



“AIR QUALITY PERMITTING DATA CENTERS IN PENNSYLVANIA”

“REQUIREMENTS AND BEST PRACTICES FOR AIR PERMITTING DATA CENTERS IN PENNSYLVANIA”

The construction and air permitting of data centers continues to be a growing industry worldwide. Each country and state have their own set of requirements as part of the construction and permitting process. Currently, Pennsylvania is a hotbed for data center growth given the recent news regarding 90 billion dollars of investment in data center construction. A critical component of meeting construction schedules and avoiding costly delays is obtaining the air permit required to start project-related construction. Typical aspects of air permitting include preparing an air permit strategy to evaluate construction phases and proposed equipment, collaboration with the regulatory agency, and evaluation of Environmental Justice considerations surrounding the development and establishment of data centers.

While data centers are primarily powered by the electric utility, there are additional power sources used for maintaining continuous power to the data center. Natural gas turbines, natural gas reciprocating internal combustion engines, and/or fuel cells are options that are considered for onsite generation of power, if needed. In the event electricity is disrupted, backup power sources are used to support the data center operations. The most common backup power sources are diesel emergency backup generators. These diesel-fired emergency engines generate emissions of air pollutants regulated at the federal level by United States Environmental Protection Agency (U.S. EPA) and at the state level, primarily under the Pennsylvania Department of Environmental Protection (PADEP), requiring careful evaluation for potential air emissions.

Location is critical when considering potential construction and development. Pennsylvania is one of the northeastern states that is located in the **Ozone Transport Region (OTR)** under the Clean Air Act (CAA). As such, states, counties, and cities identified in 40 Code of Federal Regulations (CFR) §81.457 are subject to lower applicability thresholds for criteria pollutants even if they meet **ozone National Ambient Air Quality Standards (NAAQS)**, which could significantly impact a project’s maximum capacity of installed equipment. Additionally, major source thresholds (MST) may be lower dependent upon the region in Pennsylvania. For example, in Pennsylvania the MST for volatile organic compounds (VOCs) is 50 tons per year (tpy) except in a five-county area in Southeast Pennsylvania, where the threshold is 25 tpy, including **Bucks, Chester, Delaware, Montgomery, and Philadelphia counties**. The geographic area in which construction will occur greatly impacts the potential for stricter regulations that may be applied, along with requirements for improvement to help offset additional air quality concerns to the community, such as through environmental justice initiatives. Staying below the MST is critical for reducing one additional hurdle during the permitting process.

The Federal New Source Review (NSR) program is comprised of two distinct permitting programs: PSD and Non-Attainment New Source Review (NNSR). The PSD regulations are designed to ensure that the air quality in current attainment areas does not significantly deteriorate beyond baseline concentration levels. PSD regulations specifically apply to the construction of major stationary sources in areas designated as attainment or unclassifiable with respect to the NAAQS for each criteria pollutant¹. NNSR

¹ Criteria air pollutants include the six common air pollutants, also known as “criteria air pollutants”. These pollutants include ozone, particulate matter, carbon monoxide, lead, sulfur dioxide, and nitrous dioxide.

regulations specifically apply to the construction of major stationary sources in areas designated as nonattainment with respect to the NAAQS for each criteria pollutant that is designated as nonattainment. Data centers typically stay below the respective PSD and NNSR thresholds to avoid lengthy processing and review time. However, depending on the desired capacity, staying below these thresholds could result in limited availability for the onsite generation and/or backup sources on site. This paper reviews the nuances of the permitting process in Pennsylvania, specifically regarding synthetic minor sources (i.e., sources that accept a regulatory limit to stay below major source thresholds).

POTENTIAL AIR EMISSIONS ASSOCIATED WITH DATA CENTERS

Without onsite generation, emergency backup generators are the most significant air emissions sources at data centers. With onsite generation, the mix of equipment will vary. Regardless, large data centers may include hundreds of generators, each with a capacity of 2-3 megawatts (MW) or more. Key pollutants, of diesel include:

- Nitrogen Oxides (NO_x)
- Carbon Monoxide (CO)
- VOCs
- Particulate Matter (PM₁₀ and PM_{2.5})
- Sulfur Dioxide (SO₂), primarily from diesel fuel
- Hazardous Air Pollutants (HAPs), e.g., formaldehyde

Minor air emissions sources may include fire pumps, fuel tanks, wet cooling towers, and fugitive emissions from refrigerant systems. These sources are typically insignificant compared to generators.

The key steps to determine air quality permitting requirements for a data center are:

- **Calculate the Potential to Emit (PTE):** Determine the maximum potential air emissions from all sources at the facility, primarily the emergency generators and onsite generation. If onsite generation is needed, depending upon ownership/operatorship, PTE from both prime and backup power may need to be aggregated for the purposes of permitting. As discussed above, Pennsylvania is located in the northeast OTR; therefore, major source applicability has lower emissions thresholds. A facility located in Bucks, Chester, Delaware, Montgomