INDEPENDENT ANALYSIS

Below the Curve

What Virginia Counties Chose Not to Measure

Data Center Noise and the Instrument Virginia Uses to Measure It

Virginia Data Center Reports

NOISE

Prepared by Tommy N. Turner

Williamsburg and Christiansburg, Virginia

October 2026 · Version 1.1

DOI: 10.5281/zenodo.23145782 ORCID: 0009-0005-7422-9881

BELOW THE CURVE

What Virginia Counties Chose Not to Measure

Series: Virginia Data Center Reports
Evidence snapshot: October 4, 2026
Updated through: October 24, 2026, for the items dated in the text
Version: 1.1 (supersedes v1.0, October 2026)
Author: Tommy N. Turner
Location: Williamsburg and Christiansburg, Virginia
Contact: 757-784-0979 · tommy@gofast.pro · linkedin.com/in/tommyturner
ORCID: 0009-0005-7422-9881
DOI: 10.5281/zenodo.23145782
Published: October 2026 (v1.0) · Revised October 2026 (v1.1)

Related volumes in this series:

- What Virginia Is Spending, What Virginia Is Getting: The Commonwealth Data Center Reference
- Two Systems, One Drought: Virginia's Groundwater Ceiling, Its Rivers, and the Water the Energy Buildout Actually Uses
- Governing the Demand Shock: Local Institutional Variation in Virginia's Data Center Expansion
- Case Study: Loudoun County, Virginia: The Endgame Case: What It Costs to Change the Rules After the Industry Is Load-Bearing
- Case Study: Prince William County: Governance Capture, the Revolving Door, and the Democratic Correction
- Case Study: Pittsylvania County: The County Turned Down One Data Center Plan, Then Rezoned for a Bigger One

Disclosure: The author serves on the advisory board of an Alfred P. Sloan Foundation-funded study at Emory University on data centers and the Southern energy buildout. The study had no role in this report.

© 2026 Tommy N. Turner

CONTENTS

SUMMARY **4**
PURPOSE, SCOPE, AND METHOD **5**
PART ONE: THE GAP **6**
1. Two true measurements 6
PART TWO: THE INSTRUMENT **8**
2. What A-weighting removes 8
2.1 Two claims this volume will not make 9
3. Seventy-six instruments 10
3.1 The exemptions do the work 11
PART THREE: THE CHOICES **13**
4. Loudoun, 2016 13
4.1 What Loudoun's rule says now 15
5. Prince William, 2025 16
5.1 What was adopted 17
5.2 The reason, on the record 17
6. Chesapeake, 2026 18
PART FOUR: THE JUSTIFICATION **20**
7. The theory the counties were acting on 20
7.1 What the evidence says, and what it does not 21
7.2 The instrument as a political choice 22
8. The claim, tested 22
9. What quiet costs 24
9.1 Two things the engineering record says that the advocacy record does not 25
9.2 Nobody has named a price 25
PART FIVE: THE MACHINERY **27**
10. The generators 27
10.1 The count that exists 28
10.2 What enforcement looks like when there is a hook 28
11. Forty to fifty-nine 29
12. What the health evidence will bear 30
PART SIX: THE LAW **32**
13. The state arrives, slowly 32
13.1 Why there is no floor underneath any of this 33
14. Nuisance 34
14.1 The better Virginia case is about proffers 35
PART SEVEN: THE SILENCE, AND WHAT TO DO **37**
15. The word that does not appear 37
16. What to borrow 37
17. Open 38
ENDNOTES **40**
About the Author **111**

SUMMARY

As of October 2026 Virginia has a budget mandate for state data center noise regulations due by the end of 2029, a governor's order to speed them up, and a growing list of local ordinances. Most of the local instruments cannot register what people living beside the buildings describe, a low and steady tonal hum: of the 75 adopted instruments in this volume's census, 64 carry no tonal provision and 62 no low-frequency provision, and three more on each count are coded n/a rather than none: Prince William's general noise ordinance and Culpeper County's light-industrial zoning standard on both counts, Prince William's advisory octave-band table on tonality, and Fauquier County's zoning performance standard, which has partial frequency resolution, on low frequency. The reason is a set of choices about the measuring instrument, made in public, at stated prices, for stated reasons.

The volume follows those choices. In 2016 Loudoun County staff recommended against regulating tonal noise, priced the alternative at $1,000, and gave the reason in writing: regulating it "may place the County at a competitive disadvantage." That rationale is absent from the two staff reports that preceded the July 2016 public hearing and present in the September report that followed it. In 2025 Prince William County built an octave-band standard with its own consultants, raised every value in it by six decibels, demoted it to an advisory appendix, and adopted a C-weighted limit instead, exempting the generator testing that its own definition names. In 2026 Chesapeake's staff proposed Prince William's numbers as "the most stringent adopted noise standards we identified in Virginia." The City Council adopted no number at all.

The competitive-disadvantage claim does not survive the Virginia record. Warrenton imposed the strictest data center permit conditions among the approvals examined and the applicant stayed, although nothing has been built there to test them; in King George the applicant proffered limits below the county's own ordinance. The cost the industry has not named in any Virginia venue examined can be estimated against a verified construction benchmark: Loudoun's $1,000 is 2.3 parts per million of one forty-megawatt building, and on this volume's estimate a designed-in mitigation package runs about one to two percent. What collapses after approval is leverage, not affordability.

Of the 75 adopted instruments in a census of 76 across 43 jurisdictions, more than half carry no numeric decibel limit, and eight carry any tonal provision. The volume closes on what Virginia's localities and the Department of Environmental Quality could adopt from instruments already written: a C-minus-A screening trigger, testing procured by the locality, and a measured pre-construction baseline.

PURPOSE, SCOPE, AND METHOD

This volume asks why Virginia's local noise rules measure data center sound the way they do, and what the record shows about the reasons given. It is built from primary records read on or before 4 October 2026, the evidence snapshot: county and city codes, staff reports, board packets, action reports and minutes; the Code of Virginia, the enacted 2026 budget and legislative histories; Department of Environmental Quality guidance and comment dockets; JLARC Report 598; consultant reports filed with local governments; court opinions; manufacturer and federal engineering data; and the published scholarly literature. Two items rest on records read on 24 October 2026 and are current to that date: the Loudoun pause resolution (section 4.1) and *Haas v. Goochland* (section 14.1). Every other item stands as of the evidence snapshot, or as of the earlier date the text gives it. Press reports are used where no public document carries the fact, and the text says so where it relies on one.

The ordinance census is a structured appendix of 76 instruments across 43 jurisdictions, deposited with this volume as a workbook. Its rows were compiled from adopted text through mid-August 2026 and updated for Chesapeake and Rockingham County from their adopted 2026 ordinances. Local actions whose adopted text was not available to the author are described in the body and not counted.

Minutes and action reports paraphrase speakers, and this volume quotes them as the record's words, not the speaker's. Every negative claim states what it rests on: the documents read, the instruments counted, or the venues examined. Elected and appointed officials are named where the record names them; residents are named where they put their names on a public record.

PART ONE: THE GAP

1. Two true measurements

In April 2026 Supervisor Koran Saines told *Loudoun Now* that the average sound level recorded at the residential property adjacent to the Vantage data center campus in Sterling had never exceeded 55 dB(A).[1] County staff had checked that property more than once.[2] On his account, no reading the county has taken there has produced a violation.[3]

Kasey Hatch lives in a townhouse about half a mile from the campus. She measured the sound herself and reported the conditions along with the reading: "When it was 87 degrees, I was measuring between 70 and 80 decibels."[4] The two statements describe different places, and neither describes the other's.

Both are probably true. That is the problem this volume is about.

Loudoun's procedure is written down. Staff take readings at the point on the receiving lot line closest to the source, five feet above grade, with a Type 1 meter on FAST response, in fifteen-second samples, a minimum of three.[5] Samples are to be taken only when the subject sound "can be clearly heard and identified by the operator without any extraneous sounds such as passing traffic or bird songs"; Saines described the practice as excluding airplane flyovers, passing cars, lawn equipment and barking dogs.[6] What survives is averaged arithmetically.[7] The average is compared against the number in Table 7.05.03-1.[8]

Consider what that procedure does to a hot afternoon. Cooling load rises with outdoor temperature.[9] The protocol discards any sample with another sound in it and averages what remains, and nothing in it requires a reading at peak load. Whether a clean sample can be taken at the hour the complaints describe is a question the protocol was not written to answer, and no document examined for this volume reports a test of it. Hatch is the only person in the record examined for this volume, resident, official, consultant or auditor, who reported a decibel reading together with the temperature at which she took it.[10] Then the average does the rest. The samples are averaged arithmetically, in decibels, which gives a loud sample less weight than its acoustic energy would carry.

Hatch is describing a sound. The county is describing a statistic derived from that sound after four decisions about which parts of it count: which frequencies, which samples, which averaging period, and which property line.

This volume is about those four decisions. Who made them, when, what they were told at the time, and what it would have cost to decide otherwise.

The answer to the last question is unusually precise. In 2016 Loudoun County staff told the Board of Supervisors that regulating the tonal character of noise, the narrow-band hum residents describe and an A-weighted total does not isolate, would require additional software and training, and put the figure in the fiscal note: one thousand dollars.[11]

The county declined.[12]

PART TWO: THE INSTRUMENT

2. What A-weighting removes

A sound level meter set to A-weighting does not report the sound at the microphone. It reports what remains after a filter has been applied, and the filter discounts most heavily the frequencies that carry a data center's sound into a bedroom.

The curve began in 1936 as an approximate inversion of the 40-phon equal-loudness contour, a description of how the ear responds to quiet sound. The modern standard no longer derives it that way: IEC 61672-1 specifies A-weighting by a fixed transfer function and a table of values. The shape it inherited is the shape it still has.[13] Human hearing is insensitive at low frequencies, so the curve subtracts there, and the subtractions are not marginal:[14]

Frequency	A-weighting correction
31.5 Hz	−39.4 dB
63 Hz	−26.2 dB
125 Hz	−16.1 dB
250 Hz	−8.6 dB
500 Hz	−3.2 dB
1 kHz	0.0 dB

Sixty decibels at 31.5 Hz reads as 20.6 dB(A), and inside a 43 dB(A) total it adds less than three hundredths of a decibel.[15] At that frequency the average ear hears little, which is the curve's justification. The more sensitive ear hears more: the consultant who supplied the example estimated that the same sound, concentrated near 40 Hz, would be detectable indoors by about four people in ten. A meter calibrated to the average listener does not register what they hear.

The one manufacturer's published octave-band data put the sound-power peak of its largest air-cooled chiller, with standard fans, at 500 Hz rather than in the bass; with the EC fans sold as the efficient option, the same unit's 63 Hz band is louder than any band of the standard one.[16] What arrives at a bedroom is another matter. A building façade strips high frequencies far faster than low ones: Prince William's consultant tabulated about 11 dB of façade attenuation at 31.5 Hz against about 30 dB at 8 kHz, so the spectrum indoors is roughly 19 dB more weighted toward the bass than the spectrum at the lot line.[17] An A-weighted reading at the property line measures the wrong spectrum in the wrong place.

None of this is obscure, and the people who told Virginia's counties about it were the counties' own consultants. David Nelson, retained by Prince William, put the general point in his August 2025 report to the Board of County Supervisors:[18]

> "It's possible for residents to be able to perceive the noise source separately from the ambient even when the overall source sound level is less than the ambient. This is an unfortunate consequence of the fact that the human brain is far more sophisticated than a sound level meter."[19]

Geoff Leventhall's 2003 review for the United Kingdom's Department for Environment, Food and Rural Affairs described the same failure in British practice: "A not uncommon occurrence is that there is clearly a low frequency noise present at a complaint location, but existing UK assessment methods are not able to determine its nuisance value, leading to the conclusion of 'Not a Statutory Nuisance'."[20]

2.1 Two claims this volume will not make

The strong version of the low-frequency argument overreaches in two places, and conceding both makes the rest of it defensible.

Infrasound. No published measurement of infrasound from a data center was located for this volume, and a 2026 peer-reviewed review of the subject reports none; nothing demonstrates its absence either.[21] The one document located that advances a health claim from it is a preprint containing no measurements.[22] The one manufacturer bulletin that publishes octave-band data begins at 63 Hz.[23] And Prince William's own consultant, retained to help update the county's ordinance, wrote the exclusion into his recommendation: "Because significant mechanical equipment noise has not been observed below the 31.5 Hz band, the 8 Hz and 16 Hz octave bands have not been included in the recommended limits."[24] Unmeasured, the infrasound question is open rather than answered.

Constancy, as a health claim. The intuitive claim is that noise which never stops is worse than noise that comes and goes. The evidence is thinner than either side assumes. The one large survey located that tests eventfulness at equal energy, Brink and colleagues' analysis of the Swiss SiRENE study, found that for road traffic the steadier exposures were the more annoying, by a shift of up to about 6 dB in the exposure-response curve, which the authors suggest may reflect the noise-free intervals between events; for rail and aircraft the measure added little.[25] That runs toward the residents' intuition, but the source was road traffic, and carrying it to a fixed industrial plant would be this volume's extrapolation, not the study's. On sleep the evidence points the other way: the WHO's objective sleep-disturbance functions are event-based by construction.[26]

What survives without extrapolation is narrower, arithmetic, and sufficient. A source running twenty-four hours a day loads an energy-averaged metric far more heavily than an intermittent one. Nelson ran the numbers for Prince William. A constant 55 dB(A) produces roughly 62 Ldn,[27] adjusted to 65 Ldn for low-frequency content,[28] against a suburban compatibility threshold of 55.[29] His forecast was 25 percent of residents highly annoyed in the long run and 40 percent where the source is newly introduced.[30]

That is at full legal compliance. He wrote it down:

> "From the foregoing it should be clear that a constant 55 dBA industrial noise introduced into a suburban environment would elicit numerous, strong complaints despite being acceptable under the current Ordinance."[31]

3. Seventy-six instruments

Forty-three Virginia jurisdictions were examined, yielding seventy-six discrete regulatory instruments.[32] The count exceeds the jurisdiction count because most Virginia localities regulate noise twice: a general code chapter enforced by police or code compliance, and a zoning performance standard enforced by zoning administration.[33] The two frequently set different numbers, bind different parties, and carry different exemptions.[34]

Excluding the one instrument that is a draft rather than law,[35] the picture is this:

Finding	Count	Share of 75
No numeric decibel limit	42	56%
No measurement metric specified at all	33	44%
Any tonal provision	8	11%
Any low-frequency provision	10	13%

Source: the census workbook deposited with this volume.[36]

More than half of the 75 adopted instruments contain no number. Two of the instruments behind that count were adopted in the summer of 2026, both written for data centers, and neither carries one: Chesapeake's August ordinance requires a sound-profile assessment for facilities of 100 megawatts or more and sets no limit, and Rockingham County's July amendment ties design to a measured baseline and sets no number.[37]

Three local actions are not reflected in the counts. Two came after the census closed: Henry County adopted a data center ordinance on 25 August 2026 that, as reported, sets 50 dB(A) at the exterior property line and prohibits a clearly audible pure tone

at a residential property line;[38] and Frederick County, as reported, removed data centers as a permitted or conditional use on 23 September 2026, with two pending applications grandfathered.[39] The third came earlier: Shenandoah County adopted a data center ordinance in June 2026 whose adopted text was not examined.[40]

The dominant alternative to a number is "plainly audible," meaning audible inside another person's dwelling with the doors and windows closed.[41] Chesterfield, Henrico, Isle of Wight and Frederick all run some version of it.[42] Goochland does not: its technology overlay sets 55 dB(A) and 65 dB(C), which makes it one of the ten instruments in the census carrying a low-frequency provision. A plainly-audible standard works against a car stereo at midnight. Against a constant mechanical hum near the threshold of audibility it produces an officer standing in a living room being asked whether he can hear it. *Tanner v. City of Virginia Beach*, 277 Va. 432 (2009), did not rule on a plainly-audible standard; it struck an ordinance whose reach depended on "the subjective tolerances, perceptions, and sensibilities of the listener,"[43] and a standard that turns on what one officer can hear invites the same argument.

Tanner is a drafting constraint rather than a limit on power.[44] On this volume's reading, the ordinance least exposed to it is numeric and objective. Warren County read it the same way: its response, recorded in an unpublished Court of Appeals opinion, *Souter v. County of Warren*, was to adopt maximum sound pressure levels by zoning district.[45] The tools exist, and the one Virginia locality whose answer to *Tanner* appears in the record examined reached for them.

Where numbers do exist in Virginia, they were usually written for someone else. Prince George County caps a battery energy storage installation at 20 dB(A) at nearby residences in its R-A and A districts and 60 dB(A) at adjoining property lines in its M districts,[46] and caps a data center at nothing.[47] Among the 43 jurisdictions in the census, fourteen have written specific numeric noise limits for other uses, ten of them for wind, solar or battery storage, and most impose nothing comparable on data centers.[48] The drafting capacity is present. It has not been pointed at data centers.

3.1 The exemptions do the work

In roughly half the jurisdictions examined, the operative provisions are not the limits.[49]

Virginia Code § 15.2-980 caps the civil penalties a locality may attach to a noise ordinance and exempts industrial property from civil penalty enforcement.[50] The same bar recurs, in materially identical language, in five Virginia local codes: Prince

William, Fairfax, Hanover and Warren counties and the city of Chesapeake. Richmond goes further. Its code exempts industrial sound from the noise ordinance altogether, "as required by Code of Virginia, § 15.2-980," a statute that requires only the civil-penalty bar.[51] Where it applies, a locality wanting to enforce against a data center must seek an injunction or prosecute, and a prosecution needs proof beyond reasonable doubt.[52]

Then the specific carve-outs. Loudoun exempts generator testing from its decibel limit outright.[53] Fairfax's zoning code requires a data center noise study showing compliance with the county noise ordinance, and because that ordinance exempts routine generator testing between 7 a.m. and 9 p.m., a staff handout tells applicants the study need not address it.[54] Prince William names backup generators in its definition of steady tonal sound,[55] builds a C-weighted standard to catch them,[56] and exempts exercising from it two subsections later.[57]

PART THREE: THE CHOICES

4. Loudoun, 2016

The document is ZOAM 2014-0006, *Noise Standards*, Board of Supervisors Business Meeting Action Item #17, adopted 22 September 2016 and effective 1 January 2017. Its staff contacts were Theresa Stein of Zoning Administration and Ricky Barker, Director of Planning and Zoning. The county's acoustical consultant was Hessler Associates, Inc., which the county's own documents also call Hessler and Associates. [58]

The amendment made five decisions.

It declined to regulate tonal noise. The staff report states the reasoning without hedging:

> "Staff believes that regulating tonal noise may place the County at a competitive disadvantage with other regional jurisdictions when competing for businesses such as data centers."[59]

The rationale appears in the ISSUES section and twice more, in other words, in Attachment 3: "There are concerns that measuring tonal noise, especially with respect to data centers, would place the County at a disadvantage when trying to attract such businesses."[60] The same response concedes the harm before subordinating it: "While tonal sound can be the greatest annoyance factor to citizens, it has not been the driving force in noise complaints within the County. Therefore, in recognition of the County's desire to stay competitive with neighboring jurisdictions that do not regulate tonal sound, Staff recommends that the proposed regulations move forward without regulating tonal quality."[61] The staff report records that one jurisdiction in the region did regulate tonal noise: Fauquier County. [62]

The fiscal note gives the price. "Should the Board wish to regulate tonal sound, additional software and training would be required, increasing the cost by $1,000."[63]

It created the generator exemption. Staff give the cause in their own words: "in response to the contractual concerns of data center users, Staff revised the proposed text to exempt testing and operation during defined emergencies, with no restrictions." The ISSUES section records that the consultant's initial draft regulated the timing of generator testing, and that "after consulting with representatives from the data center industry who expressed concerns about the proposed time limitations, the draft text was revised to exempt noise caused by generators in all settings."[64] Attachment 3 explains why generators could be let go: "generators

are not typically the greatest source of noise in data centers, as it is typically the cooling units that produce the most objectionable sound."[65] Staff knew where the sound came from. The tonal standard that would have reached it was the one they declined.

The consultant objected at the time. From the Transportation and Land Use Committee item of 13 May 2016:

> "The Consultant cautioned that such an exemption could be abused and result in indiscriminate noise emission that could pose enforcement challenges. While the Consultant's concern is understood, staff believes that the exemption as proposed is reasonable and sufficiently defined to enable an effective enforcement response should any such abuse occur."[66]

That passage cuts against a simple capture story and is printed here for that reason. On generators the industry-facing consultant was the restrictive party. The county was the permissive one.

It dropped a lower rural threshold. An earlier draft had carried a "Non-suburban/Rural" category with a maximum of 45 decibels for dwellings on parcels larger than ten acres and at least 315 feet from the noise source's property line. Staff deleted it, citing the difficulty of defining "rural" and the "potential impacts on rural economy uses," which they listed as wayside stands, farm-based tourism, wineries and agritainment.[67]

It rewrote the measurement architecture. The original § 5-1507, as revised in 1998, measured continuous noise at the emitter's property boundary, keyed limits to the zoning district, and used a Type 2 meter on SLOW response.[68] The 2016 text moved measurement to the receiving property line, keyed the limits to the receiving use, and specified a Type 1 integrating meter on FAST response over fifteen-second samples.[69]

It deleted the one time-of-day differential the old text contained. The 1998 ordinance reduced levels by 5 dB(A) before 7 a.m. and after 7 p.m., but only in its table for impact noise, defined as bursts usually under one second, such as a punch press or a drop forge. Continuous plant noise carried no day-night differential in either era.[70] The deletion is real. It was never a protection a data center would have paid.

Two of these decisions name the data center industry as their reason. The third names wineries and agritainment. The measurement changes traveled under the amendment's general purpose, which the July staff report gave as revising "outdated standards" to "better protect residents from excessive noise levels while balancing the needs of businesses to promote increased economic development."[71]

The sequence matters. Neither the 13 May 2016 committee item nor the staff report for the 13 July 2016 public hearing uses the language of competition or disadvantage, though both discuss tonal noise; the 22 September item states the competitive rationale three times.[72] At the July hearing, "eleven members of the public spoke about data center and outdoor recreation noise, as well as the proposed maximum decibel level being too high for rural areas of the County."[73] The complaint base behind the rewrite was not large: three data centers had drawn noise complaints in the preceding five years, and 21 of the 34 complaints concerned one of them, Digital Realty at Loudoun Station, beside The Regency.[74]

The staff report also told the Board what the amendment would do for the people who had complained. Because the uses that had drawn tonal complaints already existed, and Virginia law vests existing uses against later amendments, the ISSUES section closes: "such uses will not be impacted by the Noise ZOAM."[75]

4.1 What Loudoun's rule says now

The 2023 zoning rewrite renumbered the 2017 text of § 5-1507 as § 7.05.03 without changing a decibel.[76] Table 7.05.03-1 and the 2017 table it replaced carry identical values, 60, 55, 65 and 70 dB(A),[77] keyed to the receiving property's development category rather than to the source's classification,[78] applied at all hours with no day-night split, measured at the receiving lot line five feet above grade.[79]

The 70 dB(A) figure is the value for an industrial receiving use. It is spatial, not temporal.[80] Applications accepted for review on or before 13 December 2023 continue under the old numbering; the numbers are the same either way.[81]

JLARC credits Loudoun with "proactive sound measuring" for data centers. The provision behind it is § 4.06.02.D.10.a, which makes data centers "subject to the Noise Study standards pursuant to Section 7.05.03.G": a pre-construction study at site plan review and a post-construction study between one and twelve months after the first certificate of occupancy. It is a duty on the operator, not a county monitoring program, and it reaches a new project at two fixed moments. It does not reach a facility operating on 13 December 2023, or, so long as it is diligently pursued, one whose application had been accepted by then, which includes every facility behind the 2016 complaints.[82]

The county is plain about the gap. Its noise page states that Loudoun "does not currently have policy or regulatory language specific to tonal noise or low frequency noise."[83] The Phase 2 data center standards proposed in September 2026 promise "additional sound measurement methodologies to measure low frequency noise and tonal noise"; the draft zoning text posted with them, which does not include the noise

section itself, contains no tonal or low-frequency standard and no C-weighted limit. The schedule runs through a Board check-in in December 2026 and a Planning Commission hearing in February 2027 to the Board's public hearing in July 2027.[84]

On 22 July 2026, at a reconvened session of its 21 July business meeting, the Board directed the County Administrator to have staff prepare an item for 15 September to stop processing data center and substation applications until Phase 2 is complete. The motion passed 6-1-2 and does not mention noise.[85] By September the County Attorney had advised that a moratorium on approvals is not legal, and the Board instead advanced a resolution pausing final votes on legislative data center and substation applications for up to twelve months, set for a final vote on 20 October 2026. On 20 October the item was deferred to the Board's 17 November 2026 business meeting. The Action Report of the 20 October meeting, a memorandum of the County Administrator dated 22 October 2026, records the deferral and no vote on the resolution; the resolution published with the agenda is a draft, and as of 24 October 2026 it remains one.[86]

5. Prince William, 2025

Of the counties examined, Prince William came closest to a binding octave-band standard written with data centers in view, then reversed.

A citizen advisory group, the Data Center Ordinance Advisory Group as restructured in December 2024, worked with Nelson Acoustics, JMT, and The Noise Consultancy LLC, the three firms named in the recitals to Ordinance 25-62, to produce an octave-band standard.[87] It was a real one: binding criteria running down to 31.5 Hz, summing to roughly 43 dB(A) at night, about twelve decibels more stringent than the existing limit, built to catch the low-frequency content A-weighting discards.[88]

Two hands took it apart.

County staff substituted an "intermediate scale," which the staff report attributes to the County Executive.[89] Supervisor Kenny Boddye then substituted C-weighting entirely. On 14 October 2025, as an added agenda item not previously listed, the Board voted 4-2 on his motion to schedule the public hearing on the amended Chapter 14 for 28 October.[90]

The relaxation is uniform and it is admitted in the adoption packet. Every one of the eighteen values, nine octave bands by day and night, moved by exactly six decibels.[91] The staff report for Item 7-J says so: "the associated levels would be raised by 6 decibels over the levels recommended by the Noise Consultants."[92]

On 28 October 2025 the Board adopted C-weighting as Ordinance 25-62 by 5-2: Angry, Bailey, Boddye, Franklin and Gordy in favor, Jefferson and Vega opposed, after their motion to defer to December failed 2-5. Seven members voted on an eight-member board; the Gainesville seat was vacant.[93]

Twenty-one days earlier, on 7 October, the Board had disbanded the advisory group that produced the octave-band work. It did so as an added agenda item not previously listed, moved by Angry, carried 4-2.[94]

The band table survives in the adopted code as Appendix A, which states that "these values are advisory and do not constitute the legal compliance test." Section 14-4(b) says it again in its own words: the "[o]ctave band tables are advisory only."[95]

5.1 What was adopted

Chapter 14 sets 60/55 dB(A) for residential and mixed use, 65/60 for commercial and office, and 79/72 for industrial, measured as dB(A) Leq in intervals of at least thirty seconds, with a violation requiring three or more intervals in any hour. Those Table 1 figures were not changed by the amendment.[96] What the amendment added was § 14-4(b), a steady tonal standard of 73/68 dB(C) over a five-minute interval, with the slow response setting specified at § 14-3.[97]

Backup generators are named in the § 14-3 definition of steady tonal sound.[98] Section 14-4(d)(2) then exempts generator exercising from § 14-4(b) altogether.[99] The ordinance identifies the equipment, builds a metric to catch it, and excuses it two subsections later.

The penalty moved the opposite way from a crackdown. The amendment downgraded a first offense from Class 2 to Class 4 and added a civil alternative of $250 and $500 that expressly excludes industrial property and railroads.[100] The same evening the Board directed staff, on Supervisor Gordy's directive, to report in a year on the ordinance's effectiveness, "any violations found," and any revisions needed. That report, due in the fall of 2026, would supply a published count of violations under the amended chapter, which the record examined does not yet contain.[101]

C-weighting is a real improvement over A-weighting for this source class, and the volume says so plainly. It is also what was adopted after county staff wrote down that they were raising the octave-band numbers by six, and the Board left even the raised numbers in an advisory appendix.

5.2 The reason, on the record

Deputy County Executive Wade Hugh explained the concern in an email dated 17 September 2025, as quoted by *InsideNoVa* six days later:

> "They understand the ordinance won't impact their business, but they are concerned with the larger message this sends about the county's business atmosphere."[102]

The worry was the signal. On the account Hugh relayed, the industry understood the standard would not bind its business.

Donna Gallant, the advisory group's representative for Amberleigh Station, described Hugh on a call with *InsideNoVa* on 18 September: "He has gone rogue and done his own thing and gave us the straight middle finger." The statement predates both the disbandment and the vote, and its subject is Hugh, not the Board.[103]

Boddye's own explanation of the weaker standard, as the *Prince William Times* reported it two days after the vote, belongs in the cost section of this volume as much as here: "If you have a mom-and-pop shop that doesn't have the sophistication to measure (noise) and then remediate, we would not want to send the message that, on one hand, we want more diversity of businesses, but, on the other hand, only data centers would have the means to remediate."[104]

6. Chesapeake, 2026

The third instance ended in August 2026, and it ended without a number.

Chesapeake's staff proposed a steady tonal standard of 73/68 dB(C) in its draft of 17 June 2026. The Planning Commission's July version lowered it to 60/55 dB(C). Staff's draft of 3 August reverted to 73/68.[105] The 73/68 was staff's original position rather than a rollback of the Commission's number, and staff named its source:

> "The original staff recommendation reflects the most stringent adopted noise standards we identified in Virginia, specifically the standards established by Prince William County."[106]

Prince William's numbers were the product of a six-decibel relaxation and a demoted octave-band table.[89][91] By the time they reached another city's planning commission, its staff was describing them as the most stringent adopted standard it could find in Virginia. On this volume's census that was not so: Goochland's technology overlay sets 65 dB(C), lower on the same weighting,[42] and Stafford's data center standard, on the A-weighted scale, sets 55 dB(A), or 52 where a prominent tone is present.[107] That a city's staff could reach for Prince William's relaxed numbers as the high-water mark is the argument of this volume in one sentence.

The diffusion also dropped things on the way. Chesapeake's staff drafts carried Prince William's definition of steady tonal noise and its number, but not the ±3 dB

steadiness test and not the slow-response specification, which is to say they carried the number without the test that determines whether the number has been exceeded.[108]

Then the Council adopted neither number. On 21 July it paused consideration of data center applications for eight months.[109] On 18 August it adopted, 9-0, a substitute proposed by Council member Amanda Newins that made data centers a conditional use in the industrial districts only, barred private groundwater systems, and, in WHRO's account, "pushes off decisions about the specifics of regulations like setback distances and noise level limits."[110] The adopted § 13-3400 contains no decibel limit, no weighting, no steady-tonal definition and no measurement protocol. Its only reference to sound requires a facility expected to draw 100 megawatts or more to submit a site assessment of "the sound profile of the HEUF on residential units and schools located within 500 feet of the HEUF property boundary," the language of the state's 2026 disclosure statute.[111] The city then scheduled three open houses for September, one of whose display boards explained that dB(A) and dB(C) "are not interchangeable."[112]

The number Chesapeake's staff borrowed from Prince William traveled without its test, and in the end the Council enacted neither the number nor the test, only the state's disclosure language.

Rockingham County went a different way. On 22 July 2026 its Board adopted, 5-0, a data center amendment that sets no decibel figure and requires instead a baseline noise study by a licensed professional engineer specializing in acoustics or an INCE board-certified engineer, documenting "noise and ambient sound levels in the surrounding area," with a model prediction at full load, and requires the application to "incorporate sound mitigation measures recommended in the baseline noise study into the facility design to prevent noise levels from exceeding noise and ambient sound levels observed in the baseline study."[113] It is a design requirement at the application stage. It states no compliance test after construction. It is also the only adopted Virginia instrument located that ties a data center's design to measured ambient sound before the building exists.

PART FOUR: THE JUSTIFICATION

7. The theory the counties were acting on

Loudoun was restating one of the most influential propositions in the study of local government.

Paul Peterson's *City Limits* holds that local governments face a constraint national governments do not: capital and residents can leave, so a city that imposes costs on mobile investment loses it to the jurisdiction next door.[114] Peterson sorts local policy by its effect on the city's economic position. "Developmental policies are those local programs which enhance the economic position of a community in its competition with others."[115] Local politics is pushed toward them and away from redistribution, whoever holds office. The feature of the argument that matters here is what it does not require. Nothing in the mechanism needs corruption, lobbying or capture, and in Peterson's account the politics of development is consensual, often handed to bodies "outside the mainstream of local politics," the Chamber of Commerce among them.[116] The constraint does the work by itself.

