental topics since the late 1980s. He joined The Washington Post in 1994. He is the author of several books, including the "Washington Post Garden Book" and "Chanticleer, a Pleasure Garden." Follow @adrian_higgins

Submission to the Mayoral Transition Team
City of Pensacola
December 20, 2018

Quiet Neighborhoods and Leaf Blower Noise

by John Herron

There is a problem caused by the overuse of leaf blowers in our neighborhoods because they make too much noise. One recent weekend, my family was exposed to more than eleven hours of loud leaf blower noise exposure in our home. We are not alone. Peace and quiet has become a rarity.

Cities across the nation are establishing rules for leaf blower use because there is increased public awareness about the dangers of noise, particulate matter, and air pollution. Responsible policy makers are considering new research and recognize the overall health risks created by leaf blowers, especially gas-powered leaf blowers. Accordingly, they implement sensible rules to eliminate or mitigate those risks. Nearly all commercial landscapers in Pensacola continue to use two-stroke gas-powered leaf blowers that generate chronic noise far exceeding health and safety standards. They create excessive noise and particulate matter pollution in our neighborhoods, near our schools and around our parks. Chronic noise produced by leaf blowers is a public health issue that should be mitigated by policy makers.

The noise

The CDC recognizes leaf blowers as a source of hazardous noise and tells us "continual exposure to noise can cause stress, anxiety, depression, high blood pressure, heart disease, and many other health problems," and people at higher risk are those who "are exposed to loud sounds at home and in the community." More specifically, the CDC recognizes leaf blowers cause too much noise that can cause permanent hearing loss.[1]

The Department of Labor says commercial leaf blowers create noise in the range of 102-112 decibels ("dBs") at the ear of the operator, well above levels deemed safe without hearing protection. Numerous federal agencies declared noise levels above 85 dBs harmful.[2] Noise level is measured on a logarithmic scale, so an increase of 17 dBs or more represents a huge change in the amount of noise and the potential damage to a person's hearing.[3]

University of Michigan researchers estimate more than 100 million Americans are at risk for noise-related health problems, and over 145 million at risk of hypertension due to noise, and even more at an increased risk of heart attack.[4] The researchers said: "I can't think of any other environmental hazard that affects so many people and yet is so ignored. … There are a lot of assumptions that noise exposure is self-inflicted, which is often not the case. We'd like to have people see connections beyond hearing loss and expand the conversation."[5] The researchers advise "[t]here is a clear need for policy aimed at reducing noise exposures."[6] (See **Attachment 1**, Effects of noise).

The EPA says children are particularly susceptible to chronic environmental noise because unwanted noise, often dismissed as a "nuisance", can become particularly harmful while growing

and it poses a serious threat to a child's physical and psychological health.[7] Researchers identified learning and behavioral difficulties from too much environmental noise, and adverse health effects include heart disease, hypertension, and decreased school performance.[8] They found strong evidence uncontrollable noise significantly impairs cognitive performance because it can induce learned helplessness, increase arousal, alter the choice of task strategy, and decrease attention to a task.[9] Important effect-modifying factors are anxiety and a feeling the noise is unnecessary.[10] This explains why noise is more irritating to unwilling recipients than its creator. (See **Attachment 2**, Adverse effects of noise exposure).

The World Health Organization strongly recommends 53 decibels or less for general outdoor noise and warns continuous noise above this level is associated with adverse health effects. It recognizes environmental noise is an important public health issue and in its latest report found stronger evidence of cardiovascular and metabolic effects from loud environmental noise.[11] Most leaf blowers are powered by loud and inefficient 2-stroke engines, and a recent and important study of sound metrics reveals leaf blower noise is higher than the World Health Organization recommendation of 53 dB out to a distance of 800 feet. Of significance, there is a low frequency dominance of gas-powered leaf blowers. This is concerning because of the ability of the low frequency sound to travel over long distances, penetrate construction walls, and negatively impact health, productivity, and/or quality of life. This low frequency characteristic is an important metric for policy considerations, and it is very important to understand the impact this has on surrounding communities.[12] (See **Attachment 3**, Frequency characteristics of leaf blowers). Acoustic experts explain the low frequency characteristic (100 to 125 Hz) of gas-powered leaf blowers has a greater impact on people and the surrounding community because the low frequency sound travels further, is audible over greater distances, and transmits most easily through windows and glass doors of homes. Accordingly, it's more audible inside surrounding homes and has a greater impact on communities.[13]

Particulate matter blasted into the air, and our lungs

Leaf blowers blast dangerous contaminants called particulate matter – dirt, dust, pollen, excrement, mold, fungus spores, pesticides, herbicides, etc. – into the air after high-velocity and high volume air disturbs the topsoil. Particulate matter is then absorbed into our lungs and can increase the number and severity of asthma attacks, bronchitis, and other lung diseases, particularly among children and the elderly as well as landscapers.

Particulate matter (PM) is grouped into two categories (1) $PM_{2.5}$ or "fine particles", which are < 2.5 micrometers in diameter and travel deeply into the respiratory tract and worsen medical conditions; and (2) PM_{10} or "coarse particles", which are < 10 micrometers in diameter, can consist of chemicals, soil particles, and allergens (pollen or mold spores). An Integrated Science Assessment by the EPA explains particulate matter is easily inhaled, causing or exacerbating lower respiratory tract diseases, such as chronic bronchitis, asthma, pneumonia, lung cancer, and emphysema.[14] [15] (See **Attachment 4**, Particulate matter). "Conclusions regarding the relationship between $PM_{2.5}$ and lung cancer risk [are] robust", according to the International Agency for Research on Cancer, in a study published September 2014.[16]

Particulate matter is harmful to our hearts too. The American Heart Association warns about the dangers of particulate matter that comes from sources such as windblown dust – like the fine particles shot into the air from a high-powered leaf blower. "Particulate matter … is a significant

source of heart-damaging air pollution. Of greatest concern is fine particulate matter … because $PM_{2.5}$ is so small, when inhaled, it can reach deep inside the lungs leading to a wide range of health problems", according to the AHA.[17]

Doctors with the AHA explain the biological mechanisms linking particulate matter exposure to cardiovascular disease and identified three biological pathways.[18] (See **Attachment 5**, Particulate matter effects). Popular Mechanics reports on new personal protection equipment for landscapers that includes protective masks specifically designed to filter fine dust that "can be a real danger to your lungs."[19] What about the rest of us?

Air pollution

Two-stroke engines burn a mixture of oil and gas that generates high levels of ozone-forming chemicals. In addition to kicking up particulate matter from the ground, leaf blower engines are their own source of fine particulate matter. These chemicals and particulate matter are then inhaled by leaf blower operators and passers-by. An independent research laboratory, Edmonds, compared emissions from a Echo PB-500T two-stroke gas-powered leaf blower with a 2011 Ford Raptor. The leaf blower generated 23 times the carbon monoxide and nearly 300 times the non-methane hydrocarbons than the Raptor. In other words, to equal the emissions of a half-hour yard work with one two-stroke leaf blower, you would have to drive the Raptor 3,877 miles, or the distance from Pensacola to Whitehorse in the Yukon Territory.[20]

Conclusion – educate; establish simple, balanced and reasonable rules; continuing education

The good news is battery technology is evolving at a rapid pace and landscaping equipment manufacturers are adapting. After some resistance, businesses are responding positively to cities and clients who want less noise, less pollution, and less perfect lawns. Local retailers now display leaf blowers with rated noise levels and they are competitively priced. Improved battery technology and quieter leaf blowers are now readily available. Cities that have enacted gas powered leaf blower bans haven't reported any substantial cost increases. Furthermore, leaf blower manufacturing representatives recognize the ability to adapt to quieter and less polluting methods and recommend landscapers to use quiet leaf blowers exclusively and responsibly.[21]

Positive steps forward include, first, educate professional landscapers and residents about the dangers associated with excessive use of leaf blowers. Second, consider amending the City's noise ordinance to address leaf blower use in light of new scientific research and increased policy-making awareness about the dangers associated with the dangerous environmental noise and hazardous particulate matter. An amended noise ordinance should address leaf blower machine noise ratings, days of use, and duration. It should distinguish between residential use by homeowners on their own yards and commercial use. It should perhaps exempt large land parcels greater than one acre, golf courses and athletic arenas. Also, blowing leaves and debris into streets should be addressed. Third, implement a continuing education process for commercial landscapers and residents as science and technology continues to evolve. We should encourage commercial landscapers to use best landscape practices.

