# Data Centers' Unique Sound Signatures Have Public Health Impacts Extending Far Beyond Normal Urban Noise

Research and Readings Compiled by Kevin J. Coyle, JD.

Editor's note: the text in this compilation are direct article excerpts.

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## Introduction: Getting in Front of a Problem

The Board of County Supervisors of Prince William County, Virginia have, to date, approved some 65 to 70 million square feet of data centers. This is more square footage than has been approved by any single jurisdiction on Earth. Roughly 25 million square feet of this total are in the Gainesville and Bristow areas. This is over and above the 23 million square foot development called the Prince William Digital Gateway. The County's 2023 approval of the Digital Gateway was voided the Virginia courts.

About two thirds of the developments in Gainesville and Bristow: Gainesville Crossing, NTT, Village Place, Mango Farms, Atlantic Research, Garder property, Hunter property and others are in locations relatively near dozens of neighborhoods and at least seven public schools. Other neighborhoods in the County such as the Great Oak community near the Manassas Airport, the Innovation Town Center, and the Gateway Blvd townhomes have or will experience data center noise, particularly infrasound.

Importantly, while the County has OK'd or is near to approving more than 40 data centers near Gainesville and Bristow neighborhoods with some 20,000 to 25,000 residents, virtually none of these data centers in are currently in operation. They are not yet generating noise, particularly the

signature low frequency day and night hum common to data centers. Once these facilities are in operation, the sound generated by rooftop air conditioning, backup diesel generators and more will be day and night.

This compilation of research and perspective on the unique signatures of data center noise suggests that exposing many thousands of residents in their homes and children and faculty in schools will have significant health impacts. This exposure will extend longer distances than conventional decibel volumes due to the far-reaching impact of low frequency noise. This, in turn, will lead to health and related property devaluation effects and numerous public objections County residents will pursue political recourse and also legal remedies and damages either through class action litigation or as individuals. Getting in front of what could be a costly and extended battle aimed at the data companies and the County makes good sense. Failure to do so will likely have long term and costly consequences for the residents, schools, the PW County officials, the companies themselves and the business climate of Prince William.

## Why Data Center Noise is Making Residents Sick

The boom in AI infrastructure has produced a side effect that most standard monitoring equipment cannot register: a continuous low-frequency hum from cooling systems, diesel generators, and gas turbines that residents near data centers report they cannot hear but physically feel. **TechRadar reports** that this infrasound, low-frequency sound below 20 Hertz, bypasses the ear entirely and reaches the body as pressure or vibration, prompting complaints ranging from dizziness and nausea to insomnia and migraines.

The documented cases are specific. In Granbury, Texas, a Bitcoin mining center sitting less than 100 yards from a mobile home park hosts 60,000 computers and their associated cooling and power systems; dozens of residents there reportedly experienced vertigo, nausea, high blood pressure, migraines, fluid from their ears, and insomnia. In Southaven, Mississippi, the roar from 27 natural gas-powered turbines at an xAI facility has disturbed nearby residents' sleep. Across facilities, data centers have reportedly emitted noise up to 96 decibels continuously, around the clock. Infrasound at high volumes can affect the central nervous system and heart function, according to McGill University researchers cited in the reporting.

AI Data Centers' Inaudible Hum Is Sickening Nearby Residents | AI Weekly

## The Unique and Often-Overlooked Sound Signature of a Data Center:

One dimension has received little systematic attention: the acoustic environment generated by data centers, and the sub-audible acoustic frequencies produced continuously by data center mechanical infrastructure. Data center cooling fans, heating, ventilation, and air conditioning (HVAC) equipment, uninterruptible power supplies, backup diesel generators, and power transformers collectively produce acoustic output that extends into the infrasound (<20 Hz) and low-frequency noise (LFN, 20–200 Hz) range, referred to collectively here as ILFN. In other industrial, occupational, and community contexts, ILFN exposure has been associated with

documented non-auditory health effects, including sleep disturbance, cardiovascular stress responses, cognitive impairment, and audio-vestibular symptoms [8,9,10].