Read against that, the Loudoun staff report of 22 September 2016 looks less like an anomaly than like Peterson's thesis restated by a planner.[117] Charles Lindblom's "The Market as Prison" makes the same structural claim with an example even closer to this case. In the town where he lived, a chemical plant discharged something "that carries both a bad odor and irritants to the eyes," and "Town and state governments are both reluctant to put an end to the problem for fear that the plant will find it advantageous to move to a new location in another state."[118]

Two things follow, and they pull in opposite directions.

The theory predicts what happened, which weakens the capture reading. Daniel Carpenter and David Moss set a deliberately demanding standard for asserting regulatory capture, requiring among other things a showing of industry intent and action directed at the outcome.[119] Loudoun's record does not meet it. The generator exemption was rewritten after industry representatives raised contractual concerns, over the consultant's warning that it "could be abused,"[120] and that is the strongest evidence of industry action in the file. The tonal decision has none behind it: no operator is quoted and no request is recorded, and staff justified it on competition, adding that tonal sound had not been the driving force in complaints. The disciplined literature would not call the tonal decision capture, and this volume does not.[119] Cultural or cognitive capture is a closer fit for the concern Prince William's Deputy County Executive, Wade Hugh, put in writing in 2025, about "the larger message this sends about the county's business atmosphere," and even that requires more than the record supports.[121]

But the theory has a competing prediction, and its empirical foundation does not reach this case. William Fischel's homevoter account predicts the opposite outcome for a suburban county like Loudoun, where in his model residential property owners dominate local politics and have every incentive to protect property values against a nuisance.[122] Adjudicating Peterson against Fischel on this record is the most useful thing this volume can do with the theory.

7.1 What the evidence says, and what it does not

It is tempting to say the economics literature has found that environmental regulation does not drive firms away, and that Loudoun therefore acted against the evidence. That is not what the literature says.

The early reviews found little. Jaffe, Peterson, Portney and Stavins concluded in 1995 that "there is relatively little evidence to support the hypothesis that environmental regulations have had a large adverse effect on competitiveness," and that studies of plant location "have produced estimates that are either small, statistically insignificant, or inconsistent."[123] Those null results did not survive better identification.[124] Becker and Henderson find substantially fewer plant births in non-attainment areas.[125] Greenstone's work on the Clean Air Act finds losses on the order of hundreds of thousands of manufacturing jobs.[126] Environmental stringency can and does affect industrial location.[124]

What that literature measures is federal attainment status, abatement cost and state-level stringency, the price of meeting pollution standards. No study in it measures a local nuisance ordinance or a land-use condition.[127] Jaffe and his coauthors named the gap themselves: "only two of the studies we reviewed controlled for differences in 'regulatory climate' between jurisdictions."[128] The magnitudes are also not comparable: the intervention Loudoun declined cost one thousand dollars[129] and the mitigation packages in section 9 run one to two percent of construction.[130]

So the correct claim is narrower than the tempting one. Loudoun's belief was not contradicted by the evidence. It was unaddressed by it. The county applied a belief about firm mobility, whose evidence base is federal pollution control, to a local tonality penalty, and the staff report that did so names no jurisdiction that gained investment by declining to regulate tonality and quotes no operator.[131]

That asymmetry, regulators acting on a widely shared belief about firm mobility that the evidence neither establishes nor refutes at the relevant scale, is an established finding about state environmental regulators. In Kirsten Engel's 1996 survey, 57 of the 65 state environmental regulators who answered the question said that concern over industry relocation and siting affects environmental decisionmaking in their

state.[132] What this volume can contribute is the missing test at the scale where the belief operates, in a state that has run the experiment several times.

Jenna Burrell's ethnography of Prineville, Oregon is a published reading of data center siting that rejects the capture story. She argues that the town's leaders were neither naive nor duped: "the narrative of small town officials duped by slick corporations" accomplishes "a displacement and concentration of blame," recasting "the harsh realities of rural spatial marginality" as "the incapability and inferiority of its leaders."[133] Her reading supports this volume's refusal of the capture story, and her case differs from Loudoun's on the point that matters. Prineville was trading tax abatements for a first facility it did not yet have. Loudoun in 2016 already had the industry, and the complaints the noise amendment answered came from it. Cailin Slattery's estimate of subsidy competition among states sets the outer bound on what such competition buys: "states compete away the surplus, transferring all of the rents to firms."[134]

7.2 The instrument as a political choice

Theodore Porter's *Trust in Numbers* is the strongest objection to reading A-weighting as concealment. In Porter's account quantification is a technology of distance, adopted most readily by actors whose authority is weak and who need a rule that seems to decide by itself; it is "a way of making decisions without seeming to decide."[135] A county with no acoustical staff reaching for an off-the-shelf A-weighted number is Porter's model working as he describes it, and that explains the adoption of dB(A) across Virginia better than any theory of motive. It does not explain Loudoun in 2016. There the county's staff wrote that tonal sound "can be the greatest annoyance factor to citizens," priced the fix at $1,000, and declined it in writing, citing competition.[61] Wendy Espeland and Mitchell Stevens on commensuration,[136] and Sally Engle Merry on indicators,[137] describe what that choice did: the distributive consequence was settled in the choice of instrument, where it did not look like a decision at all. Prince William did the same thing in 2025, when staff raised every octave band by six decibels and the Board then replaced the octave-band limits with a single C-weighted number.[92]

8. The claim, tested

"Competitive disadvantage" is an empirical proposition. Virginia's record offers four tests of it, of uneven strength, and in none of them did the predicted loss occur.

Warrenton imposed the strictest data center noise permit conditions among the approvals examined. Special Use Permit 2022-03, adopted 14 February 2023, requires a third-party sound test by a full member of the Acoustical Society of America or an INCE Board-Certified member before each phase's conditional

occupancy, then an annual test procured by the Town and billed to the applicant for the life of the use, with forty-eight hours to cure and automatic suspension of the certificates of occupancy if the applicant does not.[138] Its mitigation condition is a performance standard with an illustrative list of measures, not a mandate for any one of them.[139] Warrenton's ordinance already carried a 5 dB correction to its octave-band limits for tonal sound, a tonal provision of the kind Loudoun declined for a thousand dollars.[140] Loudoun's staff in 2016 had named Fauquier County as the one jurisdiction in the region that regulated tonal sound;[62] the provision nearest to what they described is the Town of Warrenton's, in Fauquier's county seat.

Amazon did not walk. It filed the site plan five weeks later, took it to administrative approval in April 2024, intervened to defend the permit, and on 31 July 2025 asserted vested rights, claiming costs in excess of $3,500,000.[141]

Nothing has been built at Warrenton. The reasons are a challenge to the validity of the underlying zoning text amendment, a consent order, the Town reversing its position in its own litigation, and a July 2025 ordinance banning data centers from the industrial district outright. The noise conditions are not among them.[142]

King George. The Birchwood applicant proffered 60/55 dB(A), fifteen decibels below the county ordinance by day and ten by night, and its counsel said on the record: "We are burdening ourselves with that requirement."[143]

Pittsylvania. Anchorstone proffered a forty-eight-hour cure-or-cease and was approved 7-0.[144]

Henrico. As a tracking site reports, the Henrico Planning Commission deferred DC BLOX's proposal in July 2024 to address noise and aesthetics concerns raised by county staff and residents; DC BLOX withdrew the application that November and returned three months later with a smaller, single-story project on the same site.[145]

No case of an operator declining a Virginia site over noise requirements appears in the record examined here: twenty-nine approvals across fifteen localities, every located Virginia withdrawal, and the published statements of the operators and trade bodies active in the Commonwealth.[146] At the Prince William hearing that produced the weakened ordinance, the Data Center Coalition's representative, as *InsideNoVa* summarized her remarks, objected to the absence of grandfathering for existing facilities, to the six-month effective date, and to criminal rather than civil enforcement. The account reports no competitiveness argument and no dollar figure.[147]

The one operator statement located that bears on it is a concession. Vantage Senior Vice President John Stephenson, speaking to KSL-TV in July 2026: "While we are operating well under noise limits and ordinances of Loudoun County, we have determined that we can do it better."[148]

9. What quiet costs

Turner & Townsend price Northern Virginia data center construction at $10.92 per watt of IT load.[149] A forty-megawatt building is therefore about $437 million.[150]

Against that denominator:

Item	Cost	Share of one 40 MW building
Loudoun's tonal regulation, 2016	$1,000	0.00023%
Designed-in mitigation package	$4.0–8.9M	0.91–2.04%

Sources: Loudoun's 2016 fiscal note;[129] this volume's estimate of a designed-in package.[130] The package is priced from the items that carry published prices, a perimeter wall, generator enclosures and chiller treatment, all of them path measures; section 9.1 explains why path treatment is the weaker instrument. The figure is an order of magnitude for what mitigation costs, not a design.

The thousand dollars is 2.3 parts per million of a single building.[150]

No verified cost for any data center noise retrofit appears anywhere in the record examined. The figures that circulate for the one retrofit with a reduction reported by both sides, at Amazon's Great Oak campus in Prince William, are a homeowners' association president's estimates, which the company has not confirmed.[151] That absence matters. A burden no one has priced cannot be tested, and in no venue examined has the competitive-disadvantage argument had to be.

What the record does support is a claim about timing. On the only estimates available, a homeowners' association president's figures set against this volume's own construct, retrofit costs between about one and two and a half times what designed-in mitigation does.[151] What collapses after approval is leverage. At Great Oak, the *Prince William Times* reported, the sound level "immediately dropped 10 points to around 50 decibels, according to both residents' and Amazon's measurements."[152] Amazon's head of community engagement then wrote to the homeowners' association president that the company's sound study showed it "is in compliance with applicable law," and the same paper reported that Amazon had "indicated it does not intend to do more to comply with a new noise ordinance that does not yet exist."[153] Nothing in the county's ordinance required more.[154] The

argument for imposing conditions before approval rests on that, not on a cost multiplier the record will not support.

The industry's admission on the point, as JLARC reported it, concedes it: "reducing noise after a building is operational can be difficult and expensive."[155]

9.1 Two things the engineering record says that the advocacy record does not

Barriers are the wrong instrument. For highway noise barriers built from 2020 to 2022, the Federal Highway Administration reports about $925 million spent on 222 miles, for an average reduction of 7 dB(A). Its own table rates a 15 dB reduction "very difficult" and 20 dB "nearly impossible."[156] Berms outperform walls by one to three decibels.[157] News coverage, municipal records and operator statements examined document five data center noise retrofits. In four, path treatment (walls, wraps, shrouds or screens) produced no verified reduction; the fifth published no result at all. At one of the four, Great Oak, the operator then abandoned path treatment and re-engineered the source, the only reported success, and the only retrofit in the American record examined whose decibel result, as reported, both the operator's and the residents' measurements confirmed. Residents later reported continuing noise and new vibration.[158]

The equipment marketed as quiet does little where the problem is. Trane's own published data shows its low-noise chiller option buying 4 dB(A) overall and 0.0 dB at 63 Hz.[159] The EC fan option is half a decibel quieter A-weighted and 3.5 dB louder at 63 Hz.[160] Night-time fan setback, a control option rather than a capital item, is the only option in that menu that lowers 63 Hz.[159] Siting equipment away from receptors works at every frequency, needs no equipment, and is bought at rezoning or special-use approval or not at all; JLARC found 29 percent of operational Virginia data center properties within 200 feet of residentially zoned property.[161]

The newer catalogs examined do not publish at all. Trane's Ascend catalog lists sound data as "available on request." Carrier's 30XA product data carries none. Daikin supplies a blank form. No manufacturer examined publishes sound data for dry coolers, the equipment on which liquid cooling depends.[162]

9.2 Nobody has named a price

In every Virginia venue examined, the Data Center Coalition's published materials and press archive, the Northern Virginia Technology Council's site, the appendices to JLARC Report 598, the Warrenton record and the Prince William 2025 proceeding, no dollar figure is attached to any claim that noise requirements are burdensome. No correspondence file for the 28 October 2025 item appears on the meeting agenda

or the county's public-comment pages.[163] The competitive-disadvantage argument has been made repeatedly and costed nowhere in the record examined.

What exists instead is a supervisor making the opposite argument while voting to weaken the standard: "only data centers would have the means to remediate."[164]

PART FIVE: THE MACHINERY

10. The generators

Backup generation is a second noise source, separately permitted, and it falls through a gap that is statutory rather than accidental.

The Virginia Department of Environmental Quality does not regulate data center noise today, and the Air Pollution Control Law gives it no means to. Va. Code § 10.1-1300 defines air pollution as the presence in the outdoor atmosphere of one or more substances.[165] Noise is not a substance. Neither 9VAC5-80 Article 6 nor the general permit at 9VAC5-540 contains a noise provision.[166]

The runtime rules cap the predictable noise and leave the unpredictable uncapped. Federal rules at 40 CFR 60.4211(f)(1) and 63.6640(f)(1) state that there is no time limit on emergency operation of emergency stationary engines.[167] The hundred-hour annual testing cap and the fifty-hour non-emergency sub-cap bind only scheduled running.[168] Virginia's general permit caps total operation, emergency running included, at 450 hours a year in attainment areas and 500 in nonattainment areas such as Loudoun and Prince William, though most large campuses are permitted under Article 6 instead, with hours set permit by permit.[169] Senate Bill 1407, enacted as Chapter 344 on 21 March 2025 by votes of 38-1 and 97-0, put a fifty-hour non-emergency allowance into statute months before DEQ took up the question by guidance.[170]

Then the localities exempt the scheduled hours. Loudoun's zoning ordinance excuses generator testing from the decibel limit and substitutes windows set by season rather than by sleep, applicable only adjacent to residential property and carrying no decibel cap.[171] In the census, Stafford and Frederick were the only localities to keep their full numeric standard in force during permitted testing. Prince William keeps its A-weighted limits during daytime exercising but lifts the C-weighted standard built to catch generators. Fauquier reaches a similar result by exempting generators only during outages, so that its 65 dB(A) day and 55 dB(A) night limits apply to testing, except where a data center is the principal use on industrially zoned land, which the chapter exempts entirely.[107] Frederick has since removed data centers as a use, and Henry County's August 2026 ordinance, as reported, confines routine testing to weekdays between 9 a.m. and 5 p.m.[172]

The state's emergency definition has moved in the industry's direction. DEQ guidance memorandum APG-578, effective 3 January 2026, addresses "sudden and reasonably unforeseeable events in the context of planned electric outages."[173] As noticed for comment in November 2025, it treated a utility-planned outage announced with fourteen days' notice or less as one that could qualify as sudden and

reasonably unforeseeable, depending on the circumstances, which makes equipment permitted as emergency backup available for planned grid events. The noise consequence is a change in kind: generators sized and permitted for rare emergencies can run on the utility's calendar. The Southern Environmental Law Center objected on procedure, arguing the change required rulemaking.[174]

Residents noticed the docket even though the docket was not about them. By this volume's count of the public comment file, the APG-578 forum, open from 3 November to 3 December 2025, drew 411 comments, of which 76, more than eighteen percent, concerned noise, in a proceeding with no noise component whatever.[175] Two comments located on DEQ dockets, one in this forum and one in a 2023 variance docket, put residents' own decibel figures on a state record under permanent comment identifiers; neither states the instrument, weighting, duration or position, and they stand as what residents told the state rather than as measurements.[176][177]

10.1 The count that exists

Somebody did count the generators. JLARC reported approximately 8,000 permitted generators statewide from DEQ air-permit data as of August 2024, averaging 54 per site, and a median of 35 trailer-sized generators per site.[178] The figure has been in a published legislative report since December 2024.

Report 598 does not analyze their noise.[179] The inventory exists in the emissions frame because DEQ permits emissions. The acoustic question belongs to the localities.

10.2 What enforcement looks like when there is a hook

On 31 May 2025, during the permitted integration period at Amazon Data Services' Cosner campus in Spotsylvania County, a power outage started generators whose catalytic reduction systems then failed, which led to DEQ notice of violation ANRO003354 and a proposed consent order carrying a civil charge of $72,067.80.[180] Eighty-one days passed before the operator noticed.[181]

That is the shape of the record: a proposed penalty with a real dollar figure, in a real enforcement action, with an air pollutant as the hook, because noise has none.

On the morning of 22 July 2026 a transmission line fault in Northern Virginia shifted load off the grid and onto on-site backup in minutes. Dominion-zone load, as RTO Insider reported from PJM and Yes Energy data, fell from 17,682.6 to 14,775.2 MW between 7:55 and 8:00 a.m., about 2,907 MW.[182] It is the largest transfer of data center load to backup power documented in the Virginia record examined, and it

happened the same day Loudoun's Board voted to have staff prepare an item to stop processing data center and substation applications.

11. Forty to fifty-nine

A single figure recurs in accounts of data center noise in Virginia: operating levels of 40 to 59 decibels. It is in the peer-reviewed literature and, from the same three authors, in *The Conversation*.[183] Traced to ground, it is an artifact of the measurement problem it is used to describe.

The chain runs from *Frontiers in Climate* (Gour, Ortiz and Maibach, 2026)[183] to JLARC Report 598 at printed page 75,[184] and from there to unpublished A-weighted readings, of unstated duration, taken by Fairfax and Loudoun county staff.[185]

JLARC's own sentence reads "an estimated 40 to 59 decibels," at "selected data centers."[186] The note under Figure 6-2 disposes of the rest:

> "Measurements are a response to complaints, so they are not representative of all data centers. Measurements indicate total sound, not the isolated amount from data centers."[187]

Two details of the report make the laundering easy. The number sits on printed page 75; the figure, its source line and that note sit on page 76.[187] A reader who cites the sentence never meets the qualification. And Report 598 carries no endnotes at all: the evidentiary apparatus behind a figure now carried into peer review runs to a caption, a source line and a short note, with no count of readings, no date range, no instrument, no protocol, no receptor location and no averaging period anywhere in the report.[188]

Appendix B, which carries JLARC's methodology, has no paragraph on how the noise data was obtained. Water use, generator permits, tax revenue, land conversion and residential proximity each got one.[189]

By the time the range reaches peer review every qualifier is gone. The *Frontiers* paper is a Mini Review with no methods section, whose entire methodological statement is one unlabeled paragraph describing a database search, accepted the same day the revision was received.[183] It reports the range as a characterization of data center noise generally and concludes that levels "often approach or exceed" health thresholds, comparing readings of unstated averaging period against EPA's 55 dB(A) day-night average.[190] Those are different quantities, and no conversion is performed. The EPA figure is a 1974 advisory level from the agency's Levels Document, not an enforceable limit.[191]

JLARC also said, in the same report, what the number means for enforcement: "Data centers are not required to reduce their noise if they are not violating local ordinances, which has made it difficult to address noise concerns."[154]

And it identified the instrument, in a sentence a legislative agency does not write lightly: "Most local noise limits are defined using 'A-weighted' decibels… designed to target excessively loud noise from sources such as parties and barking dogs. The lower frequency noise data centers emit is not fully captured…"[192]

Prince William is not one of the measurement sources. Fairfax and Loudoun supplied the readings; Prince William appears only in the adjacent sentence about ordinance limits.[193]

12. What the health evidence will bear

Three claims commonly made on the community side do not hold.

Cardiovascular disease. The systematic review behind the WHO's 2018 guidelines[194] assigns a "high" quality rating to exactly one cardiovascular finding: road traffic noise and incident ischaemic heart disease, relative risk 1.08 (1.01–1.15) per 10 dB Lden, observed across roughly 40 to 80 dB with risk rising from about 50 dB.[195] Noise and hypertension was graded very low, with no effect in the cohort studies.[196] Virginia data center exposures are not clearly within the observed range and are not expressed in the same metric.

"Exceeds WHO guidelines." The 2018 WHO guidelines set no value for industrial or other stationary sources, and say why: industrial noise is too heterogeneous and too localized.[197] What WHO left standing for those sources is older. The 2018 guideline group recommended that values "not covered by the current guidelines (such as industrial noise and shopping areas) should remain valid," which points back to the 1999 Guidelines for Community Noise: 50 and 55 dB LAeq over the sixteen-hour day for moderate and serious annoyance outdoors, 45 dB LAeq outside a bedroom at night, 30 inside it. A data center can exceed those. No Virginia record examined measures against them, and they are A-weighted averages, the instrument section 2 faults; the 1999 document itself says that where prominent low-frequency components are present, measures based on A-weighting are inappropriate.

Transferability. Nearly the entire evidence base behind the WHO guidelines rests on transportation sources, which are intermittent, broadband and spectrally unlike a constant industrial hum.[198] The objective sleep evidence underpinning the WHO guidelines is a re-analysis of two German field studies with 61 and 33 subjects.[199] Guski's percent-highly-annoyed curves carry no confidence intervals, and the authors give a methodological reason for leaving them out.[200]

Two claims on the industry side fail as well. Compliance in dB(A) does not establish absence of impact, for the reasons in section 2. And residents do not fully habituate: Basner and McGuire find habituation incomplete, with autonomic activations habituating considerably less than cortical arousals.[201]

What survives is annoyance and instrument inadequacy. Annoyance is a WHO-recognized health endpoint, second only to sleep disturbance in the noise burden of disease.[202] The low-frequency and tonal literature supports the proposition that dB(A) under-protects against this source class: Persson Waye's experiments matching stimuli at equal dB(A),[203] and Yonemura's measured adjustments of 0 to 7 dB that grow larger as the background level falls,[204] which is to say larger at night, in the quiet, where the complaints come from. An exposure-response analysis built on fixed industrial sources rather than transportation, Miedema and Vos (2004), found that annoyance differs by source type at equal exposure.[205]

That is an argument about the design of a regulatory instrument. It is solid, and it is the argument this volume is making.

PART SIX: THE LAW

13. The state arrives, slowly

No Virginia statute expressly authorizes local noise ordinances. Authority is inferred from the general welfare grants at § 15.2-1200 for counties and § 15.2-1102 for cities and towns.[206] The statutes that name local noise ordinances presuppose the power rather than confer it, and chiefly limit it: § 15.2-980, § 15.2-917, § 15.2-2288.6(C).[207] The General Assembly has legislated about local noise power repeatedly without ever expressly conferring it.

It has also legislated about data center noise repeatedly with little result. Senate Bill 288 (Roem, 2024), the earliest located attempt, died 7-8 in committee.[208] House Bill 2712 (Lovejoy, 2025) would have authorized localities to "establish and enforce maximum allowable sound levels for operational data center facilities, including the use of alternative low-frequency metrics," and was tabled in subcommittee.[209] Senate Bill 339 (2024), as introduced, would have preempted local regulation of the sound of digital asset mining businesses in industrially zoned areas; the language was removed in committee.[210] Senate Bill 1046 (2025), the source of a certificate-of-occupancy acoustical study requirement that is not and never was law, failed to report from Senate Local Government 5-6-4 on 27 January 2025.[211] House Bill 1601 and Senate Bill 1449 passed in 2025 and were vetoed together on 2 May.[212]

Two things are now law, and a third is policy.

Va. Code § 15.2-2209.5, enacted by HB 153 (Chapter 567) and SB 94 (Chapter 568), approved 13 April 2026 and effective 1 July 2026, requires a pre-approval site assessment of a large facility's sound profile on residential units and schools within 500 feet.[213] It contains no decibel limit, no post-occupancy monitoring, no low-frequency metric and no enforcement mechanism. It is in substance a disclosure statute: the assessment is measured only against whatever noise ordinance the locality has already adopted.[214]

Item 367, paragraph E of Chapter 1, 2026 Acts of Assembly, Special Session I, the enacted budget approved 29 June 2026, directs DEQ to adopt data center noise regulations on a "lowest achievable noise" standard, effective no later than 31 December 2029, with civil penalties of up to $32,500 per day of violation from 1 January 2030.[215][216][217]

Executive Order 22, signed 18 September 2026, directs DEQ to "prioritize and expedite the development of data center noise regulations consistent with DEQ's existing statutory authority and applicable legislative direction," and to deliver a proposed accelerated timeline, workplan and stakeholder-engagement plan within 180 days.[218] It sets a date for a plan, not for a rule.

Whether that makes Virginia the first state to require data center noise regulation depends on a comparison this volume did not make in full. Nine other states were reviewed. None has an operative numeric data center noise standard in force. Arkansas's Act 173 of 2024 is an enacted noise mandate, but it reaches digital asset mining businesses rather than data centers generally, and it requires noise-reduction techniques, such as liquid or submerged cooling or a fully enclosed envelope, or relocation 2,000 feet from homes and businesses or into an industrial zone, rather than a measured limit.[219] Within that review, Virginia is the only state with an enacted deadline for state data center noise regulations.

The deadline is more than three years out, and the permitting pace in the meantime is set by the localities.[220]

And the initial promulgation is exempt from the Administrative Process Act. DEQ is not required to issue a notice of intended regulatory action, hold a proposed stage, take public comment or prepare an economic impact analysis.[221] Executive Order 22 asks for a stakeholder-engagement plan, but the regulation that decides whether any of this becomes enforceable can be written without a docket, and a guidance docket about generator emissions drew 76 unsolicited noise comments.[222] That is the quantity of public participation the exemption makes optional.

Virginia has no state ambient community noise standard in the codified regulations and DEQ guidance examined, as of this volume's evidence snapshot.[223] That changes no later than 31 December 2029 by force of a budget item, or it does not change at all.

13.1 Why there is no floor underneath any of this

Every jurisdiction in this volume is writing on a blank federal page, and Congress had less to do with it than the usual account says.

The Office of Noise Abatement and Control was created at EPA by the Noise Pollution and Abatement Act of 1970, Pub. L. 91-604. The Noise Control Act, which gave the office its regulatory program, is the 1972 statute, Pub. L. 92-574.[224] Its phase-out was proposed in 1981 and the office ceased operating in 1982.[225]

The usual account is that Congress defunded it. Joshua Galperin's 2025 reading of the appropriations acts says otherwise: "Congress never did defund the Office of Noise Abatement and Control," and "No bill even mentioned ONAC or the ONAC noise programs." The Reagan administration requested defunding in its fiscal 1982 budget revisions; the House and Senate passed different repeal bills and let them die in conference; none of the four appropriations vehicles of 1981 and 1982 mentions noise; and EPA, given lower lump sums, chose to spend none of them on noise.[226] EPA's August 1981 notice suspending enforcement of the program's

reporting and recordkeeping requirements cited congressional action that never became law.[227] In July 2026 the federal district court in Washington recited the conventional account in the opinion discussed below: "Ultimately, Congress did not repeal the law but did pass a budget consistent with the President's proposed funding cuts."[228] The two accounts agree that the money fell. They differ on who chose to spend none of it on noise, and Galperin's, the one that names the statutes, puts that choice at EPA. On either account the Noise Control Act was never repealed; it was left standing and unstaffed.[229]

So the United States has a federal noise statute with no federal noise program, and four decades of state and local rulemaking have proceeded with no federal noise standard binding on localities, no federal model ordinance with numbers in it, and no floor beneath the weakest ordinance.[230] Section 16 notes that EPA's own model ordinance was published with an empty limits table. That is the same fact seen from the other end.

On 16 July 2026, in *Quiet Communities v. EPA*, Judge Jia M. Cobb of the U.S. District Court for the District of Columbia ruled for the plaintiffs on four counts of their complaint against the agency's inaction under the Act, dismissed three for lack of jurisdiction, and ruled for EPA on one. The court did not decide the remedy, and suggested that relief on the principal counts may be limited to ordering EPA to review the reports at issue.[228] No remedy order was located as of this volume's evidence snapshot. If EPA comes under an order to act, the 2029 Virginia deadline is no longer the only clock in this story.

14. Nuisance

Reported Virginia case law on data center noise is thin. It is not empty.

Newsom v. Amazon Data Services, No. 3:25-cv-00074-JHY (W.D. Va., Charlottesville Division, Judge Jasmine H. Yoon), was filed in Louisa Circuit Court in August 2025 and removed on diversity in September.[231] The private nuisance count survived a motion to dismiss on 10 July 2026; the only count dismissed was a separately pleaded request for injunctive relief, dismissed without prejudice as a matter of pleading form, which the court said did not affect the plaintiffs' ability to seek an injunction under the surviving count.[232]

The case carries less weight than a surviving nuisance count suggests.

It is a construction nuisance case. On the complaint's allegations, which the court accepted as true at the pleading stage, construction at the Northeast Creek Technology Campus began in March 2025 and is scheduled to be completed around 2031. Every noise allegation concerns construction.[233]

The opinion, read in full, contains no decibel figure, no metric, no weighting, no standard and no sound study. The substantiality question was litigated and resolved without a number. What the complaint itself contains is a separate question this volume does not answer.[234]

And noise never stands alone in it. The court held that Virginia assesses interferences in the aggregate, expressly declining to say whether any single one would suffice,[235] and observed that the water allegation "in isolation, may be deficient."[236]

The compliance question arrived from an unexpected direction. Amazon argued that the complaint's reference to the Louisa County noise ordinance converted the claim into a public nuisance, and lost. Footnote 5 states that *City of Virginia Beach v. Murphy* "did not hold that loud noises in violation of local ordinances cannot give rise to a private nuisance claim," and cites *Bowers* for the proposition that zoning is "an important factor."[237] The opinion does not cite *Barnes v. Graham Virginia Quarries* or *Smith v. Pittston* and does not reach coming-to-the-nuisance or the industrial-locality defense. Compliance as a defense was not presented and not decided.[238]

That leaves the doctrine where it was, and where it favors the neighbors.

In a Virginia private nuisance case, compliance with a zoning ordinance or a permit is evidence and no more. *Barnes v. Graham Virginia Quarries*, 204 Va. 414 (1963), [239] and *Bowers v. Westvaco*, 244 Va. 139, 147 (1992): "the location of a business enterprise, or the zoning classification of the property on which the business is located, cannot immunize the business from a nuisance action."[240] *Bowers* is the stronger authority, because the county there had rezoned specifically for the offending use and attached mitigating conditions.

Virginia rejects the industrial-locality defense, *Smith v. Pittston*, 203 Va. 711 (1962): a plant's location does not excuse substantial damage, though it remains admissible on whether the business is run as a nuisance in fact.[241] It requires no showing of negligence, and due care is no defense. The Code supplies compliance-based nuisance immunities for agriculture at § 3.2-302 and shooting ranges at § 15.2-917. Neither the Air Pollution Control Law (Title 10.1, Chapter 13) nor the State Water Control Law (Title 62.1, Chapter 3.1) supplies one, and the negative implication is available.[242]

14.1 The better Virginia case is about proffers

Oak Valley is two decisions.[243][244] Its standing analysis contains four passages that go directly to this volume's argument. The proffered noise caps exclude construction and emergency generators run during outages. County staff "lacked in-

house expertise" to review the noise proffers before the Board. No noise study was performed for the closest neighborhoods. The record contained no data on the average decibel level at the plaintiffs' homes.[245]

That is the machinery of sections 4 and 5, recited by the Court of Appeals in a Prince William case about something else.[246]

In Goochland, *Haas v. Board of Supervisors of Goochland County*, No. CL25-1270 (Judge Timothy K. Sanner), challenges the county's technology overlay; the county's demurrer was argued on 20 October 2026, and on the county's own account the judge did not rule at the hearing and said he would issue a written opinion, with no timeframe given. Its claims concern notice and procedure rather than noise, but it is the only Virginia case located in searches through 4 October 2026 that arises from a technology overlay carrying a noise standard.[247]

So the scarcity of noise litigation is not explained by the law. A household that measures 70 dB(A) at its fence on a hot afternoon can plead a nuisance claim that a county's finding of no violation does not defeat, though it must still prove substantial and unreasonable interference. What it would need is the money for an acoustical expert.

PART SEVEN: THE SILENCE, AND WHAT TO DO

15. The word that does not appear

Across 194 pages of the industry's own impact literature, the Northern Virginia Technology Council's Virginia reports of 2022, 2024 and 2026 and the PwC national economic contribution study prepared for the Data Center Coalition, the word "noise" does not appear. Neither do "decibel," "acoustic" or "nuisance"; "sound" appears once, as a verb.[248][249]

The 2026 NVTC report contains a "Myths and Facts" section at pages 33 to 35. It answers claims about blackouts, electricity prices and water. It answers no claim about noise. That is the industry's own account, in February 2026, of what needed answering in Virginia.[250]

The omission is not confined to the industry. Shafaghat and colleagues, building a net-cost framing of data center construction, name their externality set as "carbon emissions, water depletion, grid congestion, community disruption, and e-waste." Noise is not in it.[251]

Noise mobilizes a neighborhood and vanishes from every industry document examined here. The documents written to make the industry's case are the ones that leave it out.