This issue of loud landscaping practices no longer belongs in the realm of neighborhood squabbling. A shift is underway, battery technology has evolved, and science and environmental evidence shows battery powered leaf blowers are a viable and cost-effective alternative to

antiquated gas-powered leaf blowers. Also, innovative cities have shown reasonable limitations of leaf blower use are appropriate – like loud construction equipment such as pile drivers, pneumatic hammers, and other loud equipment. Peace and quiet will provide multiple benefits for our neighborhoods and enrich our communities.

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[1] Centers for Disease Control and Prevention (CDC) Fact Sheet, "Too Loud! For Too Long!, Loud noises damage hearing", (https://www.cdc.gov/vitalsigns/hearingloss/index.html, retrieved 11/18/2018).

[2] U.S. Department of Labor, Occupational Safety and Health Guide to Instruction, "How Do We Protect Our Ears?", Professional Landcare Network, 2012 (https://www.osha.gov/dte/grant_materials/fy10/sh-21001-10.html, retrieved 11/17/2018).

[3] U.S. Department of Labor, Occupational Safety and Health Administration, "Occupational Noise Exposure, How loud is too loud?" (https://www.osha.gov/SLTC/noisehearingconservation/, retrieved 11/17/2018).

[4] Hammer M.S., Swinburn T.K., Neitzel R.L., "Environmental Noise Pollution in the United States: Developing an Effective Public Health Response", *Environmental Health Perspectives*, Vol. 22, No. 2, February 2014, pp. 115-19, (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3915267/). These researches are from the University of Michigan School of Public Health.

[5] "U-M researchers highlight hazards of noise pollution", by Laurel Thomas Gnagey, The University Record, December 5, 2013 (https://record.umich.edu/articles/u-m-researchers-highlight-hazards-noise-pollution).

[6] "Environmental Noise Pollution in the United States", *supra*, at 117.

[7] U.S. Environmental Protection Agency, "Noise and Its Effects on Children, Information for Parents, Teachers and Childcare Providers, EPA-410-F-09-003, November 2009 (https://www.epa.gov/sites/production/files/2015-07/documents/ochp_noise_fs_rev1.pdf, retrieved 11/17/2018).

[8] Passchier-Vermeer W., Passchier W.F., "Noise Exposure and Public Health", *Environmental Health Perspectives*, Vol. 108, 2000, pp. 123-31, (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1637786/pdf/envhper00310-0128.pdf).

[9] "Noise Exposure and Public Health", *supra* at 128 ("There is overwhelming evidence from laboratory experiments that the presence of uncontrollable noise can significantly impair cognitive performance. Noise can induce learned helplessness, increase arousal, alter the choice of task strategy, and decrease attention to the task.").

[10] "Noise Exposure and Public Health", *supra* at 126 ("Important nonacoustical effect-modifying factors are anxiety, fear of the noise source, and a feeling that the noise could be avoided.").

[11] World Health Organization Environmental Noise Guidelines, October 10, 2018, p. 30 (http://www.euro.who.int/en/health-topics/environment-and-health/noise/environmental-noise-guidelines-for-the-european-region, retrieved 11/16/2018).

[12] Walker E, Banks J, "Characteristics of Lawn and Garden Equipment Sound: A Community Pilot Study", *J Environ Toxicol Stu*, October 31, 2017, p. 4 (https://sciforschenonline.org/journals/environmental-toxicological-studies/JETS-1-106.php) ("The results of this study indicate that landscape maintenance sound produced by [gas-powered leaf blowers] may travel over long distances in a community at levels known to increase the risk of adverse health effect. Vulnerable populations include workers, children, the elderly, the sick, those who work from home, and those who work overnight shifts.").

