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Data Centers & Air Quality



About this series

This series by the Chesapeake Bay Journal explores the impacts of data centers on natural resources.

Key points

- Data centers typically use natural gas or diesel-powered generators for back-up power.
The generators emit pollutants into the air.
- The number and size of data centers is on the rise, leading to more back-up generators.
- Existing regulations curb the impacts on air quality, but a widespread power outage could trigger hundreds of generators and pollute the air.

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The data centers that support web traffic — and the increasing use of artificial intelligence — run 24 hours a day. So, like grocery stores or hospitals, these facilities have generators that are intended to run only during emergencies.

Such emergencies are not unthinkable. In the summer of 2025, for example, a fire knocked out an electrical substation in the midst of Data Center Alley in Loudoun County, VA. The outage caused data centers served by that station to use backup power for “several days,” according to the Virginia Department of Environmental Quality (DEQ).

Some people are concerned about the cumulative impact that similar localized or regional power emergencies could have on air pollution — especially in the Chesapeake Bay region, where data center growth has put unprecedented strain on the power grid.

Depending on its size, a data center can be equipped with dozens or hundreds of tractor trailer-sized generators largely running on diesel or natural gas. Burning these fossil fuels for

power emits pollutants such as particulate matter, nitrogen oxides, sulfur dioxides and carbon dioxide. Some of these pose risks to human health while others degrade air quality in general, affecting the environment and the water where pollutants eventually flow.

The global race to build the infrastructure enabling AI is fueling a rash of new data centers that use exponentially more power than their predecessors. And, the more power they use, the more backup power they need.

Virginia’s DEQ requires air permits for the generators. The permits allow them to kick on periodically for 15- or 30-minute increments to ensure they will work in an emergency. They also restrict when those tests can occur, avoiding hours when heavy commuter traffic is also contributing to air pollution, for example.

DEQ officials wrote in an email to the *Chesapeake Bay Journal* in September 2025 that it has issued permits for 5,447 data center generators in Loudoun County alone. Together, they have the capacity to provide more than 13.6 gigawatts of power. For

comparison, the North Anna Nuclear Generating Station in Louisa County, VA, has the capacity to produce 1.8 gigawatts of power.

DEQ officials said their database does not break down the generators by the types of fuel they use or by the amount of pollutants each emits. There is some variation among units.

A DEQ guidance document states that “while the vast majority of the existing Virginia gen-set fleet is currently diesel-fired, there are cleaner and more efficient technologies available.”

The U.S. Environmental Protection Agency uses a tiered system for regulating non-road diesel engines. Tier I means the machine has the least permissible pollution reductions, and Tier IV means it meets the highest pollution reduction standards.

As of January 2026, facilities can use their Tier II generators during planned power outages if they receive less than 15 days advance notice of the outage. The facilities must also document when, where, why and how long each generator is activated.

State or local governments can choose to require higher tiers of pollution removal from a project or industry, especially when the technology is proven to be available. But such requirements can be costly to an industry that still has a choice of locations for new projects.

Christie Sayes, a professor of environmental science at Baylor University, said the resistance to costlier, cleaner technologies is not limited to data centers.

“In airplanes and cars, catalytic converters exist that are really efficient,” Sayes said. “But in a race to the bottom to make the most inexpensive vehicle, we don’t use that technology to limit pollution.”

Even so, Loudoun County Supervisor Michael Turner says he’s ready to require more of data centers wanting to locate in the county, which is already home to the highest concentration of them in the world. The county’s board earlier this year ended by-right development of land for data



A cyclist passes diesel generators at an Amazon Web Services data center in Ashburn, VA, on Sept. 30, 2025. (Photo/Lauren Hines-Acosta)

centers so that every data center project must be approved by its members. And Turner would like to see more requirements made of the generators that accompany each project.

“Within the data industry, I’m sure I’m known as the Tier IV-generator guy,” Turner said of his desire for data center generators to use the best available pollution controls.

Doing so could have other advantages for an uncertain energy future in which onsite power generation could be important. One data center company is now using Tier IV natural gas-fired combustion turbines as a main power source, in addition to diesel backup generators. Vantage began building onsite power generation after being told by Dominion Energy in 2022 that its \$1 billion project would not be able to get power from the constrained grid for up to three years.

The summer of 2022 was a tipping point for the data center power crunch in Virginia. State regulators proposed allowing Northern Virginia data centers to use backup generators in a more continuous manner for a five-month period when energy “transmission problems” were anticipated. Local homeowners’ associations that already opposed data center projects quickly coalesced to contest the proposal. The industry ended up asking regulators to rescind it.

But the power demands have only

grown since then, especially as more hyperscale data centers enabling AI come online. The region faced another test of its grid when power demand for cooling reached record highs during heat waves in the summer of 2025. PJM Interconnection, which manages the northeastern energy grid, issued permission in late June 2025 for places with high power consumption to use backup systems to prevent blackouts.

A report commissioned by Virginia’s General Assembly in 2024 found that backup generators emit harmful pollutants but that “existing regulations largely curb adverse impacts.” It acknowledges, though, that a “worst-case” scenario involving a widespread power outage could cause hundreds of generators to start up in a concentrated area, fouling regional air quality.

“I think the thing that will get everybody’s attention is when Northern Virginia blacks out or the grid fails,” Turner said. “I think we’ve come closer to that [in 2025] than we have before.” ■

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