16. What to borrow

The most transferable idea in the comparative record is German. TA Lärm, Nr. 7.3, uses a screening trigger. For noise with predominant energy below 90 Hz, harmful effects may occur in particular where the noise is clearly perceptible and the difference between the C-weighted and A-weighted levels, measured in a protected room with the windows closed, exceeds 20 dB; detailed assessment follows.[252] The illustrative list of qualifying sources opens with slow-running fans, giving cooling towers as the example.[253]

The screen requires no octave-band table, no third-octave analyzer and no consultant. Type 1 meters commonly report both weightings. The German version is taken indoors, which means entry to the complainant's home; a Virginia adoption would have to decide whether to screen at the property line or inside the dwelling, and the trigger values circulating elsewhere, 10, 15 and 20 dB, cannot be compared without that choice.[254]

No national or Virginia public body offers a model to borrow. None of the American Planning Association, INCE-USA, the Acoustical Society of America, the National Association of Counties, the National League of Cities, the International Municipal

Lawyers Association, the Virginia Association of Counties or the Virginia Municipal League has published a model data center noise ordinance; the models that exist come from advocacy groups and one Pennsylvania county planning commission. [255] EPA's model community noise control ordinance of September 1975 contains a limits table published with its limit column blank, for each locality to fill.[256]

Virginia's localities did not decline to adopt a better standard off the shelf. In most cases there was no shelf. The one county examined that built its own octave-band standard for data center noise relaxed it by six decibels and marked it advisory.

Warrenton's Special Use Permit 2022-03 shows what enforceable conditions look like: third-party testing by a credentialed acoustician, procured by the locality and billed to the applicant, running for the life of the use, with automatic consequence for failure to cure. King George shows that an applicant will proffer below the ordinance. And Rockingham's 2026 amendment requires the measured pre-construction baseline that makes the rest of it testable, because an absolute limit with no baseline gives a county no way to say what changed. Rockingham uses the baseline only as a design target at the application stage. Joined to Warrenton's testing regime, it would be a standard.[257]

17. Open

Dated events.

Date	What	Section
20 Oct 2026	*Haas v. Goochland*, demurrer argued; no ruling at the hearing, written opinion to follow (county's account)	14.1
fall 2026	Prince William one-year report on noise ordinance enforcement and violations (DIR 25-36)	5.1
17 Nov 2026	Loudoun Board business meeting (scheduled): the twelve-month pause resolution for legislative data center and substation applications, deferred to it on 20 Oct 2026	4.1
undated	*Quiet Communities v. EPA*, remedy	13.1
Dec 2026	Loudoun Phase 2 Board check-in on draft amendments	4.1
Feb 2027	Loudoun Phase 2 Planning Commission public hearing	4.1
Mar 2027	DEQ timeline and workplan for noise rules due to the Governor under Executive Order 22 (180 days from 18 Sep 2026)	13
Mar 2027	Chesapeake's eight-month pause on data center applications runs out (from 21 Jul 2026)	6
Jul 2027	Loudoun Phase 2 Board public hearing and business meeting	4.1
31 Dec 2029	DEQ data center noise regulations due under Item 367 E	13
1 Jan 2030	Civil penalties of up to $32,500 per day become available	13

Sources: as cited in the sections named.[258]

Claims ruled out. No infrasound claim. No claim that Virginia data centers exceed WHO's 1999 community-noise values, against which no Virginia record examined measures. No cardiovascular claim at Virginia exposure levels. No claim that a road-traffic finding on steady noise transfers to a fixed industrial source. No claim that nobody has counted the generators. No claim that no Virginia data center noise litigation exists.

ENDNOTES

[1] Hanna Pampaloni, "Sterling Residents Raise Alarms Over Off-Grid Data Center," *Loudoun Now*, 16 April 2026, https://www.loudounnow.com/news/sterling-residents-raise-alarms-over-off-grid-data-center/article_3481d7fd-11ef-4948-a951-8c4ee6e69f2f.html (accessed 16 August 2026). Supervisor Koran T. Saines (D-Sterling): "Zoning does go out regularly to obtain readings that are conducted with certified calibrated machines. They require clear readings with only the turbine sounds, and readings cannot include other noise intrusions like airplane flyovers, cars passing by, lawn equipment, or even the barking of a dog. The average of the noise readings to determine if there is a noise violation has never exceeded 55 dBA at the residential property adjacent to Vantage." The statement concerns the average of qualifying readings at one receiving location, and it is a supervisor's account given to a newspaper, not a county publication.

[2] Pampaloni, *Loudoun Now*, 16 April 2026 (see note 1), reporter's paraphrase: "The county's noise ordinance sets a maximum noise level of 55 decibels and Supervisor Koran T. Saines (D-Sterling), whose district includes the property, told Loudoun Now the county staff has checked multiple times for violations but have not recorded a reading over that limit."

[3] Pampaloni, *Loudoun Now*, 16 April 2026 (see note 1): the average of the county's readings "has never exceeded 55 dBA at the residential property adjacent to Vantage." A figure of about a dozen complaints and no violations in 2026, attributed to WUSA9 ("As data center noise concerns grow, Loudoun Co. officials discuss possible mitigation efforts," date not fixed in the copy retrieved, April or July 2026, https://www.wusa9.com/article/news/local/data/loudoun-county-officials-data-center-noise/65-45884219-750f-4d47-a660-71a20d8db001), circulates in secondary accounts; no Loudoun County document examined for this volume carries it. Loudoun publishes action reports rather than verbatim minutes. Two instances of a complaint followed by no violation are documented in the sources examined: Jeff Mack, a Little River District resident speaking in public comment at the Loudoun County Board of Supervisors meeting of 6 February 2024 (meeting video at 3:10:39), describing a complaint on which county staff "found that it was in fact below the 55 decibels limits of the ordinance"; and Greg Pirio's reading of 60 dB at his own property line during the generator operation at the Vantage campus of 16 and 17 July 2026, reported in *Northern Virginia Magazine*, 21 July 2026, https://northernvirginiamag.com/news/2026/07/21/sterling-resident-says-data-centers-generators-produced-excessive-noise-pollution/. No notice of violation from that event appears in the sources cited in this volume; emergency generator operation is in any case exempt from Loudoun's decibel limit (see note 53).

[4] Pampaloni, *Loudoun Now*, 16 April 2026 (see note 1). The article places Hatch in "a townhouse approximately half a mile from the Vantage data center," not at the adjacent residential property to which Saines's figure refers. Hatch: "When it was 87 degrees, I was measuring between 70 and 80 decibels. It was echoing all through this area. It was incredibly loud." The article states no instrument, weighting network, distance, duration or time of day; it reports that residents and experts contacted through Reddit and WhatsApp were "teaching her how to take her own readings." It is a resident's own reading, not a measurement comparable to the county's lot-line standard.

[5] Loudoun County, Virginia, Zoning Ordinance § 7.05.03.C.1, C.3 and C.5 (Chapter 7, Development Standards, adopted 13 December 2023), https://www.loudoun.gov/DocumentCenter/View/176101; also https://online.encodeplus.com/regs/loudouncounty-va-zo/doc-viewer.aspx?secid=1320: "Noise must be measured with an integrating sound level meter (SLM) that meets or exceeds American National Standard Institute S1.43-1997 for Type 1 SLMs. a. The response of such SLM must be set to FAST, and a time period of 15 seconds must be used…"; "The operator must take a minimum of 3 samples that verify the repeatability and consistency of the subject sound"; "samples of the subject sound must be taken from the point on the receiving lot line that is located the closest to the source of the subject sound. The microphone of the SLM must be aimed toward the source of the subject sound, and a standard microphone height of 5 feet above grade must be used."

[6] Loudoun County Zoning Ordinance § 7.05.03.C.2 (source as at note 5). The examples of excluded sound that follow in the text (airplane flyovers, passing cars, lawn equipment, barking dogs) are Saines's description of practice, not the ordinance's words (Pampaloni, *Loudoun Now*, 16 April 2026; see note 1). The ordinance names "barking dogs at kennels" as an example of regulated noise (§ 7.05.03.A.1), and separately exempts aircraft, power lawn equipment and utility substations from the limits (§ 7.05.03.E.1, E.3 and E.6.a).

[7] Loudoun County Zoning Ordinance § 7.05.03.C.4 (source as at note 5): "The arithmetic average of all samples that verify the repeatability and consistency of the subject sound must comply with the maximum A-weighted sound levels in Table 7.05.03-1."

[8] Loudoun County Zoning Ordinance, Table 7.05.03-1, "Maximum Sound Levels" (source as at note 5), keyed to the receiving property's development category: Mixed-Use Residential 60 dB(A); Residential and Rural Economy Uses 55; Commercial, Civic and Institutional Uses 65; Industrial Uses 70. Section 7.05.03.D:

"The maximum sound levels provided in Table 7.05.03-1 apply at all times of day and night."

[9] Chiller and fan demand rises with outdoor dry-bulb temperature. Kasey Hatch described the effect from the receiving side: "As soon as the weather started getting warmer, the days started becoming more frequent where the noise is just super, super loud, like intolerably loud" (Pampaloni, *Loudoun Now*, 16 April 2026; see note 1). Henry County's August 2026 ordinance, as reported, requires acoustical analysis under "representative worst-case operating conditions, including peak cooling demand" (see note 172). Loudoun's measurement procedure (§ 7.05.03.C; see note 5) sets no condition of time, temperature or load for sampling.

[10] Pampaloni, *Loudoun Now*, 16 April 2026 (see note 1 and note 4). Documents examined: the Loudoun and Prince William board records cited in this volume, the DEQ Regulatory Town Hall comment dockets on data center generators, JLARC Report 598, the consultant reports prepared for Prince William and Loudoun counties, and the press accounts cited in this volume. None of them reports another decibel reading together with the ambient temperature at which it was taken, and none reports a test of whether Loudoun's sampling procedure can be completed at peak cooling load.

[11] Loudoun County Board of Supervisors, Business Meeting Action Item #17, "ZOAM 2014-0006, Noise Standards," staff report, 22 September 2016, p. 4, Fiscal Impact, https://loudoun.granicus.com/MetaViewer.php?view_id=86&clip_id=4631&meta_id=106012: "The upfront cost for purchase of the two SLMs and training of Zoning Enforcement staff will total approximately $18,000. Should the Board wish to regulate tonal sound, additional software and training would be required, increasing the cost by $1,000." The fiscal note is the staff's (staff contacts Theresa Stein, Zoning Administration, and Ricky Barker, Director of Planning and Zoning); the county's acoustical consultant on the amendment was Hessler Associates, Inc. The amendment was adopted on 22 September 2016 and took effect 1 January 2017.

[12] ZOAM 2014-0006, Action Item #17, 22 September 2016 (see note 11), p. 3, Issues § 2 (Tonal Noise/Penalty): "Staff and the Consultant evaluated this throughout the process and do not recommend regulating tonal noise… Staff believes that regulating tonal noise may place the County at a competitive disadvantage with other regional jurisdictions when competing for businesses such as data centers." Attachment 3, staff response #2, p. 29: "Therefore, in recognition of the County's desire to stay competitive with neighboring jurisdictions that do not regulate tonal sound, Staff recommends that the proposed regulations move forward without

regulating tonal quality." The Board adopted the amendment without a tonal provision.

[13] Harvey Fletcher and W. A. Munson, "Loudness, Its Definition, Measurement and Calculation," *Journal of the Acoustical Society of America* 5, no. 2 (1933): 82–108, https://doi.org/10.1121/1.1915637, for the first family of equal-loudness contours; American Standards Association, Z24.3-1936, *American Tentative Standard for Sound Level Meters for Measurement of Noise and Other Sounds* (definitive edition 1944), the first standard to fit an "A" network to the 40 dB contour. ("ASA" here is the American Standards Association, predecessor of ANSI.) The 1936 curve was the 40-phon contour modified by the difference between random-incidence and normal free-field thresholds, not a pure inversion. On the historical derivation and its limits, S. Yokoyama, S. Sakamoto, S. Tsujimura, T. Kobayashi and H. Tachibana, "Loudness Experiment on General Environmental Noises Considering Low-Frequency Components down to Infrasound," *Acoustical Science and Technology* 36, no. 1 (2015): 24–30, https://doi.org/10.1250/ast.36.24: "the A-weighting function was originally proposed as an inverse characteristic of the 40-phon curve of the equal-loudness contours proposed by Fletcher and Munson"; measured against the revised contours of ISO 226:2003, "it fits around the 60-phon curve." Yokoyama and colleagues conclude that A-weighted level remains an appropriate loudness indicator for general environmental noise. The modern definition is IEC 61672-1:2013, *Electroacoustics: Sound Level Meters, Part 1: Specifications*, ed. 2.0 (International Electrotechnical Commission, 2013), which gives the weightings as an analytical transfer function (Annex E, normative, p. 49; poles at 20.598997, 107.65265, 737.86223 and 12194.217 Hz, normalized to 0 dB at 1 kHz) and tabulates their values, with acceptance limits, in Table 3, "Frequency weightings and acceptance limits," p. 22; https://webstore.iec.ch/en/publication/5708.

[14] IEC 61672-1:2013 (see note 13), Table 3, "Frequency weightings and acceptance limits," p. 22. The tabulated values are computed at the exact band-center frequencies of Annex D, Table D.1, p. 47 (10^(n/10) × 1000 Hz), not at the nominal labels; at 31.5 Hz the exact center is 31.6228 Hz and the value is −39.4 dB, while the same expression evaluated at 31.500 Hz returns −39.5 dB. The table in the text prints the standard's design values; Class 1 and Class 2 acceptance limits are given in the same table. The six values agree with the octave-band A-weighting table published by NTi Audio AG, "Frequency-Weightings for Sound Level Measurements," https://www.nti-audio.com/en/support/know-how/frequency-weightings-for-sound-level-measurements (accessed 16 August 2026).

[15] 60 dB − 39.4 dB = 20.6 dB(A), using the 31.5 Hz correction in Table 3 (see note 14). The example is Nelson's (David A. Nelson, Nelson Acoustics, *Memorandum Report 1618-01*; see note 18): a sound of 60 dB in the 31.5 Hz octave band

contributes 20.6 dBA to an A-weighted total and, within a 43 dBA total, adds less than 0.03 dB. Nelson further estimates that 60 dB outdoors in that band corresponds to roughly 49 dB indoors and that, concentrated in the 40 Hz third-octave band, it would be detectable by approximately 40 percent of the population, citing K. Kurakata, T. Mizunami and K. Matsushita, "Percentiles of Normal Hearing-Threshold Distribution under Free-Field Listening Conditions in Numerical Form," *Acoustical Science and Technology* 26, no. 5 (2005): 447–449.

[16] Trane, *Air-Cooled Series R Chiller, Model RTAG*, engineering bulletin RTAG-PRB001A-EN (November 2017), Appendix A, Table A-1, octave-band sound power in dB re 1 pW, tolerance ±2 dB per band, rated per AHRI/ARI 370, https://www.tranehk.com/files/Products/RTAGPRB001AEN_1117.pdf. For the largest unit tabulated (RTAG 410): 63 Hz 101.0; 125 Hz 94.5; 250 Hz 97.0; 500 Hz 102.5; 1 kHz 100.0; 2 kHz 95.0; 4 kHz 86.0; 8 kHz 79.5. These are the standard AC-fan figures; the 100 and 250 sizes in that configuration also peak at 500 Hz. With EC fans, the same bulletin gives the RTAG 410 104.5 dB at 63 Hz, above the AC-fan unit's 102.5 dB peak at 500 Hz. This is the only manufacturer octave-band sound power data for data center cooling equipment cited in this volume. No sound data for dry coolers or air-cooled condensers was located from Güntner, Evapco, Alfa Laval, Vertiv, Stulz or Munters.

[17] Nelson, *Memorandum Report 1618-01* (see note 18), Table 7, "Attenuation of Typical Residence," p. 8: octave-band noise reduction of a typical wood-frame residence with windows open about two inches, 11 dB at 31.5 Hz, 15 at 63 Hz, 19 at 125 Hz, 21 at 250 Hz, 23 at 500 Hz, 25 at 1, 2 and 4 kHz, and 30 at 8 kHz. The 19 dB figure in the text is the difference between the 8 kHz and 31.5 Hz values. The county's board presentation of 28 October 2025 reproduced Table 7 with 29 dB at 125 Hz; Nelson's memorandum gives 19.

[18] David A. Nelson, Nelson Acoustics (Nelson Acoustical Engineering, Inc.), *Memorandum Report 1618-01: Prince William County Noise Ordinance Update, Criteria Basis and Background*, 3 August 2025, 13 pp., addressed "To: Prince William County, VA, Board of Supervisors," https://www.pwcva.gov/assets/2025-10/M1618-01%202025%20AUG%2003%20PWC%20Noise%20Ordinance%20Criteria%20Basis%20and%20Background.pdf; also Attachment 1 to Board of County Supervisors Item 7-J, 28 October 2025, https://legistarweb-production.s3.amazonaws.com/uploads/attachment/pdf/3685517/Item_7-J.pdf. Executive summary, p. 1: "Nelson Acoustics was engaged in September 2024 to assist Prince William County (PWC) in updating its Noise Ordinance…"

[19] Nelson, *Memorandum Report 1618-01* (see note 18), § 4.1, p. 11. The passage opens: "In other words, the ambient level is the de facto criterion when it is higher than the Ordinance criterion."

[20] Geoff Leventhall, with Peter Pelmear and Stephen Benton, *A Review of Published Research on Low Frequency Noise and Its Effects*, report for the Department for Environment, Food and Rural Affairs, contract EPG 1/2/50, May 2003, § 17.1, "Assessment," p. 77, https://docs.wind-watch.org/leventhall-defra-lowfreqnoise.pdf. The passage continues: "Section 15 has outlined the assessment methods of other countries, which are able to draw positive conclusions on noises that would fail an A-weighting test."

[21] Documents examined: the peer-reviewed literature as surveyed in "Infrasound and Low-Frequency Noise in Data Center Environments: A Narrative Review Toward Health-Protective Acoustic Design Standards," *Clean Technologies* 8, no. 4 (2026): 126, published 7 August 2026, https://www.mdpi.com/2571-8797/8/4/126, which states that "No published study has measured the ILFN spectrum in an operational data center" and whose screen identifies no primary study of data center acoustics reporting data below 200 Hz; the Prince William consultant record, including Nelson's field observation (see note 24); and published manufacturer octave-band data (see note 23). The standards under which the question could be examined are ISO 7196:1995, *Acoustics: Frequency-Weighting Characteristic for Infrasound Measurements*, and ANSI/ASA S12.9-2016/Part 7 (R2025), *Measurement of Low-Frequency Noise and Infrasound Outdoors in the Presence of Wind and Indoors in Occupied Spaces*.

[22] "Infrasonic and Low-Frequency Noise Exposure from Large Data Centers: A Proposed Analytical Framework," preprint, ResearchGate publication 404091160, https://www.researchgate.net/publication/404091160; also https://www.academia.edu/165875697/ (addendum at https://www.academia.edu/165875960/). Not peer-reviewed; it proposes joining acoustic modeling to public health data and reports no measurements. Its abstract states that "no peer-reviewed statistical framework exists for linking ILFN from data centers to population-level health disparities."

[23] Trane, RTAG-PRB001A-EN, Appendix A, Table A-1 (see note 16): the octave-band series begins at 63 Hz, with no 31.5, 16 or 8 Hz band. The governing rating standard is ANSI/AHRI 370, *Sound Performance Rating of Large Air-Cooled Outdoor Refrigerating and Air-Conditioning Equipment*. The other equipment catalogs cited in this volume (Trane Ascend Model ACR, Carrier 30XA, Daikin AWV) publish no octave-band sound power; Trane's Ascend catalog (AC-PRC001G-EN, January 2022) states, "Sound power levels for chillers are available on request."

[24] Nelson, *Memorandum Report 1618-01* (see note 18), p. 6, n. 8: "Low frequency noise as evaluated in one-third octave bands according to the DIN standard covering the range 8 Hz to 100 Hz. Because significant mechanical equipment noise has not been observed below the 31.5 Hz band, the 8 Hz and 16 Hz octave bands have not been included in the recommended limits." The DIN standard is DIN 45680 (2020), *Messung und Beurteilung tieffrequenter Geräuschimmissionen*.

[25] Mark Brink, Beat Schäffer, Danielle Vienneau, Maria Foraster, Reto Pieren, Ikenna C. Eze, Christian Cajochen, Nicole Probst-Hensch, Martin Röösli and Jean-Marc Wunderli, "A Survey on Exposure-Response Relationships for Road, Rail, and Aircraft Noise Annoyance: Differences between Continuous and Intermittent Noise," *Environment International* 125 (April 2019): 277–290, https://doi.org/10.1016/j.envint.2019.01.043. From the abstract: "for road traffic noise, IR has an additional effect on %HA and can explain shifts of the exposure-response curve of up to about 6 dB between low IR and high IR exposure situations, possibly due to the effect of different durations of noise-free intervals between events. For railway and aircraft noise annoyance, the predictive value of IR was limited." The intermittency ratio is defined in Jean Marc Wunderli et al., "Intermittency Ratio: A Metric Reflecting Short-Term Temporal Variations of Transportation Noise Exposure," *Journal of Exposure Science and Environmental Epidemiology* 26, no. 6 (2016): 575–585, https://doi.org/10.1038/jes.2015.56. On the authors' analysis the direction for road traffic is that the low-IR, steadier exposures were the more annoying at equal Lden, which is what the abstract's reference to noise-free intervals between events implies. The functions concern transportation noise; they establish nothing directly about a stationary industrial source.

[26] World Health Organization Regional Office for Europe, *Environmental Noise Guidelines for the European Region* (Copenhagen: WHO Regional Office for Europe, 2018), https://www.who.int/europe/publications/i/item/9789289053563; and the systematic review on which its sleep recommendations rest, M. Basner and S. McGuire, "WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environmental Noise and Effects on Sleep," *International Journal of Environmental Research and Public Health* 15, no. 3 (2018): 519, https://doi.org/10.3390/ijerph15030519. The polysomnographic functions give the probability of awakening as a function of the maximum level of a single noise event and rest on two German field studies of 61 and 33 subjects. Basner and McGuire: "the effects on sleep are primarily determined by the number and acoustical properties (e.g., maximum SPL, spectral composition) of single noise events." The self-reported sleep-disturbance functions use Lnight, which the same authors call questionable "as the only indicator for predicting the effects of noise on sleep."

[27] Nelson, *Memorandum Report 1618-01* (see note 18), § 2, p. 3: "The day-night sound level associated with a round-the-clock steady sound meeting the current nighttime limit (55 dBA) would be 62 Ldn, clearly incompatible with all three neighborhood types." Ibid., p. 4, n. 4: "The Ldn for a constant-level sound can be estimated by adding 7 dB to the A-weighted sound level." The derivation table on p. 4 (labeled Table 2) is captioned "Median Percent Highly Annoyed at 65 Ldn," a caption that belongs to Table 3.

[28] Nelson, *Memorandum Report 1618-01* (see note 18), § 2, p. 4: "Even a moderate amount of LFN would raise the effective Ldn from 62 to an adjusted 65 Ldn." Ibid., n. 5, applying ANSI S12.9-2005/Part 4, Annex D: "a moderate low-frequency sound level L_LF of 65, which might often occur in conjunction with L_pA 55, is equivalent to adding 62 Ldn to the previous total: in decibel math, 62 + 62 = 65 Ldn." Part 4 has since been revised as ANSI/ASA S12.9-2021/Part 4; Nelson's arithmetic follows the 2005 annex.

[29] Nelson, *Memorandum Report 1618-01* (see note 18), p. 3: "The American National Standard ANSI S12.9 Part 5 defines an adjusted sound level above 60 Ldn as incompatible with urban residential living [Ref. 2]. Suburban and rural communities are more sensitive by 5 and 10 dB respectively, so the unadjusted compatibility limits for those neighborhood types are 55 and 50 Ldn, respectively… Incompatibility, for the purposes of this project, is therefore based on the limit for suburban residential living: 55 Ldn." The underlying standard is ANSI/ASA S12.9-2007/Part 5 (R2024), *Quantities and Procedures for Description and Measurement of Environmental Sound, Part 5: Sound Level Descriptors for Determination of Compatible Land Use*.

[30] Nelson, *Memorandum Report 1618-01* (see note 18), Table 3, "Median Percent Highly Annoyed at 65 Ldn," p. 4: urban, long-term 15 percent and new 25; suburban, long-term 25 and new 40; rural, long-term 40 and new 55. Both figures in the text are the suburban values and attach to the adjusted 65 Ldn (see note 28). Nelson, same page: "The initial response to a new intrusive noise, especially if public relations are poor, is equivalent to increasing the Ldn by an additional 5 dB." Ibid., n. 6: "'highly annoyed' suggests persons willing to go beyond making sporadic individual complaints."

[31] Nelson, *Memorandum Report 1618-01* (see note 18), p. 4.

[32] *Virginia Data Center Noise Ordinance Census*, workbook Below_the_Curve_VA_Noise_Ordinance_Census.xlsx, deposited with this volume. The Census sheet records one row per regulatory instrument; the Summary sheet totals 76 instruments across 43 jurisdictions: all 20 Tier 1 counties, all 22 Tier 2 jurisdictions (independent cities and counties) and the Town of Culpeper. Where a

jurisdiction regulates noise through more than one instrument, each instrument is a separate row.

[33] *Virginia Data Center Noise Ordinance Census* (see note 32), README, which notes that most jurisdictions regulate noise through two separate instruments, a general code noise chapter and a zoning performance standard. Examples from the Census sheet: Loudoun, Codified Ordinances Part Six, ch. 654, § 654.02 (enforced by the Sheriff's Office) and Zoning Ordinance § 7.05.03 with Table 7.05.03-1 (enforced by Zoning Enforcement); Chesterfield, County Code § 14-27 and Zoning Ordinance ch. 19.2 (effective 1 January 2026); Goochland, County Code ch. 10, art. II, §§ 10-41 to 10-45, and Zoning Ordinance ch. 15, art. 27A, § 15-449.A(1)a.

[34] The clearest instance is Loudoun. Codified Ordinances Part Six, ch. 654, § 654.02 (amended effective 1 September 2016), https://www.loudoun.gov/4718/Noise-Ordinance, is an audibility standard applied inside another person's dwelling and enforced criminally; Zoning Ordinance Table 7.05.03-1 (see note 8) is a numeric dB(A) standard applied at the receiving lot line and enforced by zoning administration.

[35] The draft is Isle of Wight County, "DRAFT STRAWMAN / Data Center Ordinance / Rev. 7/22/26," Planning Commission agenda of 28 July 2026, item 9.B.2; the staff report states: "This item is for Planning Commission review and discussion only. No action is required." Census row I2 (see note 32). The draft carries a numeric limit, a specified metric, a tonal provision and a low-frequency provision; excluding it reduces the denominator from 76 to 75, leaves the two counts of missing elements unchanged, and lowers the tonal and low-frequency counts by one each.

[36] *Virginia Data Center Noise Ordinance Census* (see note 32), Summary sheet, counts for adopted instruments only (75): no numeric decibel limit, 42 (56 percent); no measurement metric specified, 33 (44 percent); any tonal provision, 8 (11 percent); any low-frequency provision, 10 (13 percent). The same sheet counts 64 instruments, all adopted, with no tonal provision and 62 with no low-frequency provision. Three adopted rows on each count are coded n/a, not none, because the census cell cross-refers, is empty or is partial: on tonality, P1 (Prince William's general noise ordinance, which refers to P2), P3 (Prince William's advisory octave-band table) and K3 (Culpeper County's light-industrial zoning standard, whose cells carry no entry); on low frequency, P1, K3 and Q2 (Fauquier County's zoning performance standard, coded partial: frequency resolution only, with no 63 Hz limit in residential districts). On each count the three codes sum to 75: 8, 64 and 3 for tonality; 10, 62 and 3 for low frequency. Counts are by instrument, not by jurisdiction. The receiving-zone limits recorded in the workbook are keyed in four

different ways (to the receiving district, to the source district, to both, or countywide) and are not comparable across jurisdictions without that key.

[37] City of Chesapeake, Ordinance PLN-TXT-2026-001, enacting Zoning Ordinance (City Code app. A) art. 13, § 13-3400, adopted 18 August 2026, https://www.cityofchesapeake.net/DocumentCenter/View/33223/Data-Center-Ordinance-081826, § 13-3400(C)(2)(a)(i): an applicant for a "high energy use facility" (100 megawatts or more) must submit "A site assessment that examines, to the extent practicable and within any timeline established by applicable law: i. The sound profile of the HEUF on residential units and schools located within 500 feet of the HEUF property boundary." The adopted text contains no decibel limit, weighting, steady-tonal definition, measurement procedure or generator-testing provision. Rockingham County, OA26-0887, "High Energy Use Facility Noise," amending County Code § 17-607, "Data center," subsection (c)(1), adopted 5–0 on 22 July 2026 (draft minutes printed in the Board of Supervisors agenda packet of 26 August 2026, pp. 13–15, https://www.rockinghamcountyva.gov/AgendaCenter/ViewFile/Agenda/_08262026-972; minutes approved 26 August 2026): a special use permit application must include "A baseline noise study conducted by a third-party licensed professional engineer specializing in acoustics or an engineer who is board certified by the Institute of Noise Control Engineering (INCE)," and must incorporate recommended mitigation "to prevent noise levels from exceeding noise and ambient sound levels observed in the baseline study." The census workbook (see note 32) codes both as adopted instruments with no numeric limit and no metric.

[38] Pat Thomas, "Henry County Adopts 'Stringent' Regulations on Data Centers," WDBJ7, 25 August 2026, https://www.wdbj7.com/2026/08/26/henry-county-adopts-stringent-regulations-data-centers/ (accessed 4 October 2026): "The ordinance establishes a maximum operational noise level of 50 dBA at the exterior property line," and "prohibits mechanical equipment from producing a clearly audible pure tone or tonal component at or beyond the property line of a residentially-zoned property." Also WSLS 10 News Digital Team, "Henry County Board Adopts Stringent Data Center Regulations," WSLS, 28 August 2026, https://www.wsls.com/news/local/2026/08/28/henry-county-board-adopts-stringent-data-center-regulations/; and "Supervisors Approve Data Center Ordinance," *Henry County Enterprise*, 2 September 2026, https://henrycountyenterprise.com/supervisors-approve-data-center-ordinance-2026-09-03/ (vote 6–0; "Operational noise would be limited to 50 decibels at the exterior property line"). The adopted ordinance text was not examined; the provisions are given as reported.

[39] Jack Parry, "Data Centers Stripped as Allowable Use in Frederick County," *Winchester Star*, 24 September 2026, https://www.winchesterstar.com/winchester_star/data-centers-stripped-as-allowable-use-in-frederick-county/article_94c129c1-2f19-5ff1-a1f3-72269aabfac1.html; also carried by the *Northern Virginia Daily*, https://www.nvdaily.com/nvdaily/data-centers-stripped-as-allowable-use-in-frederick-county/article_79da8f36-a547-5430-bf96-e07bcc68a7ef.html (both accessed 4 October 2026): "An ordinance amendment that removes data centers as a permitted or conditional use in Frederick County was approved by the Board of Supervisors on a 6-1 vote Wednesday night" (Supervisor Gary Oates opposed); "The same vote also removed definitions and additional data center regulations from the ordinance." By separate unanimous resolution the Board grandfathered two applications under review, Virginia Technology Park and Winchester Gateway, requiring both to come before it for a public hearing by 28 October. The adopted text was not examined.

[40] Mason Willett, WHSV, 23 June 2026, https://www.whsv.com/2026/06/24/shenandoah-county-moves-forward-with-data-center-ordinance/ (the amendment includes "requirements related to water use, noise, setbacks, environmental impacts and public input"); Ryan Fitzmaurice, *Northern Virginia Daily*, 24 June 2026, https://www.nvdaily.com/nvdaily/shenandoah-county-supervisors-pass-data-center-rules-over-calls-for-a-ban/article_86ac5b6d-5fe0-5c7c-adee-8970bbe8e13e.html (both accessed 4 October 2026). The Board of Supervisors adopted the ordinance 6–0 on 23 June 2026. The adopted text was not examined, and the figures reported for the Planning Commission's draft are not given here because the adopted text may differ.