[13] Testimony of Chris Pollock, PE, Arup, before the D.C. City Council Committee, July 2, 2018 (http://www.quietcleandc.com/testimony/july-2-pollock).

[14] "Particle Pollution (PM)", *AirNow*, January 31, 2017 (https://www.airnow.gov/index.cfm?action=aqibasics.particle) ("Small particles less than 10 micrometers in diameter pose the greatest problems, because they can get deep into your lungs, and some may even get into your bloodstream. Exposure to such particles can affect both your lungs and your heart. … Exercise and physical activity cause people to breathe faster and more deeply – and to take more particles into their lungs.")

[15] U.S. EPA Integrated Science Assessment (ISA) for Particulate Matter, December 2009, at pp. 2-1 to 2-26 (https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=216546, retrieved 11/18/2018) ("Controlled human exposure studies have demonstrated $PM_{2.5}$-induced changes in various measures of cardiovascular function among healthy and health-compromised adults" … "The recent epidemiologic studies evaluated report consistent positive associations between short-term exposure to $PM_{2.5}$ and respiratory [emergency department] visits and hospital admissions …").

[16] "Outdoor Particulate Matter Exposure and Lung Cancer: A Systematic Review and Meta-Analysis", *Environmental Health Perspectives*, Vol. 122, No. 9, Hamra, GB, Guha N, et al, September 2014, at pp. 906-11, at p. 910 (https://www.ncbi.nlm.nih.gov/pubmed/24911630).

[17] American Heart Association, "FACTS, Danger in the Air, Air Pollution and Cardiovascular Disease", 2014 (https://www.heart.org/idc/groups/heart-public/@wcm/@adv/documents/downloadable/ucm_463344.pdf).

[18] "Particulate Matter Air Pollution and Cardiovascular Disease", *Circulation, American Heart Association Scientific Statement*, Brook RD, MD, Rajagopalan S, MD, et al., June 1, 2010, pp. 2331-78, at p. 2353 (https://www.ahajournals.org/doi/pdf/10.1161/CIR.0b013e3181dbece1).

[19] "How Not to Maim Yourself, Hands, eyes, toes, ears, lungs – if you care about a body part, you'll want to protect it while you're working", *Popular Mechanics*, September 9, 2018, p. 92.

[20] "Emissions Test: Car vs. Truck vs. Leaf Blower", Edmonds, December 5, 2011 (https://www.edmunds.com/car-reviews/features/emissions-test-car-vs-truck-vs-leaf-blower.html)(article) and (https://www.youtube.com/watch?v=pDxQIHoTmxs)(video).

[21] "Industry specialist warns leaf blower bans are coming if changes are not made", *Total Landscape Care*, January 18, 2018.