Infrasound and Low-Frequency Noise in Data Center Environments: A Narrative Review Toward Health-Protective Acoustic Design Standards

## Constant Data Center Noise Often Exceeds Recommended Nighttime Health Limits

Residents who moved to quiet neighborhoods now find silence replaced by a low industrial drone rattling through bedroom walls at 3 AM. That hum comes from cooling systems running around the clock to keep AI servers from overheating. At property lines, noise routinely hits **55–65 dBA**, according to the Environmental and Energy Study Institute — roughly 20–30 dB above natural nighttime baselines in rural areas. The **World Health Organization** flags nighttime noise above 55 dB as a threshold for adverse health effects, including hypertension and cardiovascular risk. These facilities clear that threshold every single night.

The Devastating Effects of AI Data Center Noise On The Human Body & Mind - Gadget Review

## The Symptoms Caused by Unique Data Center Noise Can be Physical More Than Auditory and Responses Are Involuntary

The body's unwitting receiver: infrasound—low-frequency sound below 20 Hertz—bypasses the ear entirely. The body feels it as pressure or vibration. Residents living as close as 50 feet from data centers report symptoms remarkably similar to electromagnetic radiation syndrome, the condition linked to cell towers and Wi-Fi networks.

Paul Héroux, associate professor of medicine at McGill University and vice chair of the International Commission on the Biological Effects of Electromagnetic Fields, said the overlap is no coincidence.

"Sound, electric and magnetic fields of the same frequency have some overlap in their biological effects because they are similarly disruptive energy injections," Héroux said.

Infrasound at high volumes can directly affect the human central nervous system, causing disorientation, anxiety, panic, bowel spasms, nausea and vomiting, according to Héroux. German researchers published an in-vitro study five years ago showing that after just one hour of exposure, high levels of infrasound interfered with the heart muscle's ability to contract properly, raising questions about chronic exposure effects.

AI data centers' "infrasound" pollution linked to nausea, insomnia in nearby residents

## Non-auditory Effects Cause Especially Serious Damage to Public Health

According to the noise reaction model introduced by Babisch and colleagues, chronic low levels of noise can cause so-called nonauditory effects, such as disturbances of activity, sleep, and communication, which can trigger a number of emotional responses, including annoyance and subsequent stress. Chronic stress in turn is associated with cardiovascular risk factors, comprising increased blood pressure and dyslipidemia, increased blood viscosity and blood glucose, and activation of blood clotting factors, in animal models and humans. Persistent chronic noise exposure increases the risk of cardiometabolic diseases, including arterial hypertension, coronary artery disease, diabetes mellitus type 2, and stroke.

The Adverse Effects of Environmental Noise Exposure on Oxidative Stress and Cardiovascular Risk - PMC

## The Tonal Character of Data Center Noise Differs from Other Industrial Noise and Traffic Noise

Data centers emit constant low-frequency noise that is structurally different from other industrial sources — tonal, continuous, and resistant to conventional barrier mitigation. Minnesota's applicable noise standard measures sound in a way that systematically underweights the frequency range most associated with data center complaints: in documented cases, facilities measured at 40 to 59 dB(A) on residential property — within applicable limits — while neighbors reported sleep disruption, difficulty concentrating, and avoidance of outdoor spaces.

**Tonal character.** Most regulated industrial noise — manufacturing equipment, aggregate operations, truck traffic — is broadband: acoustic energy spread across many frequencies. Chiller fans and diesel generators produce tonal noise: energy concentrated at discrete frequencies. The noise concern from low-frequency tonal sources is not primarily peak annoyance in the way measured by short-duration listening tests.[6] The concern is instead chronic exposure: research on low-frequency noise exposure indicates that because tonal noise is predictable and repetitive, habituation is incomplete, and sleep disturbance and related effects may persist at exposure levels that would not produce acute complaints — though the epidemiological evidence on this point remains limited in scope.[7] [2] Low-frequency tones also penetrate building walls and conventional acoustic barriers more effectively than higher-frequency sound. Beginning in April 2023, Williams County, North Dakota officials began receiving noise complaints from residents surrounding the Atlas Power Data Center west of Williston — a high-performance computing and cryptocurrency mining facility — shortly after it became operational.[8] The company installed an acoustic barrier as mitigation; complaints continued, and in 2023 residents filed a civil lawsuit citing excessive noise, property value impacts, and quality-of-life harms.[9] A monetary settlement was reached in 2026.[9] According to INVC's account of the case — a vendor source — the barrier cost approximately $5

million.[10] *Analysis: INVC attributes the barrier's failure to the physics of low-frequency tonal noise from cooling fans, which cannot be effectively attenuated by conventional barriers;*

Data Center Noise: What It Is and Why the Standard Does Not Capture It | Elk River Data Center

## Traditional Sound Barriers are Ineffective.

### Why Traditional Noise Barriers Fail Against Data Center Hum

The ineffectiveness of such a colossal wall against data center noise lies in the lack of an accurate diagnosis of the cause of the noise complaints and understanding of the fundamental principles of acoustics.