[41] Loudoun County Codified Ordinances, Part Six, ch. 654, § 654.02 (amended effective 1 September 2016), https://www.loudoun.gov/4718/Noise-Ordinance: "No person shall permit, operate, or cause any source of sound or sound generation to create a sound that is audible and discernible in any other person's residential dwelling with the doors and windows to that other person's residential dwelling closed."

[42] Chesterfield County Code § 14-27 (plainly audible inside another's dwelling, or off the property at 50 feet between 11:01 p.m. and 7:00 a.m. and 300 feet between 7:01 a.m. and 11:00 p.m.); Henrico County Code ch. 10, art. III, §§ 10-67 to 10-69 (plainly audible, with distance thresholds of 50 and 100 feet); Isle of Wight County Code ch. 11.2, §§ 11.2-1 to 11.2-6 (plainly audible, measured inside an enclosed dwelling unit of another person); Frederick County Code ch. 118, §§ 118-1 to 118-5 ("plainly audible or exceeding 60 decibels," with no weighting network specified).

Frederick's chapter reaches only sound between 9 p.m. and 6 a.m. originating in its RP, R4, R5 and MH1 districts (§ 118-1B). Goochland's general ordinance, County Code ch. 10, art. II, §§ 10-41 to 10-45, judges "repetitive noise on residential property" by volume, pitch, duration, repetition and time of day; its Technology Overlay District standard, Zoning Ordinance ch. 15, art. 27A, § 15-449.A(1)a, sets 55 dBA and 65 dBC. Census rows C1, H1, I1, D1, G1 and G2 (see note 32).

[43] *Tanner v. City of Virginia Beach*, 277 Va. 432, 674 S.E.2d 848 (2009), Record No. 080998, decided 17 April 2009 (Keenan, J.), http://www.courts.state.va.us/opinions/opnscvwp/1080998.pdf: "We conclude that these provisions fail to give 'fair notice' to citizens as required by the Due Process Clause, because the provisions do not contain ascertainable standards. Instead, the reach of these general descriptive terms depends in each case on the subjective tolerances, perceptions, and sensibilities of the listener." The language before the Court was "unreasonably loud, disturbing and unnecessary" noise and noise "detrimental to the life or health of persons of reasonable sensitivity" (Virginia Beach City Code § 23-47); the Court did not consider a "plainly audible" standard. It declined to reach the owners' overbreadth and selective-enforcement claims.

[44] *Tanner*, 277 Va. 432 (see note 43). The Court acknowledged that "the regulation of noise by a locality creates special problems regarding the drafting and enforcement of legislation… These problems arise from the nature of sound, which invites the use of broadly stated definitions and prohibitions," and held that "the vague language adjudged unconstitutional in this opinion affects the content of the entire ordinance." It did not question the city's authority to regulate noise.

[45] *Souter v. County of Warren*, Record No. 0120-10-4 (Va. Ct. App. Feb. 1, 2011) (unpublished memorandum opinion of Powell, J.), https://cases.justia.com/virginia/court-of-appeals-unpublished/0120104.pdf. Not designated for publication under Va. Code § 17.1-413 and not binding precedent. The court reversed a conviction under former Warren County Code § 123-2(H) because the chapter's general prohibition was indistinguishable from the language struck in *Tanner*. Footnote 1 records that on 21 September 2010, in response to *Tanner*, Warren County amended chapter 123 to, among other things, "set maximum sound pressure levels for different zoning districts" and allow both civil and criminal penalties. The replacement general prohibition, § 123-2(A), still turns on noise "likely to disturb the rest of any person of any ordinary sensibilities."

[46] Prince George County, Virginia, Zoning Ordinance § 90-1042(5) (Ord. No. O-22-13, § 1, adopted 10 May 2022), battery energy storage systems only: "shall not exceed a noise level of 20 dBA as measured at the outside wall the property line [sic] of any surrounding non-participating residence or occupied community building in

the R-A and A Zoning Districts. In M Zoning Districts, the average noise shall not exceed a noise level of 60 dBA at adjoining property lines." Compliance may be shown by "equipment and component manufacturers' noise ratings." A 20 dBA limit sits below typical rural nighttime ambient levels. Census row PR2 (see note 32).

[47] Prince George County Code ch. 54, § 54-23.1, is a plainly-audible standard at 50 feet whose enumerated acts are amplified sound, gatherings of ten or more persons, animals, vehicle audio, refuse loading and commercial lawn care; no provision describes fixed mechanical plant. Zoning Ordinance § 90-549(a), M-3 district, requires that the plan of operation "shall state all noise levels in decibels" and sets no limit. Census rows PR1 and PR2 (see note 32).

[48] *Virginia Data Center Noise Ordinance Census* (see note 32). The fourteen localities and the uses for which they set numeric limits: Botetourt (wind energy, 60 dB at any non-participating property line, with a sound study and annual documentation); Rockingham (wind energy, 60 dB, with analysis by a qualified acoustical engineer); Charlotte (small wind 60 dBA; utility-scale solar 50 dBA; battery storage 60 dBA; places of assembly 55/60; bed-and-breakfast events 55 dBA); Prince George (battery storage, 20 dBA; see note 46); Caroline (battery storage, 50 dBA at the adjoining property line and the outer wall of any occupied structure, with a three-month post-construction study); Isle of Wight (solar, 60 dBA); Goochland (solar, 60 dBA); Warren (wind 60 dB; commercial recreation 60 dB; farm winery and microbrewery 60 dB; private club 55 dB; kennels 60/55); Chesterfield (solar 65 dBA; A District 65 dBA; public-address systems and outdoor amplified music 65 dB); Henrico (small wind 55 dBA; accessory car wash and vehicle sales and service 55 dBA above ambient); Danville (Casino Entertainment District 70/50 dBA; aircraft-related industries 100 dB); Fredericksburg (light manufacturing in the Creative Maker District, 75 decibels); Orange (home-enterprise mechanical equipment, 50 decibels); Hanover (public entertainment venues, 90 dB(A), as a signage trigger). Of these, Caroline (60/55 dB unweighted, waivable by 10 dB, no study), Goochland (55 dBA and 65 dBC in its Technology Overlay District) and Orange (65/60 dB(A) in its Technology District) set numeric limits for data centers.

[49] *Virginia Data Center Noise Ordinance Census* (see note 32), column "Controlling exemption / applicability limit." Express industrial-property exemptions: Fauquier § 13.5-4(a)(7); Sussex § 20-104(12); Halifax § 17-44(11); Dinwiddie § 15-1.5(f); Page § 81-5C; Augusta § 15-8(1); Campbell § 16-10.6(N); Botetourt § 15-54(7); Chesapeake § 26-141(19); Richmond § 11-36(13); Culpeper § 10A-24(g); Spotsylvania § 14-53(a)(3) (daytime). Exemptions triggered by a permit or zoning approval: Greensville § 15-54(6); Sussex § 20-105; Dinwiddie § 15-1.5(c); Warren § 123-5B; Goochland § 10-44(5); Botetourt § 15-54(6); Amherst § 10-29(9); Chesterfield § 14-27(a). Scope clauses that exclude industrial sources: New Kent §

46-124(c); Frederick § 118-1B; Isle of Wight §§ 11.2-4, 11.2-5. Exemptions for heating and cooling equipment: Manassas Park § 15-4(b); Stafford § 16-4(c); Culpeper § 10A-24(i); Chesapeake § 26-141(15); Fauquier § 13.5-4(a)(13). Ordinances limited to enumerated acts that do not include fixed plant: Mecklenburg § 38-1; Prince George § 54-23.1; Amherst (general prohibition, § 10-30, repealed 2012). Powhatan is the only Tier 2 county in the census with no industrial or commercial exemption in its noise ordinance.

[50] Va. Code Ann. § 15.2-980 (2010, cc. 501, 788; 2017, c. 649; 2021, Sp. Sess. I, c. 532), https://law.lis.virginia.gov/vacode/title15.2/chapter9/section15.2-980/: "Any locality may, by ordinance, adopt a uniform schedule of civil penalties for violations of that locality's noise ordinance. This provision shall not apply to noise generated in connection with the business being performed on industrial property. Civil fines will not exceed $250 for the first offense and $500 for each subsequent offense."

[51] Prince William County Code § 14-2(b) ("This civil penalty provision shall not apply to noise generated in connection with the business being performed on industrial property or railroads"); Fairfax County Code § 108.1-3-2 ("this civil penalties provision shall not apply to noise generation in connection with business being performed on industrially zoned property"); Hanover County Code § 16-5(a); Warren County Code § 123-7; Chesapeake City Code § 26-131(a)(3); Richmond City Code § 11-36(13) ("The emission of sound generated in connection with business being performed on industrial property, as required by Code of Virginia, § 15.2-980").

[52] Va. Code Ann. § 15.2-980 (see note 50), second sentence. Where the civil track is unavailable, the remaining routes are criminal prosecution, on proof beyond a reasonable doubt, or injunction; Fairfax, for example, makes a violation a Class 2 misdemeanor and authorizes the Board to seek an injunction (County Code § 108.1-3-2).

[53] Loudoun County Zoning Ordinance § 7.05.03.E.4 (source as at note 5; provision created by ZOAM 2014-0006, see note 11): "E. Exemptions to Maximum Sound Levels. The maximum A-weighted sound levels in Table 7.05.03-1 do not apply to the following: … 4. Sounds created by generators and accessory equipment operating during an emergency or at the request of a utility and the testing of said generators and associated equipment." A separate hours rule, § 4.06.02.D.8, limits generator testing near residences to 11:00 a.m. to 5:00 p.m. from 1 October to 30 April and to a window beginning at 5:00 p.m. from 1 May to 30 September (the closing time is printed "7:00 m." [sic]); it sets no decibel cap.

[54] Fairfax County Zoning Ordinance § 4102.6.A(6) (adopted 10 September 2024, effective 11 September 2024): "Prior to site plan approval, a noise study must be

submitted demonstrating to the Zoning Administrator's satisfaction that the operation of the data center will comply with the Noise Ordinance, Chapter 108.1 of the County Code." Fairfax County Department of Planning and Development, "Noise Study Requirements: Data Centers," handout created 14 October 2024, https://www.fairfaxcounty.gov/planning-development/sites/planning-development/files/Assets/Documents/zoning/data-centers/Noise-Study-Requirements.pdf (which cites the provision as § 4102.7.A(6)): "The Noise Ordinance also includes an exception for the routine testing and maintenance of back-up generators if the testing: a) occurs between 7 a.m. and 9 p.m.; and b) does not occur for more than two consecutive or nonconsecutive hours in any one day. Such testing and maintenance of the back-up generators does not need to be addressed in the noise study." The exception the handout applies is Fairfax County Code § 108.1-5-1(g); § 4102.6.A(6) itself contains none.

[55] Prince William County Code § 14-3, "Steady tonal sound" (Ord. No. 25-62, adopted 28 October 2025, effective 1 May 2026), https://library.municode.com/va/prince_william_county/codes/code_of_ordinances?nodeId=CH14NO_S14-4MAPESOLE: "Steady tonal sound means a sound characterized by a droning nature and which may be referred to as a whine, hum, rumble, or buzz, which may either be broadband or include a single frequency or a narrow cluster of frequencies. Such sound sources include, but are not limited to, heating, ventilating or air-conditioning units, refrigeration units, transformers, and backup generators." The definition's ±3 dB (±5 dB where sources are perceptibly beating) figures are a steadiness criterion, not a tonality penalty.

[56] Prince William County Code § 14-4(b) (Ord. No. 25-62; source as at note 55): "No source of steady tonal sound may exceed the limits outlined below when measured at any location at or within a residential property boundary in a residential zoning district. Maximum permissible C-weighted sound level at the receiving property: Daytime 73 dB(C); Nighttime 68 dB(C). The limits above may not be exceeded over a five-minute interval." Adopted 28 October 2025, Board of County Supervisors Item 7-J, 5–2.

[57] Prince William County Code § 14-4(d)(2) (Ord. No. 25-62; source as at note 55): routine generator exercising is limited to daytime and subject to the general limits of Table 1, and is not subject to § 14-4(b).

[58] Loudoun County Department of Planning and Zoning, *ZOAM 2014-0006, Noise Standards*, Board of Supervisors Business Meeting Action Item #17, 22 September 2016, staff contacts Theresa Stein, Planner, Zoning Administration, and Ricky Barker, Director, Planning and Zoning, https://loudoun.granicus.com/MetaViewer.php?

view_id=86&clip_id=4631&meta_id=106012 (hereafter Action Item #17). On the effective date, p. 2: "Staff also added language to the Motion to establish that if adopted, the Noise ZOAM will have an effective date of January 1, 2017." The consultant's name appears as "Hessler Associates, Inc." in the body of the committee item, Loudoun County Department of Planning and Zoning, *ZOAM 2014-0006, Noise Standards*, Transportation and Land Use Committee Action Item #2, 13 May 2016, p. 3, https://loudoun.granicus.com/MetaViewer.php?view_id=68&clip_id=4490&meta_id=99514 (hereafter TLUC Action Item #2), and on the firm's own memoranda in that packet ("Hessler Associates, Inc. Consultants in Engineering Acoustics"); the chronology in the same packet reads "September 2014: Contract awarded to Hessler and Associates (Consultant)" (p. 7), and Action Item #17 also writes "Hessler and Associates (Consultant)" (p. 2).

[59] Action Item #17, p. 3, ISSUES § 2, "Tonal Noise/Penalty." The same paragraph states: "Staff and the Consultant evaluated this throughout the process and do not recommend regulating tonal noise," and "The preferred approach to addressing tonal and other noise issues such as data centers is barring residential and these types of uses in close proximity."

[60] Action Item #17, p. 3, ISSUES § 2 ("may place the County at a competitive disadvantage with other regional jurisdictions when competing for businesses such as data centers"), and p. 29, Attachment 3, staff response to question #2 ("in recognition of the County's desire to stay competitive with neighboring jurisdictions that do not regulate tonal sound"). Attachment 3 sets out "the questions presented at the July 13, 2016 Board Public Hearing and those that were received by Staff subsequent to the meeting, and the Staff response to each" (p. 2). The same response #2 carries a third wording of the point: "There are concerns that measuring tonal noise, especially with respect to data centers, would place the County at a disadvantage when trying to attract such businesses."

[61] Action Item #17, p. 29, Attachment 3, staff response to question #2, "Staff Recommendation": "While tonal sound can be the greatest annoyance factor to citizens, it has not been the driving force in noise complaints within the County." Earlier in the same response staff explain the mechanism they declined to regulate: "Tonal noise, such as the steady hum of a fan, is generally more annoying than non-tonal (atonal) noise of the same level."

[62] Action Item #17, p. 3, ISSUES § 2: "Few jurisdictions in the State of Virginia regulate tonal noise and, with the exception of Fauquier County, Staff has not found another jurisdiction within the region that regulates tonal noise because of the difficulty and the complexity." The statement reports the reach of staff's own survey.

[63] Action Item #17, p. 4, "Fiscal Impact." The same paragraph puts the base cost of "the two SLMs and training of Zoning Enforcement staff" at "approximately $18,000"; TLUC Action Item #2 gave that total as "approximately $13,500.00."

[64] Action Item #17, pp. 29–30, Attachment 3, staff response to question #3 ("contractual concerns"), and p. 3, ISSUES § 3, "Generator Exemption" ("in all settings," continuing "including those for private, residential uses"). Response #3 records the industry's reason: "during conversations with data center representatives, Staff were told that contractually, data centers cannot be restricted to test during certain time periods as they may be required to run all generators during a variety of timeframes throughout a 24 hour period to demonstrate the data center's capacity to handle emergency situations." The response concludes: "Therefore, in response to the contractual concerns of data center users, Staff revised the proposed text to exempt testing and operation during defined emergencies, with no restrictions." The exemption was enacted at § 5-1507(F)(4) (2017) and carried into Loudoun County Zoning Ordinance § 7.05.03.E.4: "Sounds created by generators and accessory equipment operating during an emergency or at the request of a utility and the testing of said generators and associated equipment."

[65] Action Item #17, pp. 29–30, Attachment 3, staff response to question #3: "Further, generators are not typically the greatest source of noise in data centers, as it is typically the cooling units that produce the most objectionable sound." The ISSUES section makes the related statement that "generators are not the greatest source of noise complaints" (p. 3).

[66] TLUC Action Item #2, pp. 3–4. The passage is preceded by: "Staff recommended that noise emitted by generators be exempted from the Noise Standards when such equipment is operated during emergencies, testing, and at the request of utilities."

[67] Action Item #17, pp. 3–4, ISSUES § 4 ("Rural Areas"), and p. 31, Attachment 3, staff response to question #6. Response #6: "A prior version of the draft text proposed a Non-suburban/Rural category that proposed a maximum noise level of 45 decibels for residential dwellings that were on parcels greater than 10 acres in size and at least 315-feet from the property line adjacent to the noise emitter," and "Rural economy uses include such enterprises as wayside stands, farm based tourism, wineries, and agritainment." ISSUES § 4 calls the category "Non-suburban Residential (Rural)" and says it "was deleted from subsequent drafts upon further consideration of the inter-related complexities of defining the County's rural areas for noise regulation purposes, and the potential impacts on rural economy uses." The current Table 7.05.03-1 places rural and residential receiving uses in one 55 dB(A) category, "Residential and Rural Economy Uses."

[68] Revised 1993 Loudoun County Zoning Ordinance § 5-1507, "Noise Standards," as revised 17 June 1998, in *Loudoun County, Virginia 1993 Zoning Ordinance* (complete text, pre-January 7, 2003), 137–39, https://www.loudoun.gov/DocumentCenter/View/99513/Complete-1993-Zoning-Ordinance-pre-January-7-2003. Section 5-1507(A)(1): "Noise levels shall be measured with a sound level meter and shall meet or exceed performance standards for a 'Type Two' meter"; § 5-1507(B): "Measurements of noise levels shall be taken at the property boundary of the noise source. Where differing zoning districts abut, the more restrictive limit shall apply"; § 5-1507(B)(1) sets continuous-noise maxima by district (Residential 55, Commercial 60, Industrial 70 dBA) and provides that "Continuous noise shall be measured using the slow meter response of the sound level meter." This text governed until the 2016 amendment took effect on 1 January 2017.

[69] Revised 1993 Loudoun County Zoning Ordinance § 5-1507 as replaced by ZOAM 2014-0006, footer "Section 5-1507 / Revision Date: January 1, 2017," https://www.loudoun.gov/DocumentCenter/View/149841/Noise-Standards-SEC-5-1507-text-final (hereafter § 5-1507 (2017)). Section 5-1507(D)(1): "A-weighted sound levels shall be measured with an integrating SLM that meets or exceeds American National Standard Institute S1.43-1997 for Type 1 SLMs. The response of such SLM shall be set to FAST, and a time period of fifteen (15) seconds shall be used"; § 5-1507(D)(5): samples are taken "from the point on the receiving property line that is located the closest to the source of the subject sound"; Table 5-1507(E) is headed "Receiving Development Type." The same text created the generator exemption at § 5-1507(F)(4); the 1998 text's two exemptions (Dulles noise-exposure areas and daytime power equipment) did not include generators.

[70] § 5-1507 (1998), opening paragraph: "In addition, before 7 a.m. and after 7 p.m., the permissible sound levels, at residential district boundaries where they adjoin nonresidential districts, shall be reduced by 5 dba in the table for impact noises." Section 5-1507(B)(2) defines impact noises as "intermittent sounds of a single pressure peak or a single burst (multiple pressure peaks) for a duration usually less than one second," naming "a punch press, drop forge hammer, or explosive blasting." The continuous-noise table at § 5-1507(B)(1) contains no time-of-day term, and § 5-1507(E) (2017) applies its limits "any time of day or night." The 1998 reduction also applied only at residential district boundaries adjoining nonresidential districts.

[71] Loudoun County Department of Planning and Zoning, Staff Report, *ZOAM 2014-0006, Noise Standards*, Board of Supervisors Public Hearing Item #13, 13 July 2016, p. 1, https://loudoun.granicus.com/MetaViewer.php?view_id=77&clip_id=4567&meta_id=102994 (hereafter Public Hearing Item #13):

"To amend the Noise Standards (Section 5-1507) ... in order to revise outdated standards and better protect residents from excessive noise levels while balancing the needs of businesses to promote increased economic development." Action Item #17 restates the purpose with "and promoting increased economic development."

[72] Cf. TLUC Action Item #2 and Public Hearing Item #13 with Action Item #17, pp. 3, 29. Documents examined: the 13 May 2016 committee packet (88 pp.), the 13 July 2016 public hearing packet (120 pp.), and the 22 September 2016 item (43 pp.). Neither of the first two uses "competitive" or any form of it, or "disadvantage," and neither uses "attract" except in an unrelated clause on commercial advertising, although both discuss tonal noise. The third states the rationale three times: at p. 3 (ISSUES § 2) and twice at p. 29 (Attachment 3, response #2). The record does not show who introduced the rationale, or when between 13 July and 22 September.

[73] Action Item #17, p. 2: "At the July 13, 2016 Board Public Hearing, eleven members of the public spoke about data center and outdoor recreation noise, as well as the proposed maximum decibel level being too high for rural areas of the County. The Board approved a motion to forward the Noise ZOAM to the September 22, 2016 Business Meeting (7-1-1, Meyer opposed and Buffington absent)." Loudoun publishes action reports rather than verbatim minutes.

[74] TLUC Action Item #2, pp. 82–83 (staff response to a question from the Board or Commission): "There are three data centers that have been the subject of noise complaints over the last five years and they were developed as by-right uses prior to the adoption of the Data Center ZOAM," and "Approximately 60% or 21 out of 34 data center noise complaints received in the last 5 years have been specifically related to the Digital Realty data center in Loudoun Station, adjacent to The Regency, with the majority of the complaints received in 2014 during the Data Center ZOAM review process." Action Item #17 counts tonal complaints only: "Zoning Enforcement has gotten noise complaints specific to tonal sound from one particular business, a data center, in five years" (Attachment 3, staff response to question #2).

[75] Action Item #17, p. 3, ISSUES § 2, closing sentence: "Further, because uses that have been the subject of tonal noise complaints already exist, such uses will not be impacted by the Noise ZOAM." Attachment 3, staff response to question #2, p. 29, gives the legal basis: the Code of Virginia "requires that lawful existing uses be 'deemed vested in a land use and such vesting shall not be affected by a subsequent amendment to a zoning ordinance'. Therefore, revisions to the Noise Standards with regard to the regulation of tonal sound would not be applicable to the particular business that has generated the complaints."

[76] Loudoun County Zoning Ordinance, adopted 13 December 2023. Loudoun County, "Zoning Ordinance: Frequently Asked Questions," https://www.loudoun.gov/6201/Zoning-Ordinance---Frequently-Asked-Ques: "On December 13, 2023, the Board of Supervisors (Board) adopted the Loudoun County Zoning Ordinance (Zoning Ordinance), which repealed and replaced the previous Revised 1993 Zoning Ordinance." See also Joint Legislative Audit and Review Commission, *Data Centers in Virginia*, House Document No. 598 (2024), Appendix L, Table L-1, 135 ("effective 12/13/2023"), https://jlarc.virginia.gov/pdfs/reports/Rpt598.pdf (hereafter JLARC Report 598). Three things other than decibel values changed: "Mixed-Use Residential" is now defined by an enumerated list of districts ("any dwelling unit located in the TRC, TC, PD-MUB, and PUD Zoning Districts"); "receiving property line" became "receiving lot line"; and a Noise Study requirement was added at § 7.05.03.G. Certain commercial and industrial parcels in the Route 28 Tax District remain under the 1972 Zoning Ordinance.

[77] Table 5-1507(E), § 5-1507 (2017), and Table 7.05.03-1, Loudoun County Zoning Ordinance § 7.05.03.D, Chapter 7, Development Standards, https://www.loudoun.gov/DocumentCenter/View/176101: Mixed-Use Residential 60; Residential and Rural Economy Uses 55; Commercial, Civic, and Institutional Uses 65; Industrial Uses 70. The column heading changed from "Receiving Development Type" to "Receiving Development"; the values did not. The 1998 table carried different values keyed to zoning district.

[78] Loudoun County Zoning Ordinance § 7.05.03.A.1: "No use is permitted to be operated in such a manner as to create noise that exceeds sound measured as A-weighted decibels or dB(A), set forth in Table 7.05.03.-1." The table's four columns are receiving development categories; zoning districts enter only through the § 7.05.03.B definition of "Mixed-Use Residential."

[79] Loudoun County Zoning Ordinance § 7.05.03.D: "The maximum sound levels provided in Table 7.05.03-1 apply at all times of day and night"; § 7.05.03.C.5: "samples of the subject sound must be taken from the point on the receiving lot line that is located the closest to the source of the subject sound. The microphone of the SLM must be aimed toward the source of the subject sound, and a standard microphone height of 5 feet above grade must be used."

[80] Table 7.05.03-1 and Table 5-1507(E) (2017), "Industrial Uses" column. In the 1998 text, 70 dBA was the continuous limit for an industrial source district, measured at the source's own boundary and subject to the rule that "Where differing zoning districts abut, the more restrictive limit shall apply."

[81] Loudoun County Board of Supervisors, Grandfathering Resolution, adopted 13 December 2023, as summarized in Loudoun County, "Zoning Ordinance Rewrite: Change Highlights," https://www.loudoun.gov/5965/Zoning-Ordinance-Rewrite-Change-Highligh: the resolution "allows all legislative and administrative applications that have been officially accepted for review in accordance with applicable county ordinances and policies on or before the date on which the new Zoning Ordinance was adopted (December 13, 2023), to continue to be processed under the previous ordinance (Revised 1993 Zoning Ordinance)," for so long as the applicant "diligently pursues" approval and makes no disqualifying modification. Resolution: https://www.loudoun.gov/DocumentCenter/View/180069/Item-01-ZOAM-2020-0001-Zoning-Ordinance-Rewrite-Supplemental-ATT-1.

[82] JLARC Report 598, Appendix L, Table L-1, 136 (Loudoun): "Created standards for data centers regardless of location including windows, main entrance features, loading bay location, and proactive sound measuring." Chapter 6, 82, describes the three localities as "requiring proactive sound measuring for existing data centers," without assigning that item to a locality. Loudoun County Zoning Ordinance § 4.06.02.D.10.a, online codification, https://online.encodeplus.com/regs/loudouncounty-va-zo/doc-viewer.aspx?secid=859: "Data Centers are subject to the Noise Study standards pursuant to Section 7.05.03.G." Section 7.05.03.G requires studies "prepared by a Commonwealth Licensed Professional Engineer (PE)": "1. Pre-Construction Study. A noise study of existing conditions at the time of Site Plan review; 2. Post-Construction Study. A noise study of existing conditions at the time of operations, at least 1 month but no more than 12 months after the issuance of the first Certificate of Occupancy." Provisions examined: §§ 4.06.02.D and 7.05.03 and the county's noise page (see note 83), which describes the same two studies and nothing further; none of them requires periodic measurement of an operating facility. Applications accepted for review on or before 13 December 2023 proceed under § 5-1507 (2017), which contains no study requirement.

[83] Loudoun County, "Data Centers: Noise & Air Quality Concerns," undated, https://www.loudoun.gov/6405/Noise-Air-Quality-Concerns (accessed 4 October 2026): "Noise complaints, which residents may submit online, are among the most persistent issues brought forward to Loudoun County officials and frequently pertain to tonal noise. The county does not currently have policy or regulatory language specific to tonal noise or low frequency noise." The same page: "Per the Loudoun County Zoning Ordinance, data centers are required to submit a pre-construction noise study at the time of site plan review as well as a post-construction noise study submitted at least one month but no more than 12 months after the issuance of the first Certificate of Occupancy."

[84] Loudoun County, "Noise Issues," open-house handout, Data Center Standards and Locations, https://www.loudoun.gov/DocumentCenter/View/222507/Noise-OH-Handout (accessed 4 October 2026): "Implement new noise standards to include additional sound measurement methodologies to measure low frequency noise and tonal noise." Loudoun County, Draft Data Center Standards ZOAM (ZOAM-2025-0002), September 2026, clean version, https://www.loudoun.gov/DocumentCenter/View/222458/Draft-Data-Center-Standards-ZOAM-Clean-Version, and redline version, https://www.loudoun.gov/DocumentCenter/View/222457/Draft-Data-Center-Standards-ZOAM-Redline-Version (accessed 4 October 2026); noise appears in them chiefly as cross-references, among them "Data Centers are subject to the Noise Study standards pursuant to Section 7.05.03.G." Documents examined: the two posted zoning drafts, neither of which contains the word "tonal," the phrase "low frequency," or any C-weighted value; § 7.05.03 itself is not among the posted texts. Loudoun County, "Phase 2 Data Center Standards & Locations," https://www.loudoun.gov/6222/Phase-2-Data-Center-Standards-Locations (accessed 4 October 2026), "Anticipated Timeline": "December 2026: Board Check-in, Present Draft Amendments," "February 2027: Planning Commission Public Hearing" and "July 2027: Board of Supervisors Public Hearing."

[85] Tim Hemstreet, County Administrator, memorandum, "Action Report of the Reconvened July 21, 2026 Board of Supervisors Business Meeting," 24 July 2026, pp. 10–11, Item 8, Department of Planning and Zoning Work Plan (Countywide), https://loudoun.granicus.com/MetaViewer.php?view_id=92&clip_id=8216&meta_id=286131: "Supervisor Briskman moved that the Board of Supervisors direct the County Administrator to have the appropriate staff prepare an Item for the September 15, 2026, Board of Supervisors Business Meeting agenda to cease processing data center applications, administrative or legislative, data center site plans, and any substation application until such time as Phase 2 Data Centers Standards and Locations is completed." The tally: "(The motion, as amended, passed 6-1-2: Supervisor Umstattd opposed; Supervisors Kershner and Letourneau absent.)" The reconvened session was held on 22 July 2026.

[86] Loudoun County, "Board Approves Process that Could Pause Legislative Data Center & Substation Applications," News Flash, 17 September 2026, https://www.loudoun.gov/m/newsflash/home/detail/10874 (accessed 4 October 2026): "The Board's vote to consider a resolution follows a legal opinion from the Loudoun County Attorney indicating that a moratorium on data center approvals is not legal," and "Next, the Board will consider a resolution, that, if approved, would enact the Board's new policy during its October 20, 2026, meeting." The vote was taken on 15 September 2026; the release adds that "The Board indicated the

resolution should be retroactive, making the pause effective September 15." It describes the resolution as one that "would pause the Board's action on data center and electrical substation applications that require legislative approval for up to 12 months, the maximum allowed by Virginia law," under which "the Board's final votes on data center and substation applications would be paused for one year." The release does not mention noise. The deferral: Loudoun County, Action Report of the Tuesday, October 20, 2026, Board of Supervisors Business Meeting (memorandum of the County Administrator, 22 October 2026), item 3, https://pub-loudoun.escribemeetings.com/FileStream.ashx?DocumentId=2151 (accessed 24 October 2026): "Item 14p, Resolution to Pause Board of Supervisors Consideration of Legislative Applications for Data Centers and Substations was deferred to the November 17, 2026, Board Business Meeting." The draft resolution: item 14.p, Attachment 1, as published with the agenda for the 20 October 2026 meeting, https://pub-loudoun.escribemeetings.com/FileStream.ashx?DocumentId=2024 (accessed 24 October 2026).

[87] Prince William County, Ordinance No. 25-62, adopted 28 October 2025, effective 1 May 2026, recitals: "1. JMT, 2. The Noise Consultancy LLC, 3. Nelson Acoustics." Board of County Supervisors, Item 7-J, 28 October 2025, https://legistarweb-production.s3.amazonaws.com/uploads/attachment/pdf/3685517/Item_7-J.pdf. The advisory group's membership was restructured by its Team Charter updated 18 December 2024, https://www.pwcva.gov/assets/2024-12/Team%20Charter%20updated%20December%2018%202024%201.pdf, which removed industry, trade-association and utility members and left seven residents and seven county staff; its mission was to "Advise the County with developing Regulatory Ordinance changes that will address data center development impacts, including noise." Nelson Acoustics' principal is David A. Nelson; The Noise Consultancy's president is Eric Zwerling.