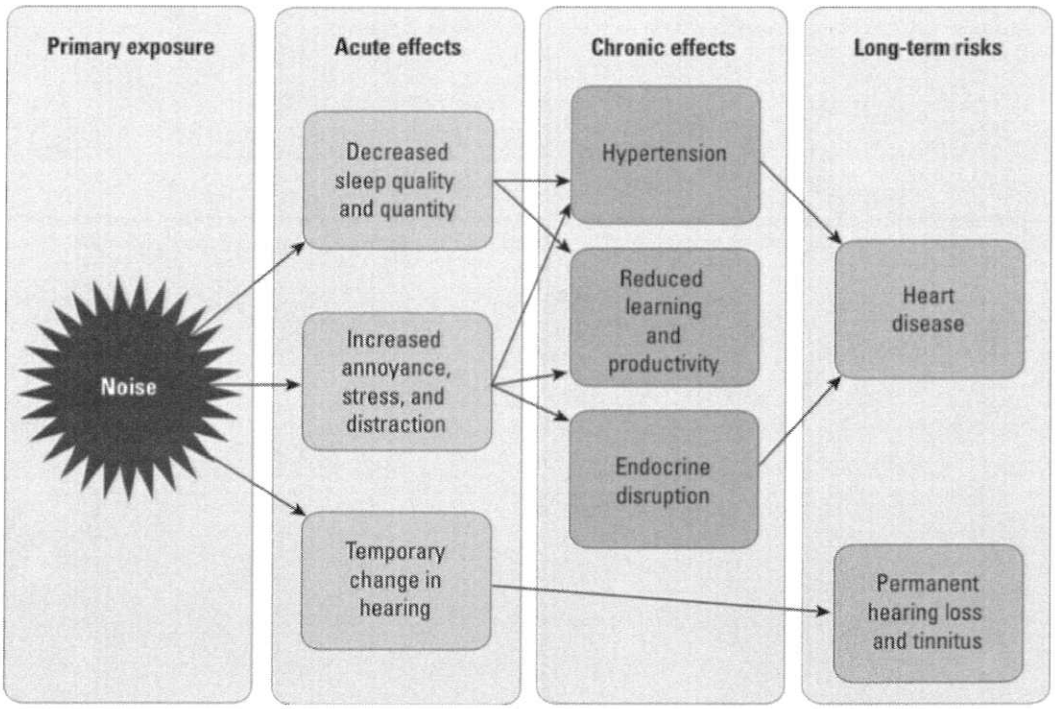


Figure 1

Select effects of noise.

- Children in noisy environments have poor school performance, which leads to stress and misbehavior. They also have decreased learning, lower reading comprehension, and concentration deficits. [p 116]

- Estimate at least 145.5 million people [greater than 1/3] were at potential risk of hypertension due to noise in 2013. [p 117]

- Direct regulation that sets maximum emission level for noise sources is the only intervention that guarantees population-level exposure reductions. The NPS supports noise source reduction as the most cost-effective intervention to protect health. [p 117]

"Environmental Noise Pollution in the United States: Developing an Effective Public Health Response", *Environmental Health Perspectives*, Vol. 22, No. 2, February 2014, at p. 116.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3915267/

Attachment 1, Biopsychosocial model of chronic noise

Table 1. Long-term effects related to exposure to noise and classification of the evidence for a causal relationship between noise and effect. The last three columns contain information on the observation threshold of an effect for which the causal relationship with noise exposure (second column) is judged to be sufficient.[a]

Effect	Classification of evidence[b]	Exposure situation	Observation threshold		
			Metric	Value (dB(A)	Indoors/ outdoors[c]
Hearing impairment	Sufficient	Occ	$L_{Aeq,8h}$	75	Indoors
		Env	$L_{Aeq,24h}$	70	Indoors
		Occ unb	$L_{Aeq,8h}$	< 85	Indoors
Hypertension	Sufficient	Occ ind	$L_{Aeq,8h}$	< 85	Indoors
		Env	L_{dn}	70	Outdoors
Ischemic heart disease	Sufficient	Env	L_{dn}	70	Outdoors
Biochemical effects	Limited	Occ			
		Env			
Immune effects	Limited	Occ			
		Env			
Birth weight	Limited	Occ			
		Env air			
Congenital effects	Lacking	Occ			
		Env			
Psychiatric disorders	Limited	Env air			
Annoyance	Sufficient	Occ office	$L_{Aeq,8h}$	< 55	Indoors
		Occ ind	$L_{Aeq,8h}$	< 85	Indoors
		Env	L_{dn}	42[d]	Outdoors
Absentee rate	Limited	Occ ind			
		Occ office			
Psychosocial well-being	Limited	Env			
Performance	Limited	Occ env			
	Sufficient	School	$L_{Aeq,school}$	70	Outdoors
Sleep disturbance, changes in					
Sleep pattern	Sufficient	Sleep	$L_{Aep,night}$	< 60	Outdoors
Awakening	Sufficient	Sleep	SEL	55	Indoors
Sleep stages	Sufficient	Sleep	SEL	35	Indoors
Subjective sleep quality	Sufficient	Sleep	$L_{Aep,night}$	40	Outdoors
Heart rate	Sufficient	Sleep	SEL	40	Indoors
Hormone levels	Limited	Sleep			
Immune system	Inadequate	Sleep			
Mood next day	Sufficient	Sleep	$L_{Aep,night}$	< 60	Outdoors
Performance next day	Limited	Sleep			