Low-frequency sounds, like the deep hum from data centers, possess long wavelengths, similar to ocean breakers. Conversely, higher-frequency sounds, typically measured and regulated using the conventional dB(A) scale, have short wavelengths, like ripples. Attempting to block a low-frequency hum with a barrier is akin to trying to stop an ocean breaker with a postcard; the sound energy simply flows around it.

This $5 million investment effectively bought a "King Canute noise barrier" – a structure that could not work.

### The "Smoking Gun": narrow band frequency analysis

The key to understanding and solving data center noise problems lies in a precise diagnostic tool: narrow band frequency analysis. As demonstrated by my simple analysis of an audio clip from a local TV news story about the complaints, the problem at the Atlas Power data center was obviously not the overall noise level. Instead, it was a group of powerful low-frequency tones based on a dominant spike at 118 Hz originating from the cooling fans. A simple, rapid remote analysis that instantly pinpointed the real culprit.

Data Center Noise Regulation: a smarter approach to a global problem - Industrial Noise & Vibration Centre

## Low Frequency Noise Travels Farther and Goes Straight Through Walls and Windows

Facility walls would need to be 4.5 feet thick to mitigate the kind of low hum that data centers typically make, according to Kasey Fowler-Finn, a biology professor at Saint Louis University.

The low-frequency noise emitted by the facilities' large-scale cooling and HVAC systems travels further and is more noticeable than the high-frequency noise that many noise ordinances are directed at, Fowler-Finn said in an interview last week.

"Data center hums [are] concentrated in single frequencies and they really stand out from background noise no matter how loud or what frequency that background noise is in," Fowler-Finn told Saint Louis Public Radio Sept. 24.

Model data center noise guidance that Fowler-Finn released last month, based on research that she says she's been conducting since 2001, focuses on the unique wavelengths of the low-frequency hum that large HVAC and cooling systems tend to emit.

"A facility can be compliant on paper while still delivering audible — or, for very low frequencies, inaudible but still physiologically relevant — daytime and nighttime noise exposure linked to numerous health concerns," Fowler-Finn says in the guidance.

All sound loses its intensity as it spreads out geometrically, she says. It will weaken 6 decibels every time it doubles its distance from the source and weaken by 30 dB by the time it spreads 3,000 feet. It also loses intensity as it's absorbed by structures that are in its path. But absorption has less impact on low-frequency sound because of the length of the wavelength, she says.

"Low frequencies ... pass through walls and windows with little loss, since ordinary building materials are, for practical purposes, ineffective at attenuating them," she says. "Low-frequency sound can also generate secondary noise by inducing vibrations and rattles in nearby structures."

A 4-inch wall is sufficient to mitigate a typical high-frequency noise like a vacuum cleaner, which can reach about 1,000 hertz, but to mitigate a low-frequency noise at 63 Hz — which is typical of large scale HVAC and cooling systems — the wall would have to be 4.5 feet thick, she says. And for a noise as low as 20 Hz, it would have to be 14 feet thick — "not a remotely practical thickness for a building enclosure," she says.

4.5-foot-thick walls needed to absorb data center noise: researcher | Construction Dive

## Data Center Hum Requires New Regulation and New Design Approaches

The industrial noise data centers produce is typically described as a low-frequency hum.

Data centers need to continuously manage the heat they generate. This cooling requires large air-handling units (which regulate and circulate air), air-cooled chillers and cooling towers, as well as pumps to circulate water—all of which produce noise.

Data centers also have backup generators. These are used when there is a disruption to the power supply or for a few minutes of testing during a maintenance check.

Both the air-handling units and the backup generators can produce noise levels above 85 dBA within the facility.

However, this noise is reduced by barriers, distance and other mitigation measures to meet compliance noise limits in surrounding areas.

Noise mitigation measures include choosing quieter cooling equipment, careful building design and the use of soundproofing equipment such as acoustic louvers, physical barriers and silencers.

Are data centers actually noisy, and is this bad for our health?