[88] David A. Nelson, Nelson Acoustics, *Memorandum Report 1618-01: Prince William County Noise Ordinance Update, Criteria Basis and Background*, 3 August 2025, Tables 4 and 5, 6–7, and § 3.3, 8, https://www.pwcva.gov/assets/2025-10/M1618-01%202025%20AUG%2003%20PWC%20Noise%20Ordinance%20Criteria%20Basis%20and%20Background.pdf; also Attachment 1 to Item 7-J. Section 3.3: "A sound spectrum exactly equal to the recommended criterion in each octave band would result in the following overall sound levels: 43 dBA during nighttime, and 48 dBA during the daytime. This is 12 dBA more stringent than the current regulation of 55 dBA night, 60 dBA day." The nighttime criteria from 31.5 Hz to 8 kHz are 60, 55, 50, 45, 40, 36, 33, 31 and 30 dB. The draft ordinance of 1 May 2025 carried them as Table 14-4.3, "MAXIMUM PERMISSIBLE MEDIAN SOUND PRESSURE LEVELS

(L50) FOR RESIDENTIAL ZONING DISTRICTS," with a Class 1 misdemeanor penalty at § 14-4.3(A), https://www.pwcva.gov/assets/2025-05/DCOAG%20Draft%20Ordinance%20202505 01.pdf; that draft's general prohibition at § 14-4.1(A) listed only Tables 14.4.1 and 14.4.2.

[89] Prince William County, staff report, Item 7-J, Board of County Supervisors, 28 October 2025, "Enforcement Approaches": "County staff recommended the establishment of an intermediate noise level for steady tonal noise. The intermediate level scale would still be an Octave Band scale; however, the associated levels would be raised by 6 decibels over the levels recommended by the Noise Consultants." The recommendation was to leave the intermediate scale in place for 12 months and then revisit it. The staff report's "Board Direction" section attributes the scale to the County Executive: "The C-weighted levels correspond very closely to the Octave Band levels proposed by the County Executive."

[90] Prince William County Board of County Supervisors, Brief (action minutes), 14 October 2025, item 8, Supervisors' Time, added agenda item, https://pwcgov.granicus.com/MinutesViewer.php?view_id=23&clip_id=3714: "APPROVED: Direct Staff to Schedule a Public Hearing on October 28, 2025, to Consider Amendments to Chapter 14, Noise, of the County Code 1: Boddye 2: Angry / ... AYES: Angry, Bailey, Boddye, Franklin / NAYS: Gordy, Jefferson / ABSENT FROM VOTE: Vega Res. No. 25-533." The Brief prints the word "Unanimous" beside a roll call of four to two. The C-weighting content of the advertised ordinance is stated in the Item 7-J packet: staff presentation, slide 18, "The Noise Ordinance advertised by the Board includes a C-weighted noise scale to address steady tonal noise"; staff report, "Board Direction," "The Board approved a C-weighted the version [sic] of the draft Noise Ordinance to be advertised for a public hearing on October 28, 2025," with "the use of Octave Bands as a supplement to the noise enforcement readings."

[91] Nelson, *Memorandum Report 1618-01*, Tables 4 and 5, compared with Prince William County Code ch. 14, Appendix A, Table 1 (Ord. No. 25-62). From 31.5 Hz to 8 kHz, daytime 65, 60, 55, 50, 45, 41, 38, 36, 35 became 71, 66, 61, 56, 51, 47, 44, 42, 41; nighttime 60, 55, 50, 45, 40, 36, 33, 31, 30 became 66, 61, 56, 51, 46, 42, 39, 37, 36. An advisory-group member, Dale Browne, described the change before the vote: "What [Hugh] has done is added six decibels to each of the octave bands" (Sébastien Kraft, "'A straight middle finger': Prince William data center advisory group sounds off over noise ordinance," *InsideNoVa*, 23 September 2025).

[92] Item 7-J staff report, "Enforcement Approaches," County Staff Recommendation. The same staff report prints the consultants' octave-band table alongside the passage, so both scales appear in the adoption packet.

[93] Prince William County Board of County Supervisors, minutes, 28 October 2025, Item 7.J, https://pwcgov.granicus.com/MinutesViewer.php?view_id=23&clip_id=3720: "FAILED: Defer Consideration of the Ordinance to Amend County Code Section 14-1 through 14-8 of Chapter 14, Noise, to December 2, 2025 1: Vega 2: Jefferson / AYES: Jefferson, Vega / NAYS: Angry, Bailey, Boddye, Franklin, Gordy (2/5)"; "APPROVED: Amend - County Code Section 14-1 - Section 14-8, of Chapter 14, Noise - Countywide - Wade Hugh, Executive Management 1: Boddye 2: Bailey / AYES: Angry, Bailey, Boddye, Franklin, Gordy / NAYS: Jefferson, Vega (5/2) Res. No. 25-561 Ord. No. 25-62." The Gainesville District seat was vacant following the death of Supervisor Bob Weir on 20 July 2025 (Prince William County, "Passing of Gainesville District Supervisor Bob Weir," https://www.pwcva.gov/news/passing-gainesville-district-supervisor-bob-weir/); the Board's roster for its 14 October 2025 meeting lists seven members.

[94] Prince William County Board of County Supervisors, minutes, 7 October 2025, https://pwcgov.granicus.com/MinutesViewer.php?view_id=23&clip_id=3705, listed as an added agenda item: "APPROVED: Direct - County Executive to Disband the Data Center Ordinance Advisory Group 1: Angry 2: Franklin / AYES: Angry, Bailey, Boddye, Franklin / NAYS: Jefferson, Vega / ABSENT FROM MEETING: Gordy (4/2) Res. No. 25-527."

[95] Prince William County Code ch. 14, "APPENDIX A (ADVISORY) - OCTAVE BAND GUIDANCE" (Ord. No. 25-62, Att., 10-28-25, eff. 5-1-26), https://library.municode.com/va/prince_william_county/codes/code_of_ordinances?nodeId=CH14NO_S14-4MAPESOLE: "This appendix provides recommended octave band design targets and diagnostic methods to identify and mitigate tonal/low-frequency noise. These values are advisory and do not constitute the legal compliance test." Section 14-4(b): "Octave band tables are advisory only (see Appendix A) and may be measured by the County for diagnosis and mitigation planning." The appendix table is headed "TABLE 1 - RECOMMENDED OCTAVE BAND SOUND PRESSURE LEVELS FOR RESIDENTIAL ZONING DISTRICTS (dBZ, L50, 30 seconds)."

[96] Prince William County Code § 14-4(a)(1), Table 1 (Ord. No. 25-62): Residential 60/55; Mixed Use District 60/55; Commercial 65/60; Office 65/60; Industrial 79/72 dB(A), day/night; the table is headed "MAXIMUM PERMISSIBLE SOUND LEVELS (Leq)." Section 14-4(a)(1): "The limits in Table 1 may not be exceeded during any three or more sampling intervals, the duration of which shall be no less than 30

seconds, within any one-hour period." Item 7-J staff presentation, slide 10: "Intermittent ('nuisance') levels in Table 1 remain unchanged from current ordinance." Daytime under § 14-3 runs from 7:00 a.m. to 10:00 p.m. on weekdays and from 9:00 a.m. to 10:00 p.m. on Saturdays, Sundays and legal holidays.

[97] Prince William County Code § 14-4(b): "No source of steady tonal sound may exceed the limits outlined below when measured at any location at or within a residential property boundary in a residential zoning district. Maximum permissible C-weighted sound level at the receiving property: Daytime 73 dB(C); Nighttime 68 dB(C). The limits above may not be exceeded over a five-minute interval." The response setting is in the § 14-3 definition of steady tonal sound: "For enforcement, assessed using C-weighted (dB(C)), slow response, measured at or within the receiving property line of the complainant." The standard applies only in residential zoning districts.

[98] Prince William County Code § 14-3, "Steady tonal sound": "Such sound sources include, but are not limited to, heating, ventilating or air-conditioning units, refrigeration units, transformers, and backup generators."

[99] Prince William County Code § 14-4(d): "(1) Emergency generators are exempt from the limits under Table 1 and subsection (b) when running during electrical grid outages, equipment failures, or at the request of a utility. (2) Exercising of emergency generators shall only be conducted during the daytime, during which time the limits in Table 1 apply. The limits in subsection (b) do not apply to such exercising."

[100] Prince William County Code § 14-2 (Ord. No. 25-62): "(a) Any person who is found to have violated any provision of this chapter shall be guilty of a Class 4 misdemeanor for the first offense," and "(b) In lieu of the criminal penalties set forth in section 14-2(a), a violation of any provision of this chapter may be punishable by a civil penalty of not more than $250 for the first offense and $500 for the second offense. ... This civil penalty provision shall not apply to noise generated in connection with the business being performed on industrial property or railroads." Item 7-J staff report: "Currently, a violation of the Noise Ordinance is a Class 2 Criminal Misdemeanor." The draft ordinance of 1 May 2025 had carried a Class 1 misdemeanor penalty for the octave-band limits.

[101] Prince William County Board of County Supervisors, directive DIR 25-36 (Gordy), 28 October 2025, directing staff "to provide a report, one (1) year from now, that includes an analysis of the effectiveness of the noise ordinance, any violations found, and any potential revisions to the noise ordinance that need to be made." The amended chapter took effect 1 May 2026 (see note 87). No such report was located as of this volume's evidence snapshot.

[102] Kraft, "'A straight middle finger,'" *InsideNoVa*, 23 September 2025, https://www.insidenova.com/headlines/a-straight-middle-finger-prince-william-data-center-advisory-group-sounds-off-over-noise-ordinance/article_ffadc0a1-9183-4391-8fe6-c7e5aab018cd.html; also published in *Rappahannock News*, https://www.rappnews.com/news/technology/a-straight-middle-finger-data-center-advisory-group-sounds-off-over-prince-william-noise-ordinance/article_3da2f244-9057-5e75-a47d-853badfd7e9b.html. The quotation in full: "The business community, not just the data center community, is expressing significant concerns with the approach we are taking with the ordinance. They understand the ordinance won't impact their business, but they are concerned with the larger message this sends about the county's business atmosphere." The article reports the email as sent to Bill Wright, a member of the advisory group, and is the only source for its words; the county has not published the email.

[103] Kraft, "'A straight middle finger,'" *InsideNoVa*, 23 September 2025: "Donna Gallant, the advisory group's neighborhood representative for Amberleigh Station near Bristow, took it one step further. 'He has gone rogue and done his own thing and gave us the straight middle finger,' she said." The article places the remarks "During a Sept. 18 call with InsideNoVa"; the preceding paragraph identifies Hugh as the subject. The headline's "A straight middle finger" compresses her sentence.

[104] Evelyn Mejia, "Supervisors OK compromise noise ordinance aimed at data centers," *Prince William Times*, 30 October 2025, https://www.princewilliamtimes.com/news/supervisors-ok-compromise-noise-ordinance-aimed-at-data-centers/article_1288e464-5559-4c12-ab8f-2a28ca28d819.html (accessed 4 October 2026). The article introduces the quotation: "The revised ordinance was written by Supervisor Kenny Boddye, who said it would be a more reasonable standard for data centers and other businesses and easier to enforce." The parenthetical "(noise)" is the newspaper's. The article does not say where Boddye spoke; the county's minutes record motions and votes, not remarks.

[105] City of Chesapeake, PLN-TXT-2026-001, draft data center ordinance dated 17 June 2026 (staff), https://www.cityofchesapeake.net/DocumentCenter/View/32470/Draft-Data-Center-Ordinance-6172026-PDF; version dated 9 July 2026 (Planning Commission-recommended), https://www.cityofchesapeake.net/DocumentCenter/View/32811; and draft dated 3 August 2026 (staff), https://www.cityofchesapeake.net/DocumentCenter/View/33114/Draft-Data-Center-Ordinance-832026-PDF; all listed at City of Chesapeake, "Data Center Ordinance and Policy," https://www.cityofchesapeake.net/3783/Data-Center-Ordinance-and-Policy (accessed 4 October 2026). Section 13-3406.D.2 of the 3 August draft: "Steady

tonal noise emitted from the data center shall not exceed the following maximum permissible C-weighted sound level at the receiving property for more than five minutes when measured at any location at or within a residential property boundary in a residential or agricultural zoning district: a. The maximum permissible daytime level is 73 dB(C). b. The maximum permissible nighttime level is 68 dB(C)." The 9 July version reads "60 dB(C)" and "55 dB(C)" and measures "at any location within any adjacent property."

[106] City of Chesapeake Planning Commission, minutes of the public hearing on PLN-TXT-2026-001, staff comments, item 4, "Section 13.3406.D(2) – Noise" (staff comments at pp. 14–15, 19), https://chesapeake.granicus.com/MinutesViewer.php?view_id=36&clip_id=9920&doc_id=04fcd149-9716-11f1-bb61-005056a89546. The quotation is preceded by: "Staff do not recommend revising the noise levels in this section as recommended by Planning Commission." The Commission recommended "APPROVAL of version dated June 17, 2026, as amended (9 – 0; Sgueglia/Williams)."

[107] Scope: the Virginia noise ordinance census compiled for this volume, as it stood through August 2026, read for every locality identified as regulating the hours of generator testing, asking in each case whether the numeric limit continues to apply during the permitted window. Six localities regulate testing hours. Four lift the numeric limit in whole or in part: Loudoun (Zoning Ordinance § 7.05.03.E.4; note 171); Fairfax (County Code § 108.1-5-1(g)(2), which exempts testing between 7 a.m. and 9 p.m., up to two hours in a day, from the ordinance); Prince William (County Code § 14-4(d)(2): "[t]he limits in subsection (b) do not apply to such exercising," which removes the steady-tonal standard during daytime exercising, while the same paragraph keeps the Table 1 dB(A) limits in force); and Goochland (County Code § 15-449.A(1)(b), weekdays 10 a.m. to 5 p.m., two hours a day, with enclosure, Tier 4 engines and a published schedule in place of a level). Stafford County Code § 28-39(q)(7)–(8) (Ord. O25-29(R), adopted 2 December 2025, 7–0) limits testing to Monday through Friday, 9 a.m. to 5 p.m., excluding federal and state holidays, and provides that "[a]ny noise which emanates from operation of the facility shall be limited to a maximum volume in A-weighted decibels of 55 dB(A), as measured 1.5 meters above ground at the boundary of the data center project. The limitation shall be 52 dB(A) in instances where a prominent discrete tone is present," with exceptions only for construction and emergencies. Frederick County Code § 165-204.41(B) (Board of Supervisors ordinance package of 12 March 2025; codified as added 9 April 2025): "Generator testing and cycling shall be limited to weekdays (Monday to Friday) between the hours of 8:00 a.m. to 5:00 p.m. Notwithstanding the foregoing, all noise generated by any on-site generator shall comply with County Code § 165-201.12." Fauquier County Code ch. 13.5, as amended by Ord. 25-03 (10 July 2025),

https://library.municode.com/va/fauquier_county/codes/code_of_ordinances?nodeId=COOR_CH13.5NO, exempts at § 13.5-4(a)(12) only the "operation of backup generators during power outages resulting from storms or other emergencies," so testing is not exempted from the § 13.5-3(a) limits of 65 dBA by day and 55 dBA at night. Two other exemptions in the same section bound that result: § 13.5-4(a)(7) exempts "Noise generated by the principle [sic] business use on industrially zoned property," which removes a data center operating as the principal use on industrial land from the chapter altogether, and § 13.5-4(a)(15) exempts noise associated with a use permitted under a specific noise condition in a special exception or special permit.

[108] Compare City of Chesapeake, PLN-TXT-2026-001, drafts of 17 June, 9 July and 3 August 2026, §§ 13-3403 and 13-3406.D, with Prince William County Code §§ 14-3 and 14-4(b). The Chesapeake definition of steady tonal noise shares Prince William's core terms ("a droning nature," "whine, hum, rumble, or buzz," "heating, ventilating, or air-conditioning units, refrigeration units, transformers, and backup generators"), and the staff drafts reproduce the phrase "at any location at or within a residential property boundary in a residential ... zoning district," adding "or agricultural." Prince William's § 14-3 adds a steadiness test, "The steady tonal sound level in any single C-weighted measurement found to exceed the limits of County Code section 14-4(b) may not exceed plus or minus 3 dB," and specifies "slow response." Chesapeake's § 13-3406.D.4 requires "a Type 1 integrating sound level meter capable of both A-weighted and C-weighted measurements that meets the standards prescribed by the ANSI" and states no response setting. Documents examined: the three Chesapeake drafts; none states a plus-or-minus tolerance or a meter response setting. Only the two staff drafts carry the 73/68 dB(C) values.

[109] City of Chesapeake, Data Center Regulations open-house display boards, Station 1 (Document Center no. 33332) and Station 9 (Document Center no. 33331), linked from https://www.cityofchesapeake.net/3783/Data-Center-Ordinance-and-Policy (accessed 4 October 2026). Station 1: "JULY 21, 2026 ... CC put 8-month pause on data center applications and deferred consideration of the policy." Station 9: "On July 21, 2026, City Council voted to implement an 8-month pause on considering applications for data centers."

[110] Toby Cox and John-Henry Doucette, "Chesapeake moves to restrict data center development, Virginia Beach presses pause," WHRO, 18 August 2026, https://www.whro.org/business-growth/2026-08-18/chesapeake-moves-to-restrict-data-center-development-virginia-beach-presses-pause (accessed 4 October 2026): "Council member Amanda Newins proposed a third version of the ordinance before the vote," and "Her proposal also removed the area around Fentress Airfield from consideration and pushes off decisions about the specifics of regulations like setback

distances and noise level limits." Web Staff, "Chesapeake city council unanimously approves data center zoning ordinance," WTKR, 19 August 2026, https://www.wtkr.com/news/in-the-community/chesapeake/chesapeake-city-council-unanimously-approves-data-center-zoning-ordinance (accessed 4 October 2026): "The Chesapeake city council voted unanimously 9-0 on Tuesday to approve the data center zoning ordinance." City of Chesapeake, Station 1 display board (Document Center no. 33332): "AUGUST 18, 2026 CC adopted a modified version of an ordinance, making data centers a conditional use permitted in only Industrial (M-1 and M-2) zoning districts, adding definitions, establishing application requirements, and requiring public utility connections."

[111] City of Chesapeake, Ordinance PLN-TXT-2026-001, adopted 18 August 2026, enacting City Code App. A (Zoning) § 13-3400, https://www.cityofchesapeake.net/DocumentCenter/View/33223/Data-Center-Ordinance-081826 (accessed 4 October 2026), § 13-3400(C)(2)(a)(i): a data center qualifying as a high energy use facility must submit "A site assessment that examines, to the extent practicable and within any timeline established by applicable law: i. The sound profile of the HEUF on residential units and schools located within 500 feet of the HEUF property boundary." Compare Va. Code Ann. § 15.2-2209.5(B) (2026 Va. Acts chs. 567, 568), requiring an applicant "to examine, to the extent practicable and within the timeline provided by subdivision A 7 of § 15.2-2286, the sound profile of the HEUF on residential units and schools located within 500 feet of the HEUF property boundary." Document examined: the six-page adopted ordinance; its only other mention of sound-producing equipment is "power generators" in the definition of "Data Center." Section 13-3400(D)(1): "Private groundwater systems shall be prohibited."

[112] City of Chesapeake, "Data Center Regulations Open House," flyer (Document Center no. 33286), listing Tuesday, September 1, Monday, September 14, and Wednesday, September 30; and "Station 4: Sound," display board (Document Center no. 33327), both linked from https://www.cityofchesapeake.net/3783/Data-Center-Ordinance-and-Policy (accessed 4 October 2026). The Station 4 board: "Sound is measured in two different ways … The two are not interchangeable," and "The steady tonal noises associated with data centers are from cooling systems, mechanical equipment, electrical noise, and on-site backup power equipment."

[113] Rockingham County Board of Supervisors, draft minutes of the regular meeting of 22 July 2026, pp. 13–15, in Board agenda packet, 26 August 2026, https://www.rockinghamcountyva.gov/AgendaCenter/ViewFile/Agenda/_08262026-972; the Board approved those minutes on 26 August 2026, as recorded in the minutes of that meeting printed in the agenda packet for 9 September 2026, https://www.rockinghamcountyva.gov/AgendaCenter/ViewFile/Agenda/_09092026-

975. The amendment (OA26-0887, "High Energy Use Facility Noise"), "ORDINANCE AMENDING PORTIONS OF TABLE 17-606 AND SECTION 17-607 OF THE CODE OF ORDINANCES OF ROCKINGHAM COUNTY, VIRGINIA," was adopted "by a roll call vote of 5 to 0" (p. 13). Section 17-607, Data Center (c)(1), as adopted (pp. 14–15), requires "A baseline noise study conducted by a third-party licensed professional engineer specializing in acoustics or an engineer who is board certified by the Institute of Noise Control Engineering (INCE)," which must "document noise and ambient sound levels in the surrounding area of the proposed data center and provide a model prediction of noise conditions at the site with all equipment operating simultaneously at full operational load" and "examine the impacts of the sound profile of the Data Center on residential units and schools within five hundred (500) feet of the property line." The application "must incorporate sound mitigation measures recommended in the baseline noise study into the facility design to prevent noise levels from exceeding noise and ambient sound levels observed in the baseline study." Subsection (c) states no post-construction measurement or enforcement mechanism. Instruments compared: those coded in the census workbook deposited with this volume (Below_the_Curve_VA_Noise_Ordinance_Census.xlsx) and the adopted texts cited in this section.

[114] Paul E. Peterson, *City Limits* (Chicago: University of Chicago Press, 1981), preface and ch. 3. Peterson's typology has three categories, not two: "Those policies which enhance the city's productivity are called developmental; those which have an adverse economic effect, even though the needy of the community may benefit, are identified as redistributive; and those whose economic effects are more or less neutral are labeled allocational" (preface). On the constraint itself, see p. 4: "There are crucial kinds of public policies that local governments simply cannot execute."

[115] Peterson, *City Limits*, 41: "Developmental policies are those local programs which enhance the economic position of a community in its competition with others. They strengthen the local economy, enhance the local tax base, and generate additional resources that can be used for the community's welfare."

[116] Peterson, *City Limits*, 133: "The consensual politics of development is illustrated by the frequency with which responsibility for developmental policy is granted to groups and entities outside the mainstream of local politics. In smaller communities the Chamber of Commerce is as likely to direct developmental programs as is an agency of local gov[ernment]."

[117] Loudoun County, Department of Planning and Zoning, "ZOAM 2014-0006, Noise Standards," Board of Supervisors Business Meeting, Action Item #17, 22 September 2016, ISSUES § 2, p. 3: "Staff believes that regulating tonal noise may

place the County at a competitive disadvantage with other regional jurisdictions when competing for businesses such as data centers." The rationale recurs at Attachment 3, staff response #2, p. 29: "in recognition of the County's desire to stay competitive with neighboring jurisdictions that do not regulate tonal sound, Staff recommends that the proposed regulations move forward without regulating tonal quality." https://loudoun.granicus.com/MetaViewer.php?view_id=86&clip_id=4631&meta_id=106012. Neither the Transportation and Land Use Committee item of 13 May 2016 nor the staff report for the Board's public hearing of 13 July 2016 contains the competitiveness rationale; it first appears in the September item.

[118] Charles E. Lindblom, "The Market as Prison," *Journal of Politics* 44, no. 2 (May 1982): 324–336, at 325, https://doi.org/10.2307/2130588: "In the town in which I live, a chemical plant discharges something into the atmosphere that carries both a bad odor and irritants to the eyes. Town and state governments are both reluctant to put an end to the problem for fear that the plant will find it advantageous to move to a new location in another state." Lindblom states the mechanism at p. 326: "Punishment is not dependent on conspiracy or intention to punish."

[119] Daniel Carpenter and David A. Moss, "Introduction," in *Preventing Regulatory Capture: Special Interest Influence and How to Limit It*, ed. Daniel Carpenter and David A. Moss (New York: Cambridge University Press, 2014), 13–15, https://doi.org/10.1017/CBO9781139565875; Introduction freely available at https://tobinproject.org/books-papers/preventing-capture. At p. 14: "Both intent and action on the part of the regulated industry are required." Of the three standards they set out at p. 15, the third requires a showing of "action and intent by the industry (special interest) in pursuit of this policy shift sufficiently effective to have plausibly caused an appreciable part of the shift"; they call showing all three "the gold standard for a diagnosis of capture."

[120] Loudoun County, Transportation and Land Use Committee, Item 2, "ZOAM 2014-0006, Noise Standards," 13 May 2016, pp. 3–4, https://loudoun.granicus.com/MetaViewer.php?view_id=68&clip_id=4490&meta_id=99514: "The Consultant cautioned that such an exemption could be abused and result in indiscriminate noise emission that could pose enforcement challenges. While the Consultant's concern is understood, staff believes that the exemption as proposed is reasonable and sufficiently defined to enable an effective enforcement response should any such abuse occur." The consultant was Hessler Associates, Inc. The September 2016 item gives the origin of the exemption: "after consulting with representatives from the data center industry who expressed concerns about the proposed time limitations, the draft text was revised to exempt noise caused by generators in all settings" (Action Item #17,

22 September 2016, ISSUES § 3, p. 3); see also Attachment 3, staff response #3, pp. 29–30 ("in response to the contractual concerns of data center users, Staff revised the proposed text").

[121] Carpenter and Moss, "Introduction," 20, on cultural capture: the questions their definition raises are "(a) does the resulting regulation or deregulation advance firms' private interests at the expense of the public interest, and (b) did the firms that benefit intentionally and actively set out to achieve such an outcome ex ante?" Shifts in the intellectual climate "cannot be considered products of capture, according to our definition, unless they can be shown to be deleterious to the public and stem from the deliberate efforts of firms to shape the intellectual climate for their own private benefit." The Hugh quotation is from an email of 17 September 2025 from Wade Hugh, Prince William County Deputy County Executive, to Bill Wright of the county's Data Center Ordinance Advisory Group, as quoted in Sébastien Kraft, "'A straight middle finger': Prince William data center advisory group sounds off over noise ordinance," *InsideNoVa*, 23 September 2025, https://www.insidenova.com/headlines/a-straight-middle-finger-prince-william-data-center-advisory-group-sounds-off-over-noise-ordinance/article_ffadc0a1-9183-4391-8fe6-c7e5aab018cd.html: "They understand the ordinance won't impact their business, but they are concerned with the larger message this sends about the county's business atmosphere." The email is known only through this press quotation.

[122] William A. Fischel, *The Homevoter Hypothesis: How Home Values Influence Local Government Taxation, School Finance, and Land-Use Policies* (Cambridge, MA: Harvard University Press, 2001). The 2005 paperback reissue is paginated differently. For an empirical test of the homevoter account against growth-machine theory, see Vicki Been, Josiah Madar and Simon McDonnell, "Urban Land-Use Regulation: Are Homevoters Overtaking the Growth Machine?," *Journal of Empirical Legal Studies* 11, no. 2 (2014): 227–265, https://doi.org/10.1111/jels.12040, which finds on New York City rezoning data that "homevoters are more powerful in urban politics than scholars, policymakers, and judges have assumed."

[123] Adam B. Jaffe, Steven R. Peterson, Paul R. Portney and Robert N. Stavins, "Environmental Regulation and the Competitiveness of U.S. Manufacturing: What Does the Evidence Tell Us?," *Journal of Economic Literature* 33, no. 1 (1995): 132–163, at 157, http://www.jstor.org/stable/2728912; author copy at https://stavins.scholars.harvard.edu/sites/g/files/omnuum8111/files/stavins/files/env.regulationand.pdf: "Overall, there is relatively little evidence to support the hypothesis that environmental regulations have had a large adverse effect on competitiveness, however that elusive term is defined. Although the long-run social costs of environmental regulation may be significant, including adverse effects on

productivity, studies attempting to measure the effect of environmental regulation on net exports, overall trade flows, and plant-location decisions have produced estimates that are either small, statistically insignificant, or inconsistent."

[124] Smita B. Brunnermeier and Arik Levinson, "Examining the Evidence on Environmental Regulations and Industry Location," *Journal of Environment & Development* 13, no. 1 (2004): 6–41, https://doi.org/10.1177/1070496503256500: "The early literature, based on cross-sectional analyses, typically concludes that environmental regulations have an insignificant effect on firm location decisions. However, recent studies that use panel data to control for unobserved heterogeneity, or instruments to control for endogeneity, find statistically significant pollution haven effects of reasonable magnitude." For the strongest of the early nulls, with its own power caveat, see Timothy J. Bartik, "The Effects of Environmental Regulation on Business Location in the United States," *Growth and Change* 19, no. 3 (1988): 22–44, https://doi.org/10.1111/j.1468-2257.1988.tb00473.x.

[125] Randy Becker and Vernon Henderson, "Effects of Air Quality Regulations on Polluting Industries," *Journal of Political Economy* 108, no. 2 (2000): 379–421, https://doi.org/10.1086/262123. On plant data for 1963–92, nonattainment designation reduces births of plants in polluting industries in nonattainment areas by 26 to 45 percent. The NBER working paper version (w6160, 1997) reports a larger range; the published figure is given here. The effect is on plant births, not employment or output.

[126] Michael Greenstone, "The Impacts of Environmental Regulations on Industrial Activity: Evidence from the 1970 and 1977 Clean Air Act Amendments and the Census of Manufactures," *Journal of Political Economy* 110, no. 6 (2002): 1175–1219, https://doi.org/10.1086/342808: "in the first 15 years in which the Clean Air Act was in force (1972–87), nonattainment counties (relative to attainment ones) lost approximately 590,000 jobs, $37 billion in capital stock, and $75 billion (1987 dollars) of output in pollution-intensive industries." The NBER version (w8484) adds that these losses are "modest compared to the size of the entire manufacturing sector."

[127] Studies examined: Bartik (1988); McConnell and Schwab, *Land Economics* 66, no. 1 (1990); Friedman, Gerlowski and Silberman (1992); Levinson, *Journal of Public Economics* 62 (1996); Gray, NBER Working Paper 5880 (1997); Becker and Henderson (2000); Greenstone (2002); List, Millimet, Fredriksson and McHone (2003); Ederington and Minier (2003); Levinson and Taylor (2008); Kahn and Mansur (2013); Millimet and Roy (2016); and the surveys of Jaffe et al. (1995), Brunnermeier and Levinson (2004) and Mark A. Cohen and Adeline Tubb, "The

Impact of Environmental Regulation on Firm and Country Competitiveness: A Meta-analysis of the Porter Hypothesis," *Journal of the Association of Environmental and Resource Economists* 5, no. 2 (2018): 371–399, https://doi.org/10.1086/695613, which covers 103 publications and more than 2,000 estimated effects. The regulatory measures used across these studies are Clean Air Act attainment status, pollution-abatement operating cost, statutory stringency indices, enforcement counts and congressional environmental voting scores. None measures a local nuisance ordinance, a local noise standard or a land-use condition.

[128] Jaffe et al., "Environmental Regulation and the Competitiveness of U.S. Manufacturing," 159: "A second caveat is that only two of the studies we reviewed controlled for differences in 'regulatory climate' between jurisdictions. If the delays and litigation surrounding regulation are the greatest impediments to exporting or to new plant location, these effects will not be picked up by studies that look exclusively at source discharge standards or traditional spending for pollution control equipment as measures of regulatory intensity."

[129] Loudoun County, Action Item #17, 22 September 2016 (see note 117), Fiscal Impact, p. 4: "The upfront cost for purchase of the two SLMs and training of Zoning Enforcement staff will total approximately $18,000. Should the Board wish to regulate tonal sound, additional software and training would be required, increasing the cost by $1,000."

[130] This volume's calculation, on the following inputs. Perimeter barrier wall: 30,000 square feet (20 feet by 1,500 feet) to 75,000 square feet (25 feet by 3,000 feet) at the Federal Highway Administration's unit cost of $48.76 per square foot for barriers built 2020–2022 (see note 156), or $1,462,800 to $3,657,000. Generator enclosures: an incremental cost of $15,000 to $60,000 per unit for a sound-attenuated over a weather-protective enclosure, from the only published price ladder located, a used-equipment dealer's figures for a 500 kW unit (Power Generation Enterprises, "Containerized vs Enclosed vs Open Skid Generators," 11 April 2026, https://powergenenterprises.com/containerized-vs-enclosed-vs-open-skid-generators/), multiplied by JLARC's median of 35 trailer-sized generators per site and its average of 54 permitted generators per Virginia site (JLARC, *Data Centers in Virginia*, Report 598 (2024), 74 and 58), or $525,000 to $3,240,000. Chiller acoustic treatment: $2,000,000, the figure reported for wrapping chillers and adding screen walls at CyrusOne's Chandler, Arizona campus, relayed third-hand in Christopher Connell, "Why are data centers so noisy? Loose rules, pricey solutions, critics say," *Prince William Times*, 17 November 2022, https://www.princewilliamtimes.com/news/why-are-data-centers-so-noisy-loose-rules-pricey-solutions-critics-say/article_18113e2e-66b5-11ed-9e82-f3debf6366c2.html; CyrusOne has stated no figure. Total $3,987,800 to $8,897,000,

or 0.91 to 2.04 percent of $436.8 million (see note 150). The generator input is a floor: data center generators run 2,500 to 3,250 kW, five or more times the unit priced.