Abbreviations: env, living environment; ind, industrial; occ, occupational situation; school, exposure of children at school; unb, unborn: exposure of pregnant mother. [a]The table is adapted from Table 1 of the 1994 Health Council report (6). [b]Classification of evidence of causal relationship between noise and health. [c]Value relates to indoor or outdoor noise assessment. [d]The observation threshold for percentage of highly annoyed persons is about 12 dB(A) lower for environmental impulse noise.

"Noise Exposure and Public Health", *Environmental Health Perspectives*, Vol. 108, 2000, at p. 125.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1637786/pdf/envhper00310-0128.pdf

Attachment 2

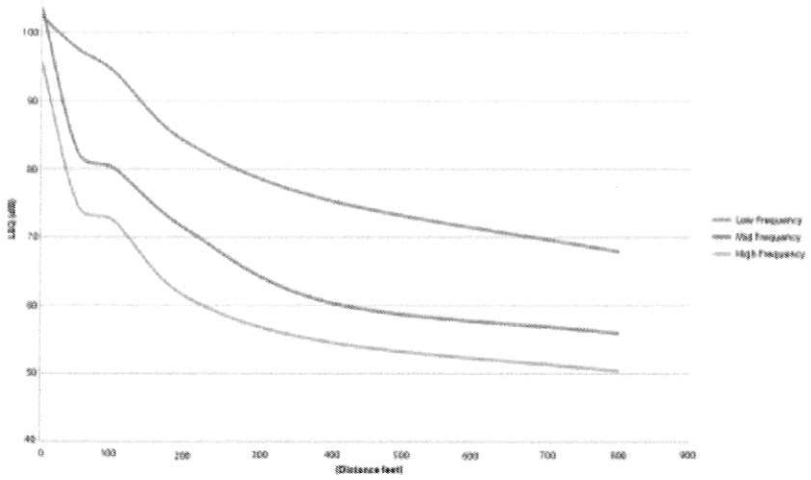
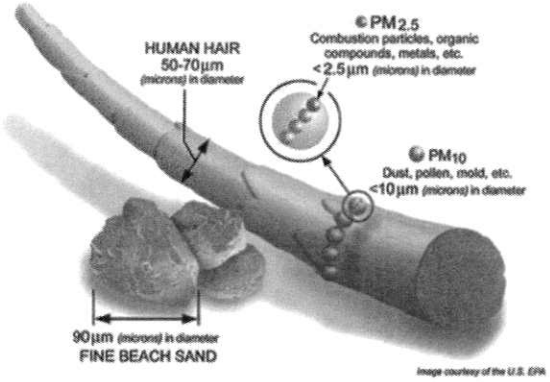


Figure 2: Sounds levels by frequency over distance

"Characteristics of Lawn and Garden Equipment Sound: A Community Pilot Study", *J Environ Toxicol Stu*, October 31, 2017, at p. 3.

https://sciforschenonline.org/journals/environmental-toxicological-studies/JETS-1-106.php

Attachment 3



- **Coarse dust particles (PM_{10})** are 2.5 to 10 micrometers in diameter. Sources include crushing or grinding operations and dust stirred up by vehicles on roads.