## Why Community Regulations Mostly Fail When Comes to Data Center Noise

Not understanding the effect of using just "A" weighted noise values that massively underestimate the impact of low frequency tonal noise as the cause of complaints is a **very** common mistake. This factor combined with the failure to carry out narrow band frequency analysis are **the** reasons for many failed data center and crypto mining noise mitigation strategies where the main sources (fans and generators) produce low-frequency tones.

Low-cost high efficiency data center noise reduction - Industrial Noise & Vibration Centre

## Data Centers Sound Signatures Require Sophisticated Monitoring and Regulation

Data center noise impacts vary by facility, time of day, proximity to residential areas, and technology use. Like other industrial facilities, data centers emit high- and low-frequency sounds. In an interview with EESI, Kyle Hart of the National Parks Conservation Association stated that because data center noise spans multiple frequency ranges, particularly in the low-frequency range, it is difficult to measure with a decibel meter and without reliable measurements it is difficult to enforce local noise ordinances for nearby residents.

When operating, data centers emit sounds from the humming of cooling systems and air chillers, the rumbling of diesel generators, and the whirring of fans. Together, these sounds can be heard for hundreds of feet around the facilities. Data center neighbors have reported headaches, vertigo, nausea, sleep disturbances, ear pain, and hypertension. Hart adds that people who live near these data centers can hear the noise day and night as a ringing in the ears. Complaints about data center noise tend to focus on its 24/7 consistent presence rather than on its volume.

Data centers are becoming noisier as developers stack more information technology (IT) equipment and servers into smaller spaces. While individual servers are not especially loud, the compounding effect of thousands or tens of thousands of servers in a computing warehouse can

raise noise levels to 96 decibels. This is a problem because some data centers are close to where people live, sometimes within 50 feet of homes.

Backup diesel generators are another source of noise pollution from data centers. Because data centers need to operate 24/7, 365 days a year, they need backup power during grid outages. To ensure this power is available when needed, the generators are tested at least once a month. During non-emergency situations, such as equipment testing, the EPA allows emergency generators to operate for up to 50 hours per calendar year. Data centers are not held to a federally-enforceable time limit when running diesel generators during unforeseen emergencies such as grid failures, fires, and floods, provided the operator reports and logs the hours and the emergency.

The number of generators per facility depends on the data center's size. As data centers grow larger, the number of generators per center increases, along with their generation capacity and size. With more and larger generators comes a louder rumbling, which can be disruptive to residents and wildlife living near these facilities. Noise levels from industrial-sized diesel generators can reach up to 105 decibels, as noisy as a jet flying overhead.

A third source of noise from data centers are dedicated onsite power plants. As more data centers come on line or existing ones expand and need more power, developers are increasingly installing jet-engine gas turbines inside the perimeter of these facilities to provide dispatchable baseload power. In some data centers, like an xAI facility in Southaven, Mississippi, the roar from 27 natural gas-powered turbines is disturbing the sleep of nearby neighbors, who have publicly express concerns about air and noise pollution from these engines.

In the United States, 46 planned, permitted, or under-construction data centers will use off-grid gas turbines for power rather than connect to the grid. Unlike emergency diesel generators that run only during testing or emergencies, off-grid turbines operate 24/7 to power the data center, which leads to uninterrupted noise in surrounding areas. Cooling towers, a major source of noise from gas-fired power plants, can emit up to 70 dBA within 400 feet.

**Local Trade-offs: Economic Growth Versus Public Health**

Today, noise pollution is regulated at the local and state level through zoning ordinances and other regulations. The *Clean Air Act of 1970* gave the Environmental Protection Agency (EPA) oversight of noise pollution and the power to carry out noise control investigations through the Office of Noise Abatement and Control. The *Noise Control Act of 1972* (P.L. 92-574) and the *Quiet Communities Act of 1978* (P.L. 95-609) empowered the EPA to provide grants to localities to mitigate noise. In 1981, the Reagan Administration defunded the Office of Noise Abatement and Control and shifted regulatory oversight and noise control to state and local governments. The EPA retains the legal authority to study noise and its effects on public health.

Data centers generate billions of dollars for localities through property, sales, and income taxes, which help fund schools, roads, and parks. Kyle Hart described data centers as the “goose that lays the golden eggs.” Due to a lack of reliable data from sound level meters and because most county or community noise ordinances are written to address noisy block parties rather than data centers, most noise complaints go nowhere. Hart added that as data center neighbors see that nothing changes in response to their complaints and frustration, they start to move away.