[131] Loudoun County, Action Item #17, 22 September 2016 (see note 117). The staff report states the competitiveness rationale (ISSUES § 2, p. 3; Attachment 3, response #2, p. 29) and supports it with no evidence of investment lost or gained: it identifies no jurisdiction that gained investment by declining to regulate tonality and quotes no operator. Document examined: the complete 43-page item.

[132] Kirsten H. Engel, "State Environmental Standard-Setting: Is There a 'Race' and Is It 'To the Bottom'?," 48 Hastings L.J. 271, 340–41 (1997), https://repository.uclawsf.edu/hastings_law_journal/vol48/iss2/2/: "Indeed, 57 out of 65 regulators (88%) who responded to the question (out of a total of 80 regulators surveyed) stated that concern over industry relocation and siting affects environmental decisionmaking in their state." The questionnaires were mailed to state environmental regulators between April and July 1996 (id. at 340 n.188). The wider survey covered more than 400 state environmental and economic development officials, legislators and interest groups; the figure quoted is for environmental agency officials only.

[133] Jenna Burrell, "On Half-Built Assemblages: Waiting for a Data Center in Prineville, Oregon," *Engaging Science, Technology, and Society* 6 (2020): 283–305, at 286, https://doi.org/10.17351/ests2020.447: "What the narrative of small town officials duped by slick corporations accomplishes is a displacement and concentration of blame. The harsh realities of rural spatial marginality are recast as the incapability and inferiority of its leaders." Her abstract (p. 283) frames the alternative: "critics have often cast rural leaders as naive or as pandering to voters. However, I argue that the alliance with Facebook was one of the few courses of action available to local leaders that had any chance of realizing regional economic development goals." The deal, at p. 285: "In exchange for a 15-year period of property tax abatements, Facebook committed to offering a certain minimum number of jobs (initially 35) at a pay rate at least 150% of the county average." Burrell's subject is a fiscal incentive, not a nuisance standard.

[134] Cailin Slattery, "Bidding for Firms: Subsidy Competition in the United States," *Journal of Political Economy* 133, no. 8 (2025): 2563–2614, https://doi.org/10.1086/735509, abstract: "I find that competition increases welfare by less than 5% over a subsidy ban, and states compete away the surplus, transferring all of the rents to firms." The model concerns discretionary subsidies offered by state and local governments for large investments, not regulatory standards.

[135] Theodore M. Porter, *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life* (Princeton: Princeton University Press, 1995; paperback ed. with new preface, 2020), 8; pages cited are from the 2020 paperback. At p. 8: "The appeal of numbers is especially compelling to bureaucratic officials who lack the mandate of a popular election, or divine right. … Quantification is a way of making decisions without seeming to decide. Objectivity lends authority to officials who have very little of their own." See also p. 4: "Where a consensus of experts is hard to reach, or where it does not satisfy outsiders, mechanical objectivity comes into its own."

[136] Wendy Nelson Espeland and Mitchell L. Stevens, "Commensuration as a Social Process," *Annual Review of Sociology* 24 (1998): 313–343, https://doi.org/10.1146/annurev.soc.24.1.313. The article defines commensuration as "the comparison of different entities according to a common metric" and "analyzes commensuration as a mode of power." It is a review offering a framework, not a study of any acoustic metric.

[137] Sally Engle Merry, *The Seductions of Quantification: Measuring Human Rights, Gender Violence, and Sex Trafficking* (Chicago: University of Chicago Press, 2016). The publisher's description states her claim that "measurement systems constitute a form of power by incorporating theories about social change in their design but rarely explicitly acknowledging them." See also Kevin E. Davis, Benedict Kingsbury and Sally Engle Merry, "Indicators as a Technology of Global Governance," *Law & Society Review* 46, no. 1 (2012): 71–104, https://doi.org/10.1111/j.1540-5893.2012.00473.x, on how indicators "affect processes of standard setting, decisionmaking, and contestation."

[138] Town of Warrenton, Special Use Permit SUP 2022-03 (SUP2022-0003), Amazon Data Services, Inc., Conditions of Approval, approved by Town Council 14 February 2023, Condition 17, https://www.pecva.org/wp-content/uploads/Amazon_SUP_conditions_of_approval_2-14-2023.pdf. Condition 17(a) requires "a third-party sound test prepared by a qualified full member of Acoustical Society of America (ASA) or a Board Certified member of the Institute of Noise Control Engineering (INCE)" before each phase's conditional certificate of occupancy; 17(b) requires "an annual sound test … as approved and procured by the Director of Community Development, for the life of the data center use," reimbursed by the applicant; 17(c) provides that on a violation "the Applicant shall have 48 hours to mitigate the violation of the use or the Certificate(s) of Occupancy are automatically suspended and the Applicant shall cease the use." The conditions were imposed by the Town under Va. Code § 15.2-2286(A)(3), not proffered. "Strictest" is measured against the twenty-nine approvals across fifteen localities examined for this volume; no other combines third-party credentialing, Town procurement, testing for the life of the use and automatic

suspension. Stafford County's 2025 ordinance is a stricter general standard, but it is an ordinance, not a permit condition.

[139] SUP 2022-03, Condition 6(d): "Noise mitigation measures, including but not limited to, silencers, sound walls, acoustical wraps, and/or low noise equipment, shall be utilized to meet § 9-14.2 of the Town of Warrenton Zoning Ordinance relating to noise."

[140] Town of Warrenton Zoning Ordinance § 9-14.2 and Tables 9-1 and 9-2, https://www.warrentonva.gov/DocumentCenter/View/5116. Section 9-14.2 limits the sound pressure level at the nearest lot line "in any octave band of frequency" to the values "specified in Table 9-1 below, or in Table 9-1 as modified by the correction factors set forth in Table 9-2." Table 9-2 includes the correction "Tone (e.g., hum or screech) (Minus 5)," which lowers the octave-band limits by 5 dB. The ordinance does not define "tone." The Town's Zoning Administrator, Rob Walton, said so in his Zoning Determination of 16 December 2022 to the applicant's counsel, John Foote: "The Zoning Ordinance requires a reduction in decibels for any 'Tone (e.g., hum or screech)' but does not define 'Tone' nor provide any specific measurements for Tone." He applied the correction unless the applicant showed otherwise: "Specific information regarding the Tone or pitch for the proposed Data Center has not been provided in sufficient detail to determine that the correction factor for Tone would not apply." He referred the applicant to ASA/ANSI S12.9-2021/Part 4, Annex C, and the applicant's consultant, Polysonics, then assumed a tone was present and applied the correction. Warrenton's correction and the measure Loudoun declined are similar in kind but not the same instrument: Loudoun's would have been a tonality penalty within an A-weighted ordinance.

[141] Town of Warrenton permit portal, site plan SDP-23-6, filed 22 March 2023 and administratively approved 18 April 2024 with 27 conditions, https://townofwarrenton.portal.opengov.com/records/3485; vested-rights request ZNG-25-31, 31 July 2025, asserting post-approval expenditures "in excess of $3,500,000." Amazon intervened in April 2023 as a party defending the permit in *Cross v. Town Council of the Town of Warrenton*, No. CL23-128 (Fauquier Cnty. Cir. Ct.). The site plan approval carries the same noise conditions forward. No record located shows Amazon objecting to Condition 17 or seeking its amendment.

[142] *Cross v. Town Council of the Town of Warrenton*, No. CL23-128 (Fauquier Cnty. Cir. Ct.), challenging the April 2021 zoning text amendment that first allowed data centers in the Industrial district, for failure to state a public purpose under Va. Code § 15.2-2286(A)(7); tried from 9 March 2026, with final argument on 15 June 2026; no ruling had been reported as of August 2026, the latest point the record examined reaches. Construction was frozen by a consent order of 14 January 2025.

Town of Warrenton Resolution RES-25-01-06 (14 January 2025, 5-2) directed the Town Attorney "to determine the appropriateness of the Town's defenses … and seek the potential amendment of its Answer so as to withdraw certain defenses." Ordinance 2025-10 (ZOTA-25-1), adopted 8 July 2025, removed data centers as a permitted Industrial use, finding that "a Data Center is a Use that does not further the health, safety and welfare of the public." Because nothing was built, no certificate of occupancy issued and Condition 17 has never operated: no sound test, violation notice or suspension is of record.

[143] King George County, Birchwood rezonings Z-2023-00099, Z-2023-00100 and Z-2023-00101, approved 5 September 2023 (Birchwood Power Partners, L.P.), Global Proffer § III(16): 60 dB(A) from 6 a.m. to 10 p.m. and 55 dB(A) from 10 p.m. to 6 a.m. at the property line, measured per ANSI S1.13-2020, against county limits recited in the staff report as 75 dB(A) day and 65 dB(A) night. Applicant's counsel, on the record: "we have proffered 60/55 dBA, there's no other industrial user in your County that would follow that requirement. … We are burdening ourselves with that requirement, so if we violate that, that's a zoning violation." Generators are exempt during outages and during testing and maintenance.

[144] Pittsylvania County, R-24-011, Anchorstone Advisors SOVA, LLC, approved 7-0 on 16 July 2024, Proffer 13: 65 dB(A) at the property line at all hours, a pre-operation test by an ASA full member or INCE Board-Certified professional, annual testing filed with the Zoning Administrator by 1 July for the life of the use, and "48 hours to mitigate the violation or operations shall be suspended and the Applicant shall cease the use." The proffer closely restates the county's own ordinance, CA-24-001, adopted about eight weeks earlier.

[145] Data Center Watch, tracking report, https://www.datacenterwatch.org/report: the Henrico County Planning Commission deferred the DC BLOX proposal in July 2024 to address noise and aesthetics concerns raised by county staff and residents; the application was withdrawn in November 2024; in February 2025 DC BLOX announced a smaller, single-story revised project on the same site. This sequence rests on a secondary tracking source; no county document for the withdrawal or the return was examined.

[146] Record examined: (1) twenty-nine approvals across fifteen Virginia localities, read for their noise conditions and proffers, in none of which an operator cited noise conditions as a reason to leave; (2) every Virginia data center withdrawal located, each traced to its stated cause (among them AWS in Louisa County, July 2025; Headwaters Site Development in Fauquier County, July 2024; and the PW Digital Gateway), none attributed by the operator or the locality to noise requirements; and (3) the published statements of the operators and trade bodies active in the

Commonwealth, including the Data Center Coalition's press releases from February 2023 onward and its published FAQ. Where operators and officials name a siting constraint it is power; the Data Center Coalition's own list of competitiveness factors, "available and suitable land, workforce, infrastructure, tax and regulatory environment, and local sentiment," does not mention noise. Not examined: the local records of Culpeper, Chesterfield and Henrico counties, General Assembly committee testimony, and Prince William public-comment packets.

[147] "Prince William supervisors greenlight new noise ordinance for businesses, data centers," *InsideNoVa*, 29 October 2025, https://www.insidenova.com/news/business/prince-william-supervisors-greenlight-new-noise-ordinance-for-businesses-data-centers/article_3892dce9-c7c1-42f0-a5a1-f0e185c30a7d.html (accessed 4 October 2026): "Reilly enumerated several of the coalition's principal grievances with the ordinance proposal, notably: a lack of grandfathering provisions for existing facilities to avoid having to retrofit those establishments; concerns with the county's six-month effective date for the new ordinance, well short of the typical 18-24-month range for implementation of engineering, design and supply chain solutions; and a lack of a civil enforcement mechanism rather than criminal penalties for individual employees." The passage is the reporter's paraphrase of Nicole Reilly's remarks, not a quotation. No transcript or written testimony of the remarks was examined.

[148] Daniella Rivera, "Life inside Data Center Alley: what Utah can learn from Loudoun County, Virginia," KSL-TV, 7 July 2026, https://www.ksl.com/article/51594843/life-inside-data-center-alley-what-utah-can-learn-from-loudoun-county-virginia. Stephenson is Vantage's Senior Vice President of Global Public Policy; KSL reported that he said the company "is working to mitigate the noise in the Sterling neighborhood this summer."

[149] Turner & Townsend, *Data centre construction cost index 2025-2026*, 9th ed., 5 November 2025, https://www.turnerandtownsend.com/insights/data-centre-construction-cost-index-2025-2026/; methodology at https://reports.turnerandtownsend.com/data-centre-construction-cost-index-2025/methodology. Northern Virginia: US$10.92 per watt of IT load. The benchmark represents "a typical air-cooled, build-to-suit hyperscale data centre in the average range of 30-50MW (IT load)," and excludes "any client direct costs, land purchase costs, utility works, abnormal groundworks, site works, active IT equipment, fibre cabling to support office fit-o[u]ts or professional services fees."

[150] This volume's calculation: $10.92 per watt × 40,000,000 watts = $436,800,000. $1,000 ÷ $436,800,000 = 0.000229 percent, or 2.3 parts per million.

Every share in section 9 is against this construction cost alone; against total capital investment, which adds land and IT equipment, each share would be smaller.

[151] Record examined for retrofit costs: the five documented data center noise retrofits listed at note 158, and the operators' statements on each. Three carry dollar figures, all from third parties: $2 million at Chandler (see note 130), a mayor's $7 million at Southaven, and the Great Oak estimates below. For Great Oak, Amazon has said only that the work took "considerable engineering and resources." The circulating figures are estimates by Dale Browne, president of the Great Oak Homeowners Association: "Browne guesses it cost as much as $30 million, based on informal conversations with Amazon officials at the meetings" (Peter Cary, "Amazon tones down its data center noise after residents sound the alarm," *Prince William Times*, 23 October 2023; see note 152); and "Former HOA President Dale Brown [sic] estimated the fix cost AWS roughly $40 million, a figure the company has not confirmed" ("Data Center Noise Still Shakes Homes in Great Oak, County Slow to Act," *Potomac Local News*, 11 June 2025, https://www.potomaclocal.com/?p=238180). The comparison in the text is this volume's calculation: spreading $30 to $40 million across the four Great Oak buildings gives $7.5 to $10 million per building, or 1.72 to 2.29 percent of the $436.8 million benchmark, which assumes each building is comparable in cost to the benchmark building. Against the designed-in range of 0.91 to 2.04 percent (note 130), the retrofit estimate is about 1.1 times (high ends compared) to 1.9 times (low ends compared), and at most 2.5 times (highest retrofit against lowest designed-in).

[152] Peter Cary, "Amazon tones down its data center noise after residents sound the alarm," *Prince William Times*, 23 October 2023, https://www.princewilliamtimes.com/news/amazon-tones-down-its-data-center-noise-after-residents-sound-the-alarm/article_b81154ea-5178-59cb-ac3b-82228a2a52cf.html (accessed 4 October 2026): "The sound level immediately dropped 10 points to around 50 decibels, according to both residents' and Amazon's measurements." The work replaced the rooftop exhaust fans and extended their stacks, and was complete by 18 August 2023. Residents later reported continuing noise and new vibration (*Potomac Local News*, 11 June 2025, see note 151).

[153] Peter Cary, "Coming crackdown on data center noise likely won't bring relief to a community most affected," *Prince William Times*, 6 March 2025, https://www.princewilliamtimes.com/news/coming-crack-down-on-data-center-noise-likely-wont-bring-relief-to-a-community-most/article_5307ae6c-fac1-11ef-89ef-13f721478913.html (accessed 4 October 2026): "'The data in our recently completed sound study demonstrates that (Amazon Web Services') efforts have significantly reduced sound, and that AWS is in compliance with applicable law,' wrote Sarah Georgiades, Amazon's head of community engagement, in an email to

Browne." The same article: "For its part, Amazon says it has done all it can and meets the county's current noise limits. But it has indicated it does not intend to do more to comply with a new noise ordinance that does not yet exist." The email is undated in the article and was addressed to Browne, not to the County; the second passage is the reporter's characterization, not Amazon's words.

[154] JLARC, Report 598, printed p. 76 (PDF p. 94): "Data centers are not required to reduce their noise if they are not violating local ordinances, which has made it difficult to address noise concerns."

[155] Joint Legislative Audit and Review Commission, *Data Centers in Virginia*, Report 598 (Richmond, 2024), 85, https://jlarc.virginia.gov/pdfs/reports/Rpt598.pdf: "Many data center companies are now doing sound modeling studies for all or some of their projects, and companies explained that sound modeling prior to construction is worthwhile because reducing noise after a building is operational can be difficult and expensive." JLARC attributes the statement to unnamed companies.

[156] Federal Highway Administration, *Summary of Noise Barriers Constructed by December 31, 2022* (updated July 2023), https://www.fhwa.dot.gov/environment/noise/noise_barriers/inventory/ (accessed 4 October 2026): for barriers built 2020–2022, 22,534,945 square feet (222 linear miles) at about $925 million, with a reported average cost of $48.76 per square foot (FHWA's own per-square-foot figure, which does not equal the total divided by the area), with an average noise reduction of 7 dB(A). Federal Highway Administration, *Noise Barrier Design Handbook*, § 3, "Acoustical Considerations," Table 4 (updated 28 June 2017), https://www.fhwa.dot.gov/Environment/noise/noise_barriers/design_construction/design/design03.cfm, rates design feasibility as "Simple" at 5 dB(A), "Attainable" at 10 dB(A), "Very difficult" at 15 dB(A) and "Nearly impossible" at 20 dB(A). The same section explains why barriers do least at low frequencies: "lower frequencies (longer wavelengths) are diffracted deeper into the 'shadow' zone behind the barrier."

[157] FHWA, *Noise Barrier Design Handbook*, § 3 (see note 156): "for a given site geometry and comparable barrier height and length, a berm barrier will typically provide an extra 1 to 3 dB(A) of attenuation." FHWA describes the increment as "at best, only barely perceptible."

[158] Record examined: data center noise retrofits in the United States reported in news coverage, municipal records, and operator and contractor statements. Five were located. (1) Chandler, Arizona (CyrusOne, 2018–2022): chiller wraps, attenuation panels and screen walls; no decibel result published (Ken Sain, "Residents skeptical about noise declines at data center," *Chandler Arizonan*, 1 November 2022, https://www.chandlernews.com/news/residents-skeptical-about-

noise-declines-at-data-center/article_c7300e30-593b-11ed-a088-cb76499dd165.html). (2) Great Oak, Prince William County, Virginia (AWS, 2022–2023): padded acoustic shrouds, which failed, then replacement of the source equipment, which achieved the 10-point reduction (note 152). (3) Williston, North Dakota (Atlas Power, 2023): more than 1,400 feet of wall; the station's own measurements "showed levels around 65 to 85 decibels" both before and after (KFYR-TV, 9 August 2023, https://www.kfyrtv.com/2023/08/09/walls-up-data-center-near-williston-residents-say-noise-issues-remain/). (4) Aurora, Illinois (CyrusOne, 2025–2026): generator and chiller sound walls, after which residents reported continuing disruption ("After mitigation measures, residents say Aurora data center still creating noise issues," *Chicago Tribune*, 6 April 2026, https://www.chicagotribune.com/2026/04/06/after-mitigation-measures-residents-say-aurora-data-center-still-creating-noise-issues/; WAND-TV, 10 July 2026). (5) Southaven, Mississippi (xAI, 2026): a sound wall, berm and trees, with some turbines relocated; the mayor reported lower readings, which residents dispute ("It still hasn't helped," *DeSoto Times-Tribune*, 21 May 2026, https://www.desototimes.com/news/musselwhite-says-xai-complying-with-city-noise-level-reduction-requests/article_183a99ed-cbd9-49be-b4c4-1997dd4bfd4a.html). The four path-treatment attempts with a reported outcome are Great Oak's shrouds, Williston, Aurora and Southaven; Chandler is the fifth case, with no published result; Great Oak's source re-engineering is the one success.

[159] Trane, *Sound Data and Application Guide For Air-Cooled Series R Chiller Model RTAG, 85–205 Tons (50 Hz)*, RTAG-PRB001A-EN, November 2017, Appendix A, https://www.tranehk.com/files/Products/RTAGPRB001AEN_1117.pdf. RTAG 250, EC fan, high efficiency, sound power: standard noise, 103.5 dB at 63 Hz and 102.0 dB(A) overall; low noise, 103.5 dB at 63 Hz and 98.0 dB(A); low noise with night setback, 94.0 dB at 63 Hz and 95.5 dB(A). The low-noise option's 4 dB(A) comes mainly at 500 Hz and 1 kHz. Night setback lowers the 63 Hz band by 9.5 dB but raises the 250 Hz band by 1.0 dB relative to the low-noise option.

[160] Trane, RTAG-PRB001A-EN (see note 159), RTAG 410 at standard noise: AC fan, 101.0 dB at 63 Hz and 104.0 dB(A) overall; EC fan, 104.5 dB at 63 Hz and 103.5 dB(A). This is one model in one manufacturer's table, the only one for which Trane publishes both fan types.

[161] JLARC, *Data Centers in Virginia*, Report 598 (2024), 77: "Almost one-third (29 percent) of operational data center properties in Virginia are within 200 feet of residentially zoned properties." Distances are measured property line to property line. By locality, Appendix B, Table B-1 (p. 103), gives 24 percent in Loudoun, 21 percent in Prince William and 55 percent in Fairfax, across 131 sites analyzed.

[162] Documents examined: Trane, *Ascend Model ACR Product Catalog*, AC-PRC001G-EN (January 2022): "Sound power levels for chillers are available on request," https://www.trane.com/content/dam/Trane/Commercial/global/products-systems/equipment/chillers/air-cooled/ascend/AC-PRC001G-EN_01302022.pdf; Carrier, *AquaForce 30XA Product Data*, Form 30XA-22PD Rev. F (2023), which has no sound tables, https://www.shareddocs.com/hvac/docs/1005/public/04/30xa-22pd.pdf; Daikin, *Catalog 626-7, Pathfinder AWV 100–565 tons* (2018), whose guide specification leaves the octave-band sound columns blank for the bidder, https://surplusgroup.com/wp-content/uploads/Daikin-AWV-100-to-565-2018.pdf; SPX Marley's low-sound product range, which attaches no decibel values; Trane's air handler catalog CLCH-PRC022F-EN (April 2019), which refers the reader to proprietary selection software; and Vertiv's Liebert CW brochure. For dry coolers and air-cooled condensers, Güntner, Evapco, Alfa Laval, Vertiv, Stulz and Munters were examined, and none published sound data. Not examined: Kohler and MTU generator sound data, and York (Johnson Controls) chiller data.

[163] Venues examined: the Data Center Coalition's published FAQ, https://www.datacentercoalition.org/cpages/faq (accessed 4 October 2026), and its press releases from February 2023 onward; the Northern Virginia Technology Council's website, including its data center community, advocacy and policy agenda pages; JLARC Report 598, whose Appendix B lists both trade associations among those interviewed and whose Appendix C carries agency responses only from the State Corporation Commission and the Virginia Economic Development Partnership; the Warrenton record, in which Amazon's land-use attorney, John Foote, called the Town's requirements "some of the most stringent frequency and sound requirements that I have ever seen" (Planning Commission work session, 26 July 2022) and stated no cost; and the Prince William 2025 proceeding, including the Prince William Chamber of Commerce's letter of 18 April 2025, as reported by *InsideNoVa* (Kraft, 23 September 2025; see note 91), objecting to "unachievable new noise limits" and "draconian penalties," which also states no figure. Asked directly, "The Data Center Coalition, an industry trade group, did not respond to questions about data center noise or what industry best practices exist for mitigating its impact on neighbors" (Ariel Wittenberg, "A data center opened next door. Then came the high-pitched whine," *Politico*, 11 March 2026, https://www.politico.com/news/2026/03/11/data-centers-ai-electricity-virginia-00815219). For the 28 October 2025 item (Item 7-J, Ordinance 25-62), Prince William's posted records examined were the meeting agenda, https://granicus_production_attachments.s3.amazonaws.com/pwcgov/df563df2c9809540e32e57cca64346cd0.html, the Board of County Supervisors page, the county's public-comment guidance and the SpeakUp! Prince William comment portal; none

carries a correspondence file for the item. The Item 7-J agenda packet and the General Assembly committee record were not examined for this point.

[164] Evelyn Mejia, "Supervisors OK compromise noise ordinance aimed at data centers," *Prince William Times*, 30 October 2025, https://www.princewilliamtimes.com/news/supervisors-ok-compromise-noise-ordinance-aimed-at-data-centers/article_1288e464-5559-4c12-ab8f-2a28ca28d819.html (accessed 4 October 2026): "If you have a mom-and-pop shop that doesn't have the sophistication to measure (noise) and then remediate, we would not want to send the message that, on one hand, we want more diversity of businesses, but, on the other hand, only data centers would have the means to remediate," Boddye said. The parenthetical "(noise)" is the newspaper's. The article identifies Boddye as the author of the revised ordinance. He moved its adoption on 28 October 2025, and it passed 5-2 (Ordinance 25-62; ayes Angry, Bailey, Boddye, Franklin, Gordy; nays Jefferson, Vega).

[165] Va. Code § 10.1-1300 (definitions), https://law.lis.virginia.gov/vacode/title10.1/chapter13/section10.1-1300/: "'Air pollution' means the presence in the outdoor atmosphere of one or more substances which are or may be harmful or injurious to human health, welfare or safety, to animal or plant life, or to property, or which unreasonably interfere with the enjoyment by the people of life or property." The Air Pollution Control Board's regulations for emergency generators, including 9VAC5-540, rest on this definition through Va. Code §§ 10.1-1307.2 and 10.1-1308.

[166] 9VAC5-540, Emergency Generator General Permit, 9VAC5-540-10 through -220 (effective 17 August 2011, as amended effective 16 June 2025), https://law.lis.virginia.gov/admincode/title9/agency5/chapter540/; 9VAC5-80, Part II, Article 6 (minor New Source Review), 9VAC5-80-1100 through -1320, https://law.lis.virginia.gov/admincode/title9/agency5/chapter80/. Documents examined: the complete text of both. Part IV of 9VAC5-540, which sets out the whole content of an emergency generator permit (general terms, monitoring, operating limits, emissions limits, testing, recordkeeping, reporting and enforcement, §§ 150–220), has no noise section, and the word "noise" does not appear in Article 6. Apart from Item 367 ¶ E of the 2026 budget, which directs DEQ to adopt and enforce data center noise regulations by 31 December 2029 (see note 215), no Virginia statute or regulation examined for this volume assigns stationary-source environmental noise authority to DEQ, the Air Pollution Control Board or any other state agency. DEQ's own guidance on generator operation speaks only of emissions: "Emergency generators remain subject to the terms and conditions of their air permits during all periods of operation, especially with respect to emissions limits and other permit terms established by DEQ or the Federal Government that are not waived during

emergency operations." DEQ Guidance Memo APG-578, "Permit Terms" (note 173 for the document).

[167] 40 C.F.R. § 60.4211(f)(1) (Standards of Performance for Stationary Compression Ignition Internal Combustion Engines, Subpart IIII), https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-60/subpart-IIII/section-60.4211; 40 C.F.R. § 63.6640(f)(1) (National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines, Subpart ZZZZ), https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-63/subpart-ZZZZ/section-63.6640. Both read, save for the engine acronym: "There is no time limit on the use of emergency stationary ICE in emergency situations."

[168] 40 C.F.R. §§ 60.4211(f)(2)(i) and 63.6640(f)(2)(i) (maintenance checks and readiness testing, 100 hours per calendar year, with provision to petition for more); 40 C.F.R. §§ 60.4211(f)(3) and 63.6640(f)(3)–(4) (non-emergency operation, 50 hours per calendar year, counted toward the 100). The fifty hours "cannot be used for peak shaving or non-emergency demand response, or to generate income for a facility to an electric grid or otherwise supply power as part of a financial arrangement with another entity" except under the conditions of § 60.4211(f)(3)(i) and § 63.6640(f)(4)(ii). The rules name who may recommend a test ("federal, state or local government, the manufacturer, the vendor, the regional transmission organization or equivalent balancing authority and transmission operator, or the insurance company associated with the engine") but not the hours at which a test may occur.

[169] 9VAC5-540-170 (Operating limits), https://law.lis.virginia.gov/admincode/title9/agency5/chapter540/section170/: "A. Each affected unit located in an attainment area shall not operate more than 450 hours per year, calculated monthly as the sum of each consecutive 12-month period. B. Each affected unit located in a nonattainment area shall not operate more than 500 hours per year." Two qualifications. These are ceilings on total operation, not testing caps: 9VAC5-540-20 defines "Operation" as "the burning of fuel regardless of whether electricity is generated." And Loudoun and Prince William lie in the Washington, DC-MD-VA ozone nonattainment area, where the ceiling is 500 hours. Most large campuses are in any case permitted under Article 6 rather than the general permit, whose eligibility ceiling is set at 9VAC5-540-40 A; DEQ's own statement is that "[t]he vast majority of emergency generators have been (and will continue to be) permitted via Article 6." Under Article 6, hour limits are set permit by permit.

[170] S.B. 1407 (Reeves), 2025 Sess.; 2025 Va. Acts ch. 344 (approved 21 March 2025; emergency clause), https://lis.virginia.gov/bill-details/20251/SB1407. Votes:

Senate 38–1; House 97–0. The Act directs that Air Pollution Control Board regulations allow an affected emergency generator to operate up to 50 hours a year for nonemergency purposes, including planned outages and switchgear and related electrical system testing, and directs DEQ to implement the change without further Board action. Compare 9VAC5-540-40 B, which since 16 June 2025 has allowed certain Department of Defense mission-critical units fifty hours "for non-emergency purposes, including planned outages," a change made by amending the regulation.

[171] Loudoun County Zoning Ordinance § 7.05.03.E.4 (Exemptions to Maximum Sound Levels), https://online.encodeplus.com/regs/loudouncounty-va-zo/doc-viewer.aspx?secid=1320: "Sounds created by generators and accessory equipment operating during an emergency or at the request of a utility and the testing of said generators and associated equipment." Table 7.05.03-1 sets maximum levels at the receiving property line (Residential and Rural Economy 55 dB(A); Mixed-Use Residential 60; Commercial/Civic/Institutional 65; Industrial 70), which under § 7.05.03.D "apply at all times of day and night." The testing control is § 4.06.02.D.8, https://online.encodeplus.com/regs/loudouncounty-va-zo/doc-viewer.aspx?secid=859: "Generator Noise Adjacent to Residential. For Data Centers on property adjacent to property with existing residential development… the following standard applies to generator testing, subject to Commonwealth regulations or permits issued for the property: a. Generator testing is limited to between 5:00 p.m. and 7:00 [p.]m. between May 1 and September 30; b. Generator testing is limited to between 11:00 a.m. and 5:00 p.m. between October 1 and April 30; and c. Except for generator testing or commissioning activities, generator use is limited to backup/emergency use only." The codified text reads "7:00 m." The provision states no reason for the seasonal split and sets no decibel level inside either window. The exemption dates from ZOAM 2014-0006, Noise Standards (Board of Supervisors Action Item #17, 22 September 2016), whose staff report gives the reason as "the contractual concerns of data center users"; the predecessor provision was Revised 1993 Zoning Ordinance § 5-1507(F)(4). A Chapter 4 PDF posted on the County's website and identified as a draft zoning ordinance (https://www.loudoun.gov/DocumentCenter/View/176098) carries a different limit, "weekdays between 8:00 a.m. and 5:00 p.m."; both online codifications carry the seasonal windows quoted here.

[172] Pat Thomas, "Henry County adopts 'stringent' regulations on data centers," WDBJ7, 25 August 2026, https://www.wdbj7.com/2026/08/26/henry-county-adopts-stringent-regulations-data-centers/ (accessed 4 October 2026): "Routine generator testing is limited to weekdays between 9 a.m. and 5 p.m." The same report gives a "maximum operational noise level of 50 dBA at the exterior property line" and requires the acoustical analysis to cover "representative worst-case operating conditions, including peak cooling demand and routine emergency generator

testing." The testing window is reported in the same terms by WSLS 10 News Digital Team, "Henry County Board adopts stringent data center regulations," 28 August 2026, https://www.wsls.com/news/local/2026/08/28/henry-county-board-adopts-stringent-data-center-regulations/; Henry County Enterprise, "Supervisors approve data center ordinance," 2 September 2026, reports the 25 August 2026 vote as 6–0. The adopted ordinance text was not examined, and none of the reports states whether the 50 dBA limit applies during testing. On Frederick, see note 39. The press accounts of the Frederick vote report that it also removed "definitions and additional data center regulations" from the ordinance; whether those include § 165-204.41, which carries the testing provision quoted in note 107, cannot be determined without the adopted text.