- **Fine particles ($PM_{2.5}$)** are 2.5 micrometers in diameter or smaller, and can only be seen with an electron microscope. Fine particles are produced from all types of combustion, including motor vehicles, power plants, residential wood burning, forest fires, agricultural burning, and some industrial processes

Particle pollution illustration

"Particle Pollution (PM)", *AirNow*, January 31, 2017.

https://www.airnow.gov/index.cfm?action=aqibasics.particle

Attachment 4

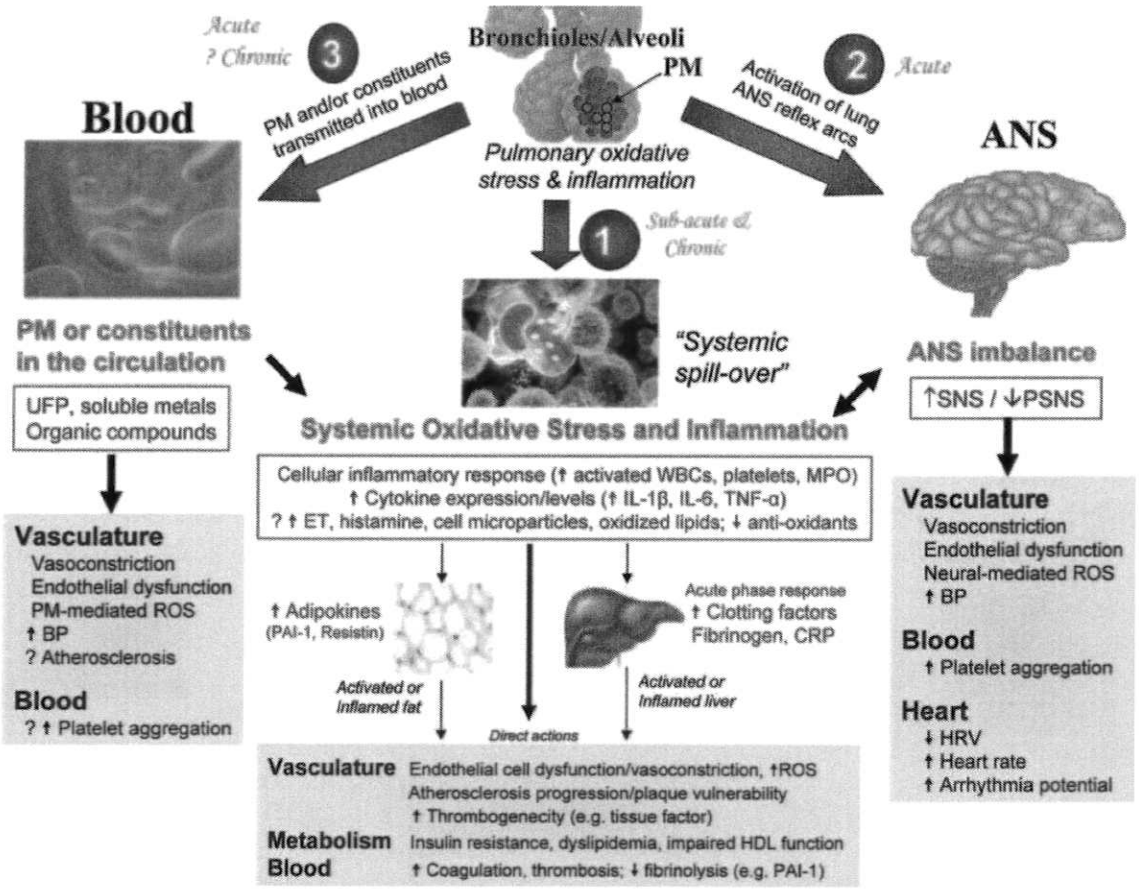


Figure 3. Biological pathways linking PM exposure with CVDs. The 3 generalized intermediary pathways and the subsequent specific biological responses that could be capable of instigating cardiovascular events are shown. MPO indicates myeloperoxidase; PAI, plasminogen activator inhibitor; PSNS, parasympathetic nervous system; SNS, sympathetic nervous system; and WBCs, white blood cells. A question mark (?) indicates a pathway/mechanism with weak or mixed evidence or a mechanism of likely yet primarily theoretical existence based on the literature.

"Particulate Matter Air Pollution and Cardiovascular Disease", *Circulation, American Heart Association Scientific Statement*, June 1, 2010, at p. 2353.

https://www.ahajournals.org/doi/pdf/10.1161/CIR.0b013e3181dbece1

Attachment 5