**Impacts on Local Communities**

Data center developments in Virginia, Arkansas, and Texas illustrate the impacts of noise pollution on local residents. Northern Virginia is the epicenter of the U.S. and worldwide data center boom. With nearly 300 operating data centers, Northern Virginia is home to about 14% of all data centers worldwide. The 2024 Virginia Joint Legislative Audit Review Commission report on data centers notes that almost one-third of the state's data centers are located within 200 feet of residentially zoned properties (this is possible because zoning ordinances consider data centers to be in the same non-industrial category as office space). Residents in Prince William County have complained that data center noise levels routinely exceed 60 decibels. While the county noise ordinance exempts air conditioning units, Amazon, the owner of some of the facilities, has decided to retrofit its data centers with acoustical shrouds as part of its noise-reduction efforts.

In May 2023, a Bitcoin mining center—a type of energy-hungry data center—popped up in Greenbrier, Arkansas, not far from a residential area. Nearby residents have complained about the 24/7 noise coming from the center, which is leading to health problems, including increased blood pressure and anxiety. The high-velocity fans used to cool computers inside the mine generate a constant hum that can be heard miles away in such a rural setting.

Since the arrival of a nearby bitcoin mining center, dozens of residents of Granbury, Texas, have also complained of medical ailments, including vertigo, nausea, high blood pressure, migraines, fluid coming from the ears, and insomnia. Neighbors attribute this spike in health issues to excessive noise pollution from the bitcoin mine. Sitting less than 100 yards away from a mobile home park, the sprawling facility hosts 60,000 computers and associated cooling and power systems, emitting noise at all hours of the day and night.

**Noise Reduction Solutions for Data Centers**

There are steps that data center developers and operators can take to reduce the noise generated by data centers and its impact on neighbors. State and local governments also have a role to play in updating regulations to address this increasingly widespread source of noise pollution. Solutions fall into four general categories: soundproofing specific equipment, soundproofing the overall building envelope, alternative cooling technologies, and better site planning.

*Equipment Soundproofing*

- Basic soundproofing measures, such as enveloping server racks with foam and sound-deadening mats, can help reduce noise levels in data centers. Noise-absorbing materials, such as acoustic tiles and foam panels, can be installed indoors on walls and ceilings to absorb sound from IT equipment.
- Compressor sound blankets, fan silencers, and sound curtain barriers can help absorb noise emanating from chillers and cooling equipment, particularly those located outside the data center.
- Sound attenuators and acoustical silencers can help muffle noise from air intakes in the diesel engine generators.

*Building Soundproofing*

- Erecting conventional acoustic barriers, such as insulated, modular metal walls around the perimeter of the data center and on roofs, can mitigate high-frequency noise from cooling units, generators, and chillers.

- Placing acoustic shields, which are generally smaller and more portable than barriers, around the data center also creates a noise barrier that captures low-frequency noise and the annoying hum from cooling systems.
- Planting bushes, shrubs, and trees around data centers can help reduce noise by creating a natural shield around the facility. Natural barriers can also enhance data centers' visual appeal and provide environmental benefits.

*Quieter Cooling Technologies*

- Immersion cooling, which bathes the servers in synthetic liquid-cooling fluid, eliminates the need for large, noisy fans and cooling equipment and is also more energy-efficient.
- Low-noise coolers for industrial facilities are designed to operate at lower decibel levels than traditional systems.

*Better Site Planning*

- Communities can create "quiet places" where loud data centers are prohibited.
- Data centers can be located far from residential areas, with zoning ordinances changing to classify them as industrial facilities.

If more data centers test different combinations of these potential solutions, communities, governments, and companies will learn what works to comprehensively address the health and environmental impacts of noise pollution from data centers.

Communities Are Raising Noise Pollution Concerns About Data Centers | Article | EESI

## Additional Articles:

Why Data Centers Are Noisy and How to Reduce the Sound Levels

Data center noise lawsuits: Residents sue over sounds of AI boom

DataCenter_Noise_General_Guidelines_sept2026

*Kevin J. Coyle, JD, resides in Prince William County, VA and has decades of experience in environmental assessment, education and advocacy. He has led several national conservation organizations, including American Rivers, the National Environmental Education Foundation, and was Vice President and Counsel to the CEO of the National Wildlife Federation. He is former chair of the Natural Resources Council of America. From 2023 to 2025, he served on the Prince William County Data Center Ordinance Advisory Group (DCOAG)*