[173] Virginia Department of Environmental Quality, Guidance Memo APG-578, "Sudden and Reasonably Unforeseeable Events in the Context of Planned Electric Outages," issued under Va. Code § 2.2-4002.1. Virginia Regulatory Town Hall, guidance document record, https://townhall.virginia.gov/L/ViewGDoc.cfm?gdid=7950 (accessed 4 October 2026): "Effective Date: 1/3/2026"; "Posted On: 1/5/2026"; applies to 9VAC5-80 and 9VAC5-540. The comment forum (Forum 2798, note 175) records: "Effective Date: 12/4/2025 Delayed until 1/3/2026 while comments are evaluated." The text noticed for comment is the document dated 1 October 2025, transmitted by memorandum of 30 September 2025 from Michael Dowd, Director, Air and Renewable Energy Division, https://townhall.virginia.gov/l/GetFile.cfm?File=C:%5CTownHall%5Cdocroot%5CGuidanceDocs_Proposed%5C440%5CGDoc_DEQ_8407_20251003.pdf. Its operative sentence: "In light of this analysis, DEQ considers that an electric outage may sometimes be a 'sudden and reasonably unforeseeable' event, even if the electricity service provider has 'scheduled' or 'planned' the outage and given notice to a source in advance." Its illustrative case is a source given fourteen calendar days' notice or less, on the rationale that longer notice "normally provide[s] sufficient notice for an operator… to acquire and set up temporary mobile (i.e., non-road) generators," and it adds: "Whether a specific planned outage actually constitutes an emergency depends on the totality of the circumstances." The conditions attached (notice, documentation, a plan of action, and reports) run to DEQ; the document contains no noise provision and no requirement of notice to residents. The quotations are from the version noticed for comment; this note does not establish whether the effective version differs. A separate forum, GdocForumID=2880 (March to April 2026), concerns the companion memo APG-576 on presumptive best available control technology for data center generator sets, not APG-578.

[174] Tyler Demetriou, Southern Environmental Law Center, quoted in Charles Paullin, "Virginia Regulators Weigh Expanded Use of Data Center's Polluting Generators," Inside Climate News, 15 December 2025, https://insideclimatenews.org/news/15122025/virginia-regulators-weigh-expanded-use-of-data-centers-polluting-generators/: "[DEQ is trying to] shoehorn these planned outages into its existing definition of an emergency, where they don't really fit. If it wants to expand that definition to cover this sort of thing, it has the regulatory power to do that, but it needs to go through the full notice and comment rulemaking process to amend the regulation." SELC and the Chesapeake Bay Foundation also filed a joint comment on the closing day of Forum 2798 (CommentID 238358) arguing that the guidance "amounts to amending a regulation without adhering to… the APA." For the regulatory route the Commonwealth used for planned-outage operation of Department of Defense units, note 170.

[175] Virginia Regulatory Town Hall, Guidance Document Forum 2798 (Department of Environmental Quality, APG-578), comment period 3 November to 3 December 2025, https://townhall.virginia.gov/L/GDocForum.cfm?GDocForumID=2798; comments at https://townhall.virginia.gov/L/ViewComments.cfm?GdocForumID=2798 (accessed 4 October 2026). Town Hall records: "Forum ended on 12/3/2025 with 411 Comments." The forum describes its subject as follows: "DEQ Guidance Memo APG-578 addresses the use of emergency generators in the case of 'sudden and reasonably unforeseeable events' as the result of a planned electric outage." The figure of 76 comments mentioning noise, decibels, sound or loudness (18.5 percent) is this volume's own count of the public comment file; DEQ publishes no such tally.

[176] Jessica Medeiros, Sterling, comment filed 19 November 2025, CommentID 237783, Virginia Regulatory Town Hall, Guidance Document Forum 2798 (APG-578), https://townhall.virginia.gov/L/ViewComments.cfm?GdocForumID=2798: "I live about 150 feet from the Vantage data center on Glenn Drive in Sterling. When the generators are run, the noise has reached 90 decibels on multiple occasions which is well above the allowed 63 decibels." The statement is a resident's account on a state record. It gives no instrument, weighting, duration or measurement position. The "allowed 63 decibels" corresponds to no Loudoun standard in the census; the County's limit at a residential receiving property is 55 dB(A) (Zoning Ordinance Table 7.05.03-1), and generator testing is exempt from it (note 171).

[177] "Z Amberleigh Station Family," Bristow, comment filed 28 February 2023, CommentID 209206, Virginia Regulatory Town Hall, Department of Environmental Quality, General Notice 2538 (order and local variance for data centers in Fairfax, Loudoun and Prince William counties; comment period 26 January to 14 March

2023), https://townhall.virginia.gov/L/ViewComments.cfm?generalnoticeid=2538: "-Crazy 74 decibels of continuous noise." The statement is a resident's account on a state record, filed in the 2023 variance docket rather than in Forum 2798. It gives no instrument, weighting, duration or measurement position.

[178] Joint Legislative Audit and Review Commission, Data Centers in Virginia, Report to the Governor and the General Assembly of Virginia, House Document No. 598 (2024), https://jlarc.virginia.gov/pdfs/reports/Rpt598.pdf. Count and mean, printed p. 58 (PDF p. 76): "On average, each data center site has 54 permitted generators… In total, the industry has approximately 8,000 permitted generators throughout the state." Median, printed p. 74 (PDF p. 92): "Trailer-sized generators (a median of 35 per site) are often lined up beside the data center building or housed in large generator sheds." Source and date, Appendix B, printed p. 100 (PDF p. 118): "The inventory was based on data provided by DEQ listing data center sites with active air emissions permits (which all Virginia data centers have for their diesel generators). This data was as of August 2024." The figures are counts of permitted, not installed, generators, for sites DEQ identified; JLARC publishes no locality breakdown. The report was presented to the Commission on 9 December 2024 and the Commission draft posted that month; the final version is dated March 2025.

[179] JLARC, Report 598. Documents examined: the full report in both published versions, its Summary, its Recommendations and Policy Options document, and the Commission presentation of 9 December 2024. The report contains no measurement, finding or recommendation on generator noise. The only clause joining generators and sound is in Appendix L, Table L-1, Loudoun row, printed p. 136 (PDF p. 154), listing standards for data centers adjacent to residential areas: "… time limits on generator testing, and acoustic barriers around mechanical equipment." JLARC describes the testing regime in a sidebar at printed p. 59 (PDF p. 77): "Data center operators indicated that maintenance testing typically involves a short (10–30 minute) monthly test and one long (one- to four-hour) annual test. Testing of generators is staggered across a site on an individual or group basis."

[180] Virginia Department of Environmental Quality, Order by Consent, Amazon Data Services, Cosner Tech Campus, Spotsylvania County (minor New Source Review Permit Registration No. 74288, issued 30 October 2024), unexecuted copy, https://ddrqacl1jpsyp.cloudfront.net/wp-content/uploads/2026/06/04144256/ADS-Cosners-Corner-DEQ-Violation.pdf. The findings of fact state that on 31 May 2025, during the permitted Integration Operational Period, a power outage started non-emergency generator sets EG-01, EG-02 and EG-04, which reached 572°F with a urea flow rate of zero for part or all of the run; the selective catalytic reduction systems failed and permitted hourly NOx limits were exceeded. The order also records a separate opacity violation from stack testing of 1–10 October 2025 (six-

minute averages of 5.6 percent for EG-05 and 6.25 percent for EG-06, against a 5 percent limit). It sets a civil charge of $72,067.80, payable to the Virginia Environmental Emergency Response Fund, with Amazon Data Services neither admitting nor denying the findings. The copy is unexecuted: its execution block is blank ("this ___ day of ___, 2026"), so its effective date is not established. The order itself gives two dates for Notice of Violation ANRO003354: 25 October 2025 at ¶ C(7) and 24 October 2025 at ¶ E(2). The violations were reported in "DEQ issued air pollution violations on Spotsylvania data center campus in 2025," Fredericksburg Free Press, 4 June 2026, where Amazon's position is that the issue arose "during commissioning… before the company had taken occupancy."

[181] Order by Consent (note 180), findings of fact: Amazon Data Services became aware of the catalytic reduction failures on 20 August 2025, notified DEQ on 21 August 2025, and filed a follow-up report on 2 September 2025. The interval from 31 May to 20 August 2025 is 81 days.

[182] Michael Brooks, "Line Fault Causes 3 GW in Data Center Load to Drop in Virginia," RTO Insider, 23 July 2026, https://www.rtoinsider.com/137301-line-fault-causes-3-gw-in-data-center-load-to-drop-in-virginia/: "About 3 GW of data center load automatically switched to backup power the morning of July 22 after a transmission line fault occurred in Northern Virginia, leading to flickering lights in the area but no loss of power, according to Dominion Energy." The same article gives the Dominion series from PJM data: "According to RTO data, Dominion's real-time load dropped from 17,682.6 MW at 7:55 a.m. ET to 14,775.2 MW at 8 a.m. before steadily rising again. It did not reach its prior level until after 8:25 a.m." Its photo caption reads: "PJM and Yes Energy data show that about 3 GW of load suddenly dropped off the grid between 7:55 and 8 a.m." The MW series and the three-gigawatt figure are therefore one report, not two. The article calls the event "a possible record drop in load from data centers," against two earlier events Dominion reported to the State Corporation Commission (1,551 MW in July 2024 and 1,800 MW in February 2025, per a November 2025 SCC staff letter). Dominion did not say how many data centers switched to backup generators. Same-day Board action: Loudoun County, Action Report of the Reconvened July 21, 2026 Board of Supervisors Business Meeting (held 22 July 2026), memorandum of 24 July 2026, pp. 10–11, Item 8: the Board directed "the County Administrator to have the appropriate staff prepare an Item for the September 15, 2026, Board of Supervisors Business Meeting agenda to cease processing data center applications, administrative or legislative, data center site plans, and any substation application until such time as Phase 2 Data Centers Standards and Locations is completed" (passed 6-1-2). Noise is not named in the motion.

[183] Neha Gour, Luis Ortiz and Edward Maibach, "Health implications of the rapid rise of data centers in Virginia: an exploratory assessment," Frontiers in Climate 8 (2026), article 1648912, doi:10.3389/fclim.2026.1648912. The journal labels the article a Mini Review. All three authors are at George Mason University. Received 17 June 2025; revision received 20 January 2026; accepted 20 January 2026; published 6 February 2026. The article has no section headed Methods; its methodological statement is one unlabeled paragraph at the end of the Introduction describing "targeted searches of academic databases (Google Scholar, PubMed, Web of Science, and Scopus)," with no inclusion criteria, search dates, record counts or appraisal method. It collected no primary data and describes itself in its Limitations as "conceptual rather than quantitative." The same authors restated the range for a general audience in Gour, Maibach and Ortiz, "5 ways data centers endanger their local communities and the country as a whole," *The Conversation*, 8 June 2026, https://theconversation.com/5-ways-data-centers-endanger-their-local-communities-and-the-country-as-a-whole-282348.

[184] JLARC, Data Centers in Virginia, House Document No. 598 (2024). Two versions are published: the Commission draft (December 2024), https://jlarc.virginia.gov/pdfs/reports/Rpt598-2.pdf, which Gour et al. cite (their reference 36), and the final version (March 2025), https://jlarc.virginia.gov/pdfs/reports/Rpt598.pdf, cited here. The noise passages are identical in both apart from three copy edits ("impacts their well-being" to "affects their well-being," printed p. 75; "by right" to "by-right," p. 80; "acoustical barriers" to "acoustic barriers," p. 136). Printed page numbers in this volume convert to PDF pages by adding 18.

[185] JLARC, Report 598, ch. 6, printed pp. 75–76 (PDF pp. 93–94): "Data center noise that has prompted resident complaints ranges from an estimated 40 to 59 decibels (per JLARC's review of noise measurements of selected data centers that have prompted complaints by residents). This sound level is typically below the 55 or 60 decibel limit that Loudoun, Prince William, and Fairfax allow in their ordinances for residential areas." The source of the readings is stated only in the SOURCE line of Figure 6-2, printed p. 76: "…and analysis of complaint data from Fairfax and Loudoun," and in its NOTE, which describes "locations where local staff recently measured data center noise using A-weighted decibels." The underlying readings are not reproduced in the report.

[186] JLARC, Report 598, printed p. 75 (PDF p. 93): "ranges from an estimated 40 to 59 decibels (per JLARC's review of noise measurements of selected data centers that have prompted complaints by residents)." The same paragraph states that the noise is "rarely loud enough to violate noise ordinances," a finding repeated in the Summary at p. viii.

[187] JLARC, Report 598, Figure 6-2, "Data center sound is noticeable but quieter than many common sounds," printed p. 76 (PDF p. 94); the range itself is in the text at printed p. 75, which carries Figure 6-1. Row label: "40-59 | Selected data centers with noise complaints." SOURCE line: "JLARC review of Occupational Safety and Health Administration, U.S. Centers for Disease Control and Prevention, and Federal Aviation Administration websites, and analysis of complaint data from Fairfax and Loudoun." NOTE line, complete: "The units are A-weighted decibels. [a] Encompasses measurements at locations where local staff recently measured data center noise using A-weighted decibels. Measurements are a response to complaints, so they are not representative of all data centers. Measurements indicate total sound, not the isolated amount from data centers."

[188] JLARC, Report 598. Documents examined: the full report and its twelve appendixes in both published versions, the Summary, the Recommendations and Policy Options document, and the Commission presentation of 9 December 2024. The report has no notes section and no note-reference markers; its apparatus consists of margin sidebars and the SOURCE and NOTE lines of figures and tables. For the 40-to-59 range that apparatus is the caption, row label, SOURCE line and NOTE line of Figure 6-2 (note 187). No count of readings, date range, instrument, protocol, measurement distance, receptor location, duration, averaging period or per-site breakdown is given anywhere in the report or its appendixes. The word "complaint" appears seven times, never with a number.

[189] JLARC, Report 598, Appendix B, "Research activities and methods," printed pp. 95–104 (PDF pp. 113–122). Its "Data collection and analysis" section, printed pp. 101–103, has five subsections: "Local data center tax revenue"; "Data center generator permit, emissions, and violations data"; "Data center water use"; "Land conversion due to data centers"; "Proximity of data centers to residential zones." None concerns noise data. Noise appears in Appendix B only as a subject of legal and literature review and interviews (printed p. 95) and in the site-visit description, where staff "listened to noise levels throughout the facilities" (printed p. 100). By contrast the water-use subsection reports, for example, that "[t]wo utilities shared annual usage data; three shared monthly usage data; and one shared daily usage data."

[190] Gour, Ortiz and Maibach, "Health implications," noise section: "Operating 24/7, data centers in Virginia generate a persistent humming noise, described as an industrial-scale 'drone' or 'hum' similar to amplified house air conditioning, with levels ranging between 40 and 59 decibels [Joint Legislative Audit and Review Commission (JLARC), 2024]. While the U. S. Environmental Protection Agency (EPA) recommends a 24-h average outdoor noise limit of 55 dBA (day–night average) or 45 dBA indoors to protect public health (U.S. Environmental Protection Agency, 1974),

data center operations in residential areas often approach or exceed these thresholds." The cited JLARC passage finds the range "typically below" local residential limits and "rarely loud enough to violate noise ordinances" (Report 598, printed pp. 75–76). JLARC states no averaging period for its readings (note 188); the EPA figure is a day-night average level (note 191).

[191] U.S. Environmental Protection Agency, Office of Noise Abatement and Control, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, EPA Report No. 550/9-74-004 (March 1974), https://nepis.epa.gov/Exe/ZyPDF.cgi/2000L3LN.PDF?Dockey=2000L3LN.PDF. The 55 dB(A) figure is an identified outdoor level expressed as a day-night average sound level (Ldn), a 24-hour energy average with a 10 dB penalty on nighttime hours, with a companion indoor level of 45 dB(A) Ldn. The document was published under the Noise Control Act of 1972 as an informational document, without regard to cost or feasibility, and sets no enforceable standard. It is distinct from EPA's Model Community Noise Control Ordinance, EPA 550/9-76-003 (September 1975).

[192] JLARC, Report 598, ch. 6, printed pp. 85–86 (PDF pp. 103–104): "Most local noise limits are defined using 'A-weighted' decibels (sidebar). This metric is designed to target excessively loud noise from sources such as parties and barking dogs. The lower frequency noise data centers emit is not fully captured in 'A-weighted' decibels. Therefore, data center noise rarely exceeds the allowable limits set in ordinances, despite the constancy of the sound being problematic for residents." JLARC suggests that localities "develop a supplemental noise limit defined using a metric that better accounts for low frequency sounds, such as 'C-weighted' decibels." The claim is that the low-frequency component is "not fully captured," not that A-weighting cannot capture it.

[193] JLARC, Report 598, printed p. 76 (PDF p. 94). The Figure 6-2 SOURCE line names "complaint data from Fairfax and Loudoun." Prince William appears in the adjacent text only as one of three counties whose residential ordinance limits are 55 or 60 decibels: "This sound level is typically below the 55 or 60 decibel limit that Loudoun, Prince William, and Fairfax allow in their ordinances for residential areas."

[194] World Health Organization Regional Office for Europe, Environmental Noise Guidelines for the European Region (Copenhagen: WHO Regional Office for Europe, 2018), ISBN 978-92-890-5356-3, https://www.who.int/publications/i/item/9789289053563. Recommendations cover road traffic (below 53 dB Lden; 45 dB Lnight), railway (54 dB Lden; 44 dB Lnight), aircraft (45 dB Lden; 40 dB Lnight), wind turbines (45 dB Lden, conditional; no night recommendation) and leisure noise (70 dB LAeq,24h, conditional). On wind turbines

at night: "The quality of evidence of night-time exposure to wind turbine noise is too low to allow a recommendation."

[195] Elise van Kempen, Maribel Casas, Göran Pershagen and Maria Foraster, "WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environmental Noise and Cardiovascular and Metabolic Effects: A Summary," International Journal of Environmental Research and Public Health 15, no. 2 (2018): 379, doi:10.3390/ijerph15020379. Road traffic noise and incident ischaemic heart disease, GRADE high, three cohort and four case-control studies: "…we found an RR of 1.08 (95% CI: 1.01–1.15) per 10 dB (LDEN) for the association between road traffic noise and the incidence of IHD within the range of approximately 40–80 dB LDEN." And: "the risk of IHD increases continuously for road traffic noise levels from about 50 dB (LDEN)." The quality rating is assigned in this systematic review, on which the WHO guidelines rest. The review covered air, road and rail traffic and wind turbines; industrial and stationary sources were not within it.

[196] Van Kempen et al., "Cardiovascular and Metabolic Effects." The overall GRADE for traffic noise and hypertension is very low. On incidence: "In the two evaluated cohort studies that investigated the impact of traffic noise on hypertension, no increased risks were found." The reviewers add that a low rating "does not mean that exposure to noise has no effect on the cardiovascular system, but encourages further research to improve the quality of the evidence."

[197] World Health Organization Regional Office for Europe, *Environmental Noise Guidelines for the European Region* (Copenhagen: WHO, 2018), https://iris.who.int/handle/10665/279952, 8: "the guidelines do not explicitly consider industrial noise as an environmental noise source, affecting people living in the vicinities of industrial sites. This is mainly due to the large heterogeneity and specific features of industrial noise, and the fact that exposure to industrial noise has a very localized character in the urban population"; and 28: "The current environmental noise guidelines for the European Region supersede the CNG from 1999. Nevertheless, the GDG recommends that all CNG indoor guideline values and any values not covered by the current guidelines (such as industrial noise and shopping areas) should remain valid." The 2018 values cover road traffic, railway, aircraft, wind turbine and leisure noise only (note 194). See also WHO, "Environmental noise," ch. 11 in *Compendium of WHO and Other UN Guidance on Health and Environment, 2022 Update* (Geneva: WHO, 2022), WHO/HEP/ECH/EHD/22.01, https://cdn.who.int/media/docs/default-source/who-compendium-on-health-and-environment/who_compendium_noise_01042022.pdf: "Recommended actions are available for specific noise sources and do not cover all potentially important noise exposures." The 1999 values: B. Berglund, T. Lindvall

and D. H. Schwela, eds., *Guidelines for Community Noise* (Geneva: WHO, 1999), https://iris.who.int/handle/10665/66217, Table 1, "Guideline values for community noise in specific environments": outdoor living area, serious annoyance, 55 dB(A) LAeq over 16 hours, and moderate annoyance, 50; inside bedrooms, 30 dB(A) LAeq over 8 hours at night for continuous noise; outside bedrooms, 45 dB(A) LAeq over 8 hours at night, with windows open. Executive summary, § 4.2: "When prominent low-frequency components are present, noise measures based on A-weighting are inappropriate."

[198] Scope of the evidence base behind the WHO guidelines: the cardiovascular and metabolic review covered air, road and rail traffic and wind turbines (van Kempen et al. 2018); the sleep review's pooled polysomnographic analysis rests on aircraft and rail field studies (Basner and McGuire 2018); the annoyance review searched "road traffic, rail traffic, air traffic, industrial sites, and wind turbines," but its summary paper reports quantitative results only for aircraft, road, rail, wind turbines and source combinations (Guski, Schreckenberg and Schuemer 2017). On the intermittent character of these sources, Basner and McGuire write: "During the night, noise can often be described as intermittent (i.e., discrete noise events rather than a constant background noise level). In this case, the effects on sleep are primarily determined by the number and acoustical properties (e.g., maximum SPL, spectral composition) of single noise events."

[199] Mathias Basner and Sarah McGuire, "WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environmental Noise and Effects on Sleep," International Journal of Environmental Research and Public Health 15, no. 3 (2018): 519, doi:10.3390/ijerph15030519. The pooled polysomnographic analysis is a re-analysis of raw data from two German Aerospace Center field studies: STRAIN (aircraft; 61 of 64 residents near Cologne-Bonn Airport contributed) and DEUFRAKO (rail; 33 individuals near Cologne and Bonn), each over nine consecutive nights; road traffic estimates combine the two. The model is keyed to the maximum level of single noise events.

[200] Rainer Guski, Dirk Schreckenberg and Rudolf Schuemer, "WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environmental Noise and Annoyance," International Journal of Environmental Research and Public Health 14, no. 12 (2017): 1539, doi:10.3390/ijerph14121539. The percent-highly-annoyed curves for aircraft, road traffic and railway are given as regression equations without confidence intervals. The authors' reason: "The latter is technically possible but not applicable, because the calculation of a confidence interval usually assumes a certain measuring model with a certain distribution of errors in combination with independent observations. None of these assumptions is

met here; therefore, we do not provide confidence intervals for aggregated data." The odds ratios per 10 dB Lden in the same paper do carry intervals.

[201] Basner and McGuire, "Effects on Sleep": habituation to noise during sleep "is not complete, i.e., subjects continue to react to noise events even after several years of noise exposure," and "activations of the vegetative nervous system habituate to a much lesser degree to noise compared to cortical arousals."

[202] Guski, Schreckenberg and Schuemer, "Annoyance": "In terms of 'burden of disease', WHO Europe estimated annoyance to be the second major health effect of environmental noise after sleep disturbance." The authors define noise annoyance as a compound of repeated disturbance of intended activities, an emotional or attitudinal response, and a cognitive response ("the distressful insight that one cannot do much against this unwanted situation").

[203] Kerstin Persson Waye, Johanna Bengtsson, Ragnar Rylander, Frank Hucklebridge, Phil Evans and Angela Clow, "Low frequency noise enhances cortisol among noise sensitive subjects during work performance," Life Sciences 70, no. 7 (2002): 745–758. Thirty-two subjects in a cross-over design performed a two-hour task battery under ventilation noise with dominant low frequencies and under a flat-spectrum reference noise, both at 40 dB(A); noise-sensitive subjects showed enhanced salivary cortisol under the low-frequency condition. The study is a daytime laboratory experiment on stress response and performance, not on sleep or disease. See also Birgitta Berglund, Peter Hassmén and R. F. Soames Job, "Sources and effects of low-frequency noise," Journal of the Acoustical Society of America 99, no. 5 (1996): 2985–3002, which reports that loudness judgments and annoyance reactions are "sometimes reported to be greater for low-frequency noise than other noises for equal sound-pressure level."

[204] Mitsuki Yonemura, Hyojin Lee and Shinichi Sakamoto, "Subjective Evaluation on the Annoyance of Environmental Noise Containing Low-Frequency Tonal Components," International Journal of Environmental Research and Public Health 18, no. 13 (2021): 7127, doi:10.3390/ijerph18137127. Listeners rated broadband noise at background levels of 25, 30 and 35 dB with tonal components at 40, 50, 100, 200 and 400 Hz and tonal audibility of 0 to 12 dB. The measured tonal adjustment ranged from 0 to 7 dB, larger at higher tonal frequencies and larger at lower background levels. The study varied background level, not time of day.

[205] Henk M. E. Miedema and Henk Vos, "Noise annoyance from stationary sources: relationships with exposure metric day-evening-night level (DENL) and their confidence intervals," Journal of the Acoustical Society of America 116, no. 1 (2004): 334–343, doi:10.1121/1.1755241. Cited here only for the existence of an exposure-response analysis for stationary sources and for its finding that annoyance

differs by source type at equal exposure; its functions are not reproduced or applied in this volume.

[206] Va. Code § 15.2-1200 (counties): "Any county may adopt such measures as it deems expedient to secure and promote the health, safety and general welfare of its inhabitants which are not inconsistent with the general laws of the Commonwealth," https://law.lis.virginia.gov/vacode/title15.2/chapter12/section15.2-1200/; Va. Code § 15.2-1102 (cities and towns), which reaches powers "necessary or desirable to secure and promote the general welfare of the inhabitants of the municipality and the safety, health, peace, good order, comfort, convenience, morals, trade, commerce and industry of the municipality," https://law.lis.virginia.gov/vacode/title15.2/chapter11/section15.2-1102/. The municipal grant names "peace, good order, comfort, convenience"; the county grant does not. The zoning power at § 15.2-2280 does not mention noise either. Statutes examined: the two general grants, § 15.2-2280, and the provisions that name local noise ordinances (note 207); none confers express authority to adopt a noise ordinance.

[207] Va. Code § 15.2-980 (civil penalties): "Any locality may, by ordinance, adopt a uniform schedule of civil penalties for violations of that locality's noise ordinance. This provision shall not apply to noise generated in connection with the business being performed on industrial property," with fines capped at "$250 for the first offense and $500 for each subsequent offense," https://law.lis.virginia.gov/vacode/title15.2/chapter9/section15.2-980/; Va. Code § 15.2-917(A) (sport shooting ranges): "No local ordinance regulating any noise shall subject a sport shooting range to noise control standards more stringent than those in effect at its effective date," https://law.lis.virginia.gov/vacode/title15.2/chapter9/section15.2-917/; Va. Code § 15.2-2288.6(C) (agricultural operations): "no local ordinance regulating the sound generated by any activity listed in subsection A shall be more restrictive than the general noise ordinance of the locality," https://law.lis.virginia.gov/vacode/title15.2/chapter22/section15.2-2288.6/. Each presupposes a local noise power it does not itself confer.

[208] S.B. 288, 2024 Gen. Assem., Reg. Sess. (Va.), "Data centers; noise abatement" (Sen. Roem), failed to report from the Senate Committee on Local Government, 7-Y 8-N, 29 January 2024, https://lis.virginia.gov/bill-details/20241/SB288. As summarized in the legislative record, the bill would have required notice within a half mile, neighborhood meetings, a third-party baseline acoustic study, a design not exceeding observed ambient levels, and annual post-occupancy noise studies for five years.

[209] H.B. 2712, 2025 Gen. Assem., Reg. Sess. (Va.) (introduced, LD 25104028D, offered 17 January 2025; patron Del. Ian T. Lovejoy), proposed § 15.2-2209.4, "Siting of data centers; local authority": "in considering any local government land use application required for the siting of a data center … a locality may … (iii) establish and enforce maximum allowable sound levels for operational data center facilities, including the use of alternative low-frequency metrics, and include such requirements in zoning ordinances." Introduced text at https://legiscan.com/VA/text/HB2712/id/3064399/Virginia-2025-HB2712-Introduced.html (accessed 4 October 2026); bill record at https://lis.virginia.gov/bill-details/20251/HB2712. The bill defines no low-frequency metric. Subcommittee #2 of the House Committee on Counties, Cities and Towns recommended laying the bill on the table, 7-Y 1-N, on 30 January 2025; it was left in committee on 4 February 2025.

[210] S.B. 339, 2024 Gen. Assem., Reg. Sess. (Va.) (Sen. Salim), enacted as 2024 Va. Acts ch. 707, https://lis.virginia.gov/bill-details/20241/SB339. As introduced, the bill would have created § 15.2-2288.9 barring local ordinances from regulating the sound of a digital asset mining business in an industrially zoned area; the committee substitute converted the bill into a study, and the enacted chapter carries no such language. The section number is now occupied by an unrelated affordable housing provision (2026 Va. Acts chs. 1009, 1096).

[211] S.B. 1046, 2025 Gen. Assem., Reg. Sess. (Va.), "Data centers; noise abatement" (introduced, LD 25104257D; sole patron Sen. Danica A. Roem; prefiled 7 January 2025), https://lis.virginia.gov/bill-details/20251/SB1046. Subsection E of the introduced text: "Upon issuance of a certificate of occupancy, the data center operator shall conduct a noise study performed by a third-party acoustical engineer to document noise levels emanating from the data center," with annual studies "for five years after completion of the initial post-construction noise study." The bill failed to report (with substitute) from the Senate Committee on Local Government, 5-Y 6-N 4-A, on 27 January 2025; it never reached the Senate floor.

[212] H.B. 1601, 2025 Gen. Assem., Reg. Sess. (Va.), "Data centers; site assessment for high energy use facility" (Del. Joshua E. Thomas), https://lis.virginia.gov/bill-details/20251/HB1601; S.B. 1449, 2025 Gen. Assem., Reg. Sess. (Va.) (Sen. Adam Ebbin), https://lis.virginia.gov/bill-details/20251/SB1449. Both houses rejected the Governor's recommended amendments on 2 April 2025, and both bills were vetoed on 2 May 2025, after the reconvened session; no override vote was taken. The veto message does not mention noise, sound or acoustics.

[213] Va. Code § 15.2-2209.5, "Siting of data centers; site assessment," enacted by 2026 Va. Acts ch. 567 (H.B. 153, Del. Thomas) and ch. 568 (S.B. 94, Sen. Roem),

approved 13 April 2026, effective 1 July 2026, https://law.lis.virginia.gov/vacode/title15.2/chapter22/section15.2-2209.5/ (accessed 4 October 2026). Subsection B: "Prior to any approval of a rezoning application, special exception, or special use permit for the siting of a new HEUF, a locality shall require that an applicant perform and submit a site assessment to examine, to the extent practicable and within the timeline provided by subdivision A 7 of § 15.2-2286, the sound profile of the HEUF on residential units and schools located within 500 feet of the HEUF property boundary." A "high energy use facility" (HEUF) is one the applicant anticipates "will require 100 megawatts or more" (subsection A). Subsection C requires the serving electric utility to submit "a form describing (i) any new or existing substations that will be used to serve the HEUF and (ii) the anticipated transmission voltage required to serve the HEUF"; subsection E provides that a site assessment "shall not be construed to change, replace, or impact any authority or jurisdiction of the State Corporation Commission." The enacted text is the same as H.B. 1601 (2025) as enrolled, under a new section number.

[214] This characterization rests on the full text of § 15.2-2209.5, subsections A through G. No subsection sets a sound level, a metric, a measurement method, a qualification for whoever performs the assessment, a post-approval obligation or a penalty; subsections C and E do not mention sound. Under subsection D the assessment is used to assess "compliance with the locality's adopted noise ordinances," so the substantive limit is whatever the local ordinance provides. The 500-foot radius defines the receptors studied; it is not a setback. Subsection F exempts expansions at approved sites that do not add 100 megawatts or more.

[215] 2026 Va. Acts Spec. Sess. I ch. 1 (H.B. 30), Item 367, ¶ E (Department of Environmental Quality, Air Protection (51300)), approved 29 June 2026, https://budget.lis.virginia.gov/get/budget/5311/HB30; item page https://budget.lis.virginia.gov/item/2026/2/HB30/Chapter/1/367/: "Notwithstanding any other provision of law, the Department shall adopt and is authorized to enforce regulations for noise at any data center, as that term is defined in subdivision A 43 of § 58.1-3506, Code of Virginia, to be effective no later than December 31, 2029." Paragraph E was added by conference amendment; it is absent from H.B. 30 as introduced. As appropriation-act language it has no home in the Code of Virginia.

[216] Item 367 ¶ E, clauses (i) and (ii): the regulations shall "(i) be based on the Department's determination of the lowest achievable noise from a data center; (ii) establish the lowest achievable noise for a data center." The paragraph specifies no numeric target, metric, receptor location, measurement protocol or reference to ambient sound. The phrase echoes the "lowest achievable emission rate" of air permitting.

[217] Item 367 ¶ E, clauses (iii) and (iv): the regulations shall "(iii) provide that on or after January 1, 2030, any data center that violates such regulations shall be subject to a civil penalty of up to $32,500 per day of violation; and, (iv) authorize and provide for enforcement by the Department or the locality in which the data center is located" (punctuation as printed). The figure is a maximum. For comparison, local civil penalties under § 15.2-980 are capped at $250 and $500 per offense and do not reach noise from business on industrial property (note 207).

[218] Exec. Order No. 22 (2026), "Establishing New Nation-Leading Standards and Initiatives to Implement the Virginia Data Center Accountability Framework and Responding to Unprecedented Risk from Artificial Intelligence," 18 September 2026, § C.1 ("Data-Center Noise Protections"), https://www.governor.virginia.gov/media/governorvirginiagov/governor-of-virginia/pdf/eo/eo-22-establishing-va-data-center-accountability-and-ai-initiatives.pdf (accessed 4 October 2026): "DEQ shall prioritize and expedite the development of data center noise regulations consistent with DEQ's existing statutory authority and applicable legislative direction," and "Within 180 days of the date of this Executive Order, DEQ shall provide the Office of the Governor with a proposed accelerated timeline, workplan, and stakeholder-engagement plan for the noise-rulemaking process." One hundred eighty days from 18 September 2026 is 17 March 2027. The order does not identify the statute it means by "existing statutory authority" and sets no decibel figure.

[219] States reviewed besides Virginia: Arkansas, Georgia, Indiana, Maryland, Minnesota, Oregon, South Carolina, Texas and Vermont. This is a review of the enacted and pending instruments of those states, not a survey of all fifty. Arkansas: Act 173 of 2024 (S.B. 78, approved 3 May 2024), "An Act to Amend the Arkansas Data Centers Act of 2023; to Create Requirements for Noise Reduction in the Operation of a Digital Asset Mining Business," https://arkleg.state.ar.us/Home/FTPDocument?path=/ACTS/2024F/Public/ACT173.pdf (accessed 4 October 2026), adding Ark. Code § 14-1-604(b)(3): "Apply noise-reduction techniques, including without limitation: (A) Using liquid cooling or submerged cooling; (B)(i) Fully enclosing the envelope," or "(C) Upon approval by the local government, locating or relocating to: (i) A minimum of two thousand feet (2,000') from the nearest residential or commercial use structure; or (ii) An area zoned for industrial use or an otherwise approved use." Subsection (b)(4) gives landowners within 2,000 feet a right of action in circuit court. The act sets no decibel limit or metric. Maryland's 2025 data center impact assessment act (Ch. 3, 2025 Spec. Sess.) does not mention noise, and Maryland H.B. 1534 (2026), which would have directed sound limits, died in committee; Minnesota's 2025 Laws chs. 12 and 13, Oregon H.B. 3546 (2025), Indiana S.B. 424 (2025) and Texas S.B. 1929 (2023)

contain no data center noise provision; Georgia enacted nothing on the subject in 2025 or 2026; South Carolina S. 867 (2026), which would have set 60 dBA day and 50 dBA night limits, was reported from committee but not passed; and Vermont H.727 (2026) was vetoed, with the override failing 83–52 on 29 May 2026.

[220] Item 367 ¶ E makes the regulations effective "no later than December 31, 2029," and its final sentence preserves local power: "This item and such regulations shall not be construed to limit the authority of any locality to adopt a more restrictive local ordinance regulating noise." Until then a facility approved and occupied in Virginia is subject to no state noise standard.

[221] Item 367 ¶ E: "The initial promulgation of such regulations is hereby exempted from the Administrative Process Act (§ 2.2-4000 et seq. of the Code of Virginia)." The exemption removes the Act's required stages for the first rule, including the notice of intended regulatory action, the proposed stage with its public comment period, and the economic impact analysis. It reaches only the initial promulgation; later amendments are not exempt.

[222] Va. Dep't of Env't Quality, Guidance Document APG-578, "Sudden and Reasonably Unforeseeable Events in the Context of Planned Electric Outages" (applies to 9VAC5-80 and 9VAC5-540, the emergency generator general permit), Virginia Regulatory Town Hall, https://townhall.virginia.gov/L/ViewGDoc.cfm?gdid=7950, and comment forum 2798, https://townhall.virginia.gov/L/GDocForum.cfm?GDocForumID=2798 (both accessed 4 October 2026): "Forum ended on 12/3/2025 with 411 Comments." The comment period ran from 3 November to 3 December 2025; the document took effect 3 January 2026. By the author's count, 76 of the 411 comments (18.5 percent) concern noise, which the guidance does not address.

[223] Sources examined: the regulation inventories of the State Air Pollution Control Board (9VAC5, 28 active and 11 inactive or repealed chapters) and of DEQ (9VAC15), the 429 DEQ guidance documents in effect, DEQ's agency activity listing on the Virginia Regulatory Town Hall, and the Virginia Register of Regulations. None contains a community noise chapter or standard. Regulations predating codification in the Virginia Administrative Code (the pre-1996 "VR" series) were not examined. Narrow provisions exist for occupational exposure in mineral mining (4VAC25-40-770), highway design (§ 33.2-276), airport noise attenuation (§ 15.2-2295) and vehicle exhaust (§§ 46.2-1049, 46.2-1051); none is a community ambient standard. The air pollution statute reaches "one or more substances" in the outdoor atmosphere, Va. Code § 10.1-1300, https://law.lis.virginia.gov/vacode/title10.1/chapter13/section10.1-1300/; sound is

not a substance, and Item 367 ¶ E proceeds by a "notwithstanding" clause and an express grant.

[224] Noise Pollution and Abatement Act of 1970, Pub. L. No. 91-604, tit. IV, 84 Stat. 1709 (Title IV of the Clean Air Amendments of 1970), codified at 42 U.S.C. §§ 7641–7642, which created the Office of Noise Abatement and Control; Noise Control Act of 1972, Pub. L. No. 92-574, 86 Stat. 1234 (Oct. 27, 1972), codified at 42 U.S.C. §§ 4901–4918; amended by the Quiet Communities Act of 1978, Pub. L. No. 95-609, 92 Stat. 3079.

[225] The President's budget for fiscal year 1982, submitted 10 March 1981, "provides for no funding of the noise enforcement program in FY 1982 and indicates that the remainder of 1981 funds will be used to phase out the program by the end of the current fiscal year," as EPA recited at 46 Fed. Reg. 41,057, 41,058 (Aug. 14, 1981) (note 227); see also U.S. Gov't Printing Off., Fiscal Year 1982 Budget Revisions: Additional Details on Budget Savings 294 (1981). On the office's closure in 1982, see Galperin (note 226). No primary document fixing the closure more precisely than the year has been identified.

[226] Joshua Ulan Galperin, "Noise Law," Michigan Journal of Environmental & Administrative Law 15 (2025): 59, at 78 ("Congress never did defund the Office of Noise Abatement and Control") and 81 ("Unequivocally, Congress never passed a law that specifically reduced or removed ONAC funding. No bill even mentioned ONAC or the ONAC noise programs."), https://doi.org/10.36640/mjeal.15.1.noise, open access at https://repository.law.umich.edu/mjeal/vol15/iss1/3. The four appropriations vehicles Galperin examines are the Omnibus Budget Reconciliation Act of 1981, Pub. L. No. 97-35, 95 Stat. 357; the Act of Dec. 15, 1981, Pub. L. No. 97-92, 95 Stat. 1183, 1187; the Department of Housing and Urban Development–Independent Agencies Appropriation Act, 1982, Pub. L. No. 97-101, 95 Stat. 1417; and the Urgent Supplemental Appropriations Act, 1982, Pub. L. No. 97-216, 96 Stat. 180. EPA's fiscal 1982 lump sum for abatement, control and compliance fell to $395 million from $545.2 million, and EPA allocated none of it to noise. The repeal bills were H.R. 3071, 97th Cong. (1981) (passed the House, 127 Cong. Rec. 31,755–56), and S. 1204, 97th Cong. (1981) (passed the Senate, 127 Cong. Rec. 15,584); a conference committee was formed, 128 Cong. Rec. 2490 (1982), and never reported. The Senate committee report approving the cut, S. Rep. No. 97-110, at 2 (1981), accompanied a bill that did not become law.

[227] U.S. Env't Prot. Agency, Noise Emission Standards for Portable Air Compressors, Medium and Heavy Trucks, Motorcycles and Motorcycle Replacement Exhaust Systems, Truck Mounted Solid Waste Compactors, and Noise Labeling Requirements for Hearing Protectors; Suspension of Enforcement of Recordkeeping

and Reporting Requirements, 46 Fed. Reg. 41,057, 41,058 (Aug. 14, 1981) (40 C.F.R. pts. 204, 205, 211), signed by Administrator Anne M. Gorsuch, 7 August 1981: "Preliminary actions by Congress indicate that this portion of EPA's budget will be enacted as proposed." The notice suspended enforcement effective on publication and announced a companion proposal to revoke the requirements; it is not a notice closing the office. The sentence is quoted in Galperin, "Noise Law," n.175.

[228] Quiet Communities, Inc. v. U.S. Env't Prot. Agency, No. 23-cv-1649 (JMC) (D.D.C. July 16, 2026) (Cobb, J.) (29 pp.), https://www.courtlistener.com/opinion/10932268/quiet-communities-inc-v-united-states-environmental-protection-agency/ (accessed 4 October 2026); page references follow the ECF pagination the opinion adopts (n.1). At slip op. 1: "But in 1981, President Reagan submitted a budget proposal to Congress through which he sought to wind down the EPA's noise control work. Congress debated that proposal and considered repealing the Noise Control Act. Ultimately, Congress did not repeal the law but did pass a budget consistent with the President's proposed funding cuts." Decretal paragraph: "Counts four, five, and six are DISMISSED for lack of jurisdiction. The Court grants summary judgment to the EPA on count seven. The Court grants summary judgment to Quiet Communities and Kempthorne on counts one, two, three, and eight (only insofar as count eight relates to the EPA's duties under 42 U.S.C. § 4903(c)(3))." Counts one through three concern EPA's duty under 42 U.S.C. § 4904(c) to "revise or supplement" its reports. On remedy, the court did "not yet address that issue" and observed that "it seems plausible that the remedy on those claims will be limited to ordering the Agency to 'review' the relevant reports and determine if any revision or supplementation is 'appropriate.'" Sources examined for later orders: the Justia docket listing (entries through 20 July 2023 only), Quiet Communities' announcement of 19 July 2026 and Summit Law's note of 21 July 2026; the court's full docket was not examined.

[229] 42 U.S.C. §§ 4901–4918 remain in the United States Code. U.S. Env't Prot. Agency, "EPA History: Noise and the Noise Control Act," https://www.epa.gov/history/epa-history-noise-and-noise-control-act (last updated 6 November 2025): "the Noise Control Act of 1972 and the Quiet Communities Act of 1978 were never rescinded by Congress and remain in effect today, although they are essentially unfunded."

[230] See notes 255 and note 256.

[231] Newsom v. Amazon Data Servs., Inc., No. 3:25-cv-00074-JHY-JCH (W.D. Va., Charlottesville Div.), docket at https://www.courtlistener.com/docket/71349795/newsom-v-amazon-data-services-inc/. Plaintiffs are Austin W. Newsom and Central VA Marine, a boat repair business

on his property; the defendant is Amazon Data Services, Inc. The complaint was filed in the Circuit Court for Louisa County on 11 August 2025 (No. CL25000284-00) and removed on 15 September 2025. Mem. Op. 4, ECF No. 37.

[232] Newsom, Mem. Op., ECF No. 37 (W.D. Va. July 10, 2026) (Yoon, J.) (24 pp.), https://storage.courtlistener.com/recap/gov.uscourts.vawd.136308/gov.uscourts.vawd.136308.37.0_1.pdf, at 23: "the court will deny Amazon's motion to dismiss Count 1 and grant the motion as to Count 2. Count 2 will be dismissed without prejudice," and "This dismissal does not impact Plaintiffs' ability to seek injunctive relief for their Count 1 private nuisance claim." Count 2 was dismissed because injunctive relief is a remedy rather than a cause of action (slip op. 21–23). Within Count 1, the court held the allegations about trucks obstructing the road and near-accidents insufficient to plead causation (slip op. 12–13); the count survived on the remaining interferences.

[233] Newsom, slip op. 2–3, reciting the complaint: "In March 2025, Amazon began construction work to build the 'Northeast Creek Technology Campus,'" and "The Amazon Property construction work began in or about March 2025 and is scheduled to be completed around 2031." These are allegations accepted as true at the pleading stage. Every interference the court catalogues arises from construction activities (slip op. 16). The opinion once refers to construction beginning in "May 2025" (slip op. 16); the background section and the complaint say March.

[234] The opinion, read in full, contains none of the terms "decibel," "dB," "dBA," "dBC," "A-weight," "sound level," "sound pressure," "acoustic," "ANSI," "OSHA" or "sound meter," and no number paired with a unit of sound; its only figures are dates, addresses, paragraph numbers, citations and the clock times of the county ordinance. The complaint (ECF No. 1-1) was not examined.

[235] Newsom, slip op. 15: "But in cases involving many alleged forms of interference, Virginia courts do not assess whether each form, in isolation, is substantial or unreasonable." Id. at 16: so long as the plaintiffs plausibly allege that, "altogether," the construction activities "substantially impair[] [Plaintiffs'] comfort, convenience, and enjoyment of the property," they have stated the element (quoting Nat'l Energy Corp., 286 S.E.2d at 182).

[236] Newsom, slip op. 14 ("Plaintiffs' allegations regarding water pollution, in isolation, may be deficient"), adding that "a lack of certain details about a few forms of interference, among the many alleged in the complaint, does not warrant dismissal of the nuisance claim."

[237] Newsom, slip op. 19 n.5: "Plaintiffs' complaints about the noise and reference to the Louisa County noise ordinance does not convert their claim to one of public

nuisance. ... It did not hold that loud noises in violation of local ordinances cannot give rise to a private nuisance claim. In fact, Virginia courts have consistently recognized private nuisance claims based on loud noises." The footnote then quotes Bowers v. Westvaco Corp., 419 S.E.2d at 666: "The court properly considered the zoning classification of the property as an important factor in determining whether the business is so conducted as to constitute a [private] nuisance." City of Virginia Beach v. Murphy, 239 Va. 353, 389 S.E.2d 462 (1990). The passage is a footnote addressing whether the claim is public or private; it does not decide whether compliance with an ordinance is a defense.

[238] Based on a full reading of the 24-page opinion. It does not cite Barnes v. Graham Virginia Quarries or Smith v. Pittston Co.; does not use the phrase "coming to the nuisance" or any variant; does not discuss the industrial-locality defense or the character of the neighborhood; and does not address whether Amazon complied with any ordinance, which Amazon did not argue. A Rule 12(b)(6) motion does not "resolve contests surrounding ... the applicability of defenses." Newsom, slip op. 5.

[239] Barnes v. Graham Va. Quarries, Inc., 204 Va. 414, 417, 132 S.E.2d 395, 397 (1963). The quarry held a use permit from the Fairfax County Board of Zoning Appeals; the court held that the permit did not immunize it from nuisance liability, citing G. L. Webster Co. v. Steelman, 172 Va. 342, 358, 1 S.E.2d 305, 311 (1939).

[240] Bowers v. Westvaco Corp., 244 Va. 139, 147 (1992): "the location of a business enterprise, or the zoning classification of the property on which the business is located, cannot immunize the business from a nuisance action." The Alleghany County Board of Supervisors had rezoned the lots at the operator's request to permit the truck staging operation and imposed conditions to minimize its effect on neighbors; the court affirmed liability. For the complementary rule that zoning is "an important factor," see Bowers, 419 S.E.2d at 666, quoted in note 237.

[241] Smith v. Pittston Co., 203 Va. 711, 717, 127 S.E.2d 79, 83–84 (1962): the instructions "told the jury, in effect, that the natural rights of particular persons must give way to the rights of trade and industry, a theory which we have rejected in this jurisdiction." The question was "whether or not its operation caused substantial damage to the plaintiff, regardless of the location of the plant and the nature and importance of its operation." Reaffirmed in Bowers, 244 Va. at 147. Locality remains admissible on whether a business is so conducted as to be a nuisance in fact.

[242] On negligence: "it is not necessary to allege or prove negligence when the acts complained of result from a nuisance committed by another in a private capacity." Barnes, 204 Va. at 417, 132 S.E.2d at 397. In Bowers, the operator's mitigation efforts defeated punitive damages but not liability. Va. Code § 3.2-302(A): "No

agricultural operation or any of its appurtenances shall be or become a nuisance, private or public, if such operations are conducted in substantial compliance with any applicable best management practices ... and with any applicable laws and regulations of the Commonwealth relevant to the alleged nuisance," https://law.lis.virginia.gov/vacode/title3.2/chapter3/section3.2-302/; Va. Code § 15.2-917(A) (shooting ranges in compliance with the noise ordinances in effect at approval are not subject to nuisance action "in any matter relating to noise"). Statutes examined for a permit-compliance defense: the Air Pollution Control Law (Va. Code tit. 10.1, ch. 13) and the State Water Control Law (tit. 62.1, ch. 3.1), in full. The only immunity provision in either is § 62.1-44.15:41, which concerns common interest communities that cede stormwater facility maintenance to a locality.

[243] Oak Valley Homeowners Ass'n, Inc. v. Prince William Cnty. Bd. of Supervisors, Record No. 1144-24-4 (Va. Ct. App. July 22, 2025) (published), https://www.vacourts.gov/static/opinions/opncavwp/1144244.pdf. The court held that Va. Code §§ 15.2-2204 and 15.2-2229 impose no duty on a governing body to "listen to and consider" public comment. The Supreme Court of Virginia refused a petition for appeal on 23 December 2025 (No. 250772).

[244] Bd. of Cnty. Supervisors of Prince William Cnty. v. Oak Valley Homeowners Ass'n, Inc., Record Nos. 1584-25-4, 1590-25-4, 1592-25-4 and 2025-24-4 (Va. Ct. App. Mar. 31, 2026) (published), VLW 026-7-114, https://www.vacourts.gov/static/opinions/opncavwp/1584254.pdf. The court held that the published advertisements did not satisfy Va. Code § 15.2-2204(A) and that the Digital Gateway rezonings are void ab initio. The Board of County Supervisors voted on 14 April 2026 not to petition the Supreme Court of Virginia.

[245] Oak Valley II, slip op. 6: "Those limits, however, would not apply to noise during construction or noise from emergency generators used during electrical outages." Id. at 25: staff "was unable to review the developers' noise-mitigation proffers because staff lacked in-house expertise and would have needed to hire an outside consultant," and Supervisor Weir "apologized at the public hearing to various 'close-in neighborhoods,' including Oak Valley, because no noise or viewshed studies had been conducted to determine the adverse impacts on them." Id. at 25 n.15: "Although multiple plaintiffs testified that it was very quiet outside their homes, the record does not include data showing the average decibel level." The proffered caps were 60 decibels by day and 55 at night at the boundary of residentially zoned land; the opinion states no weighting.

[246] Neither Oak Valley decision rests on noise, and no reported Virginia decision located has set aside a data center approval because noise impacts were

inadequately considered. The noise passages appear in the court's standing analysis. Because the caps were "[p]roffers incorporated into each rezoning ordinance" (Oak Valley II, slip op. 6), they fell with the rezonings.

[247] Haas v. Bd. of Supervisors of Goochland Cnty., No. CL25-1270 (Va. Cir. Ct. Goochland Cnty.) (Sanner, J.); case caption and number from Defendants' Responsive Pleading 1, https://www.goochlandva.us/DocumentCenter/View/13045/Defendants-Responsive-Pleading. Josh Janney, "Tract Planning 872-Acre Data Center Campus in Goochland," Virginia Business, 30 June 2026, https://virginiabusiness.com/tract-planning-872-acre-data-center-campus-in-goochland/ (accessed 4 October 2026): the four plaintiffs "allege the county violated state law by failing to properly identify the properties that would be affected and by adopting a measure that differed from what appeared in published notices," and "A hearing on the county's request to dismiss the lawsuit is scheduled for Oct. 20." See also Jackie DiBartolomeo, "Judge Rejects County's Full 8,500-Page Filing in Goochland TOD Lawsuit," Richmond BizSense, 27 May 2026, https://richmondbizsense.com/2026/05/27/judge-rejects-countys-full-8500-page-filing-in-goochland-tod-lawsuit/. The hearing: Goochland County, "Technology Overlay District & Technology Zone," update of 21 October 2026, https://www.goochlandva.us/1408/Technology-Overlay-District-Technology-Z (accessed 24 October 2026), the county's account as a party to the case: the hearing on the county's demurrer was held on Tuesday 20 October 2026, the judge did not issue a ruling at the hearing, and he stated that he would issue a written opinion, with no timeframe provided. No court record of the hearing was examined. The overlay's noise standard (55 dBA and 65 dBC at the property line) is the subject matter of the challenged ordinance; no claim asks the court to rule on it.

[248] Northern Virginia Technology Council, The Impact of Data Centers on the State and Local Economies of Virginia (prepared by Mangum Economics, LLC, March 2022), 34 pp.; Northern Virginia Technology Council, 2024 Virginia Data Center Report (prepared by Mangum Economics, 2024), 30 pp.; Northern Virginia Technology Council, The Impact of Data Centers on Virginia's State and Local Economies, 6th Biennial Report (prepared by Mangum Economics, February 2026), 41 pp.; PwC, Economic Contributions of Data Centers in the United States, 2017–2023 (prepared for the Data Center Coalition, February 2025), 89 pp. Page counts are of the whole documents, appendices included, and sum to 194.

[249] In all four documents, "noise," "decibel," "acoustic" and "nuisance" occur zero times. "Sound" occurs once, in the 2026 NVTC report, as a verb: "the LBNL estimate may sound large in isolation" (p. 35, on water). No document contains a decibel figure.

[250] NVTC, Impact of Data Centers (2026), 33–35. The three items concern blackouts (p. 33), electricity (p. 34) and water (p. 35).

[251] Shafaghat, Klimenko, Hu and Keyvanfar, "The Hidden Net Cost of Data Center Construction and Operation for Household Service Pricing," Buildings 16 (2026): 2813, at 10. The paper does not use the word "noise." It reports no external funding (p. 21).

[252] Sechste Allgemeine Verwaltungsvorschrift zum Bundes-Immissionsschutzgesetz (Technische Anleitung zum Schutz gegen Lärm, TA Lärm), 26 August 1998, GMBl 1998 Nr. 26 S. 503, as amended 1 June 2017, Nr. 7.3, https://www.verwaltungsvorschriften-im-internet.de/bsvwvbund_26081998_IG19980826.htm: "Für Geräusche, die vorherrschende Energieanteile im Frequenzbereich unter 90 Hz besitzen (tieffrequente Geräusche), ist die Frage, ob von ihnen schädliche Umwelteinwirkungen ausgehen, im Einzelfall nach den örtlichen Verhältnissen zu beurteilen. Schädliche Umwelteinwirkungen können insbesondere auftreten, wenn bei deutlich wahrnehmbaren tieffrequenten Geräuschen in schutzbedürftigen Räumen bei geschlossenen Fenstern die ... ermittelte Differenz LCeq – LAeq den Wert 20 dB überschreitet." The English in the text is the author's translation. Under Annex A.1.5 the case-by-case assessment proceeds by DIN 45680 (March 1997) and its Beiblatt 1.

[253] TA Lärm, Annex A.1.5, https://www.verwaltungsvorschriften-im-internet.de/BMU-IG-19980826-KF01-A001.htm: the illustrative list opens with "langsam laufende Ventilatoren (z.B. bei Kühltürmen)," slow-running fans, for example on cooling towers.

[254] The German trigger is measured "in schutzbedürftigen Räumen bei geschlossenen Fenstern," in protected rooms with the windows closed (note 252); no property-line version of it exists. Maryland H.B. 1534 (2026), which died in committee, would have directed limits "that prohibit dBC from exceeding dBA by more than 10 decibels"; a draft ordinance in Franklin County, Indiana, proposes 15 dB; TA Lärm uses 20 dB indoors. The three figures cannot be compared without a stated measurement position.

[255] Documents examined, by body: American Planning Association, Zoning Practice, "Zoning for Data Centers and Cryptocurrency Mining" (June 2022, David Morley), Zoning Practice 42, no. 10, "The Physical Footprint of Artificial Intelligence" (October 2025, Charlie Nichols), and PAS QuickNotes 117, "Data Center Waste Heat Recovery" (6 March 2026), which describe other jurisdictions' ordinances or recommend property-line caps without specifying them; INCE-USA's public policy page and its "Noise Policies in your Community" listing, whose most recent item dates from 2007; the ANSI/ASA standards S12.9 (Parts 1–7), S1.13 and

S12.18, which are measurement standards; National Association of Counties, Data Centers Resource Hub (updated 10 July 2026) and "NACo Informational Primer and County Considerations: Data Centers" (24 February 2026), which describe prevailing practice and state that "NACo does not endorse any particular strategy or approach shared in this resource over another"; National League of Cities, Community Strategies to Address Data Center Development and Operation (Data Centers Fact Sheet 3, September 2025), which contains no decibel value; International Municipal Lawyers Association, Navigating the Regulation of Data Centers (prepared by Best Best & Krieger LLP, 23 September 2025), which mentions noise once; Virginia Association of Counties, County Connections summary of JLARC's report (December 2024) and its 2025 committee presentation on H.B. 1601 and S.B. 1449; and the published materials of the Virginia Municipal League, in which nothing on the subject was found. Four model or sample ordinances with numeric data center noise limits do exist in the United States, from the Kentucky Resources Council, PennFuture, the York County (Pennsylvania) Planning Commission and One Hundred Miles (Georgia).

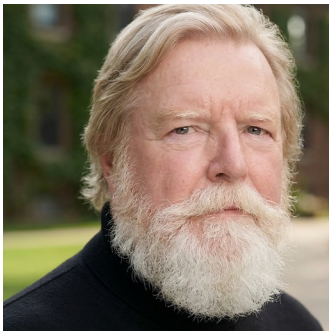
[256] National Institute of Municipal Law Officers in conjunction with the U.S. Environmental Protection Agency, Model Community Noise Control Ordinance, EPA 550/9-76-003 (Washington, DC: EPA, September 1975), ix, 48 pp., dated September 1975 on the cover and title page, https://www.nonoise.org/epa/Roll2/roll2doc7.pdf (accessed 4 October 2026). Article VIII, § 8.1, "Maximum Permissible Sound Levels," refers to Table 1, "Sound Levels by Receiving Land Use," whose limit column is blank, with hours printed as "(A) a.m. to (B) p.m."; § 8.2 provides that limits "shall be reduced by ……. dBA" for pure tones or impulsive sound, also blank. The "76" in the report number does not reflect the printed date.

[257] Town of Warrenton, Special Use Permit SUP2022-0003 (Amazon Data Services, Inc.), approved 14 February 2023, conditions of approval, https://www.pecva.org/wp-content/uploads/Amazon_SUP_conditions_of_approval_2-14-2023.pdf: third-party testing by an ASA or INCE-credentialed professional, annual testing procured by the Town and billed to the applicant for the life of the use, a 48-hour cure period, and automatic suspension of the certificate of occupancy on failure to cure. King George County, Birchwood rezonings Z-2023-00099, Z-2023-00100 and Z-2023-00101 (Birchwood Power Partners, L.P.), approved 5 September 2023, Global Proffer § III(16): 60 dB(A) by day and 55 dB(A) at night at the property line, 15 dB below the county ordinance by day and 10 dB below at night. Rockingham County, OA26-0887, "High Energy Use Facility Noise," adopted 5–0 on 22 July 2026, minutes of the regular meeting of 22 July 2026, pp. 13–15, as printed in the Board of Supervisors agenda packet of 26 August 2026, https://www.rockinghamcountyva.gov/AgendaCenter/ViewFile/Agenda/_08262026-

972 (accessed 4 October 2026); Rockingham County Code § 17-607, Data Center (c)(1): "A baseline noise study conducted by a third-party licensed professional engineer specializing in acoustics or an engineer who is board certified by the Institute of Noise Control Engineering (INCE). The study must document noise and ambient sound levels in the surrounding area of the proposed data center ... The application must incorporate sound mitigation measures recommended in the baseline noise study into the facility design to prevent noise levels from exceeding noise and ambient sound levels observed in the baseline study." The adopted subsection states no post-construction compliance test.

[258] Loudoun pause resolution: Loudoun County, News Flash, "Board Approves Process that Could Pause Legislative Data Center & Substation Applications," 17 September 2026, https://www.loudoun.gov/m/newsflash/home/detail/10874 (accessed 4 October 2026) ("the Board will consider a resolution, that, if approved, would enact the Board's new policy during its October 20, 2026, meeting"); its deferral to 17 November 2026: the Action Report of 20 October 2026 (note 86). Haas: Goochland County, update of 21 October 2026 (note 247). Prince William: DIR 25-36 (Gordy), adopted 28 October 2025, directing staff "to provide a report, one (1) year from now, that includes an analysis of the effectiveness of the noise ordinance, any violations found, and any potential revisions to the noise ordinance that need to be made." Quiet Communities: note 228. Loudoun Phase 2: Loudoun County, "Phase 2 Data Center Standards & Locations," Anticipated Timeline, https://www.loudoun.gov/6222/Phase-2-Data-Center-Standards-Locations (accessed 4 October 2026). DEQ workplan: Executive Order 22 (2026), § C.1 (note 218). Chesapeake: City of Chesapeake, Data Center Ordinance and Policy, open-house board "Station 9" (DocumentCenter item 33331), https://www.cityofchesapeake.net/3783/Data-Center-Ordinance-and-Policy ("On July 21, 2026, City Council voted to implement an 8-month pause on considering applications for data centers"). DEQ regulations and civil penalty: Item 367 ¶ E (notes 215, note 217); the penalty is "up to $32,500 per day of violation."

About the Author



Tommy N. Turner is an independent researcher and writer who documents the local-government and energy dimensions of the data center build-out. His series of jurisdiction-level case studies covers the Virginia counties where those decisions have been made, refused, or contested, and the analytical volumes extend the work into the systems the decisions run on: the transmission network and the cost-allocation machinery, the water law that governs industrial withdrawal, and the rules that determine what a resident can measure and enforce once a facility is running. This volume is the series' account of the last of those: how Virginia's localities chose the instrument that measures data center sound.

Like the rest of the series, it is assembled from primary records, from county packets, action reports and ordinances to the enacted budget, DEQ dockets and the consultants' own reports.

His work spans data center fiscal and environmental policy across Virginia, Georgia, and Tennessee, local public finance, and the governance questions the two raise, and he writes opinion and analysis on Virginia public affairs for outlets including the *Richmond Times-Dispatch*, the *Virginia Mercury*, the *Virginian-Pilot*, the *Roanoke Times*, *Cardinal News*, and *RTO Insider*. He serves on the advisory board of an Alfred P. Sloan Foundation-funded study at Emory University on data centers and the Southern energy buildout. The study had no role in this report. He holds an MBA from Emory's Goizueta Business School and spent three decades in banking, banking technology and consulting before turning to research full time.

The case studies and analytical volumes are published as open, citable editions, each deposited with a persistent identifier and revised as new versions under that identifier rather than replaced by new works. He works from Williamsburg and Christiansburg, Virginia.

Contact tommy@gofast.pro · tommynturner.com · ORCID 0009-0005-7422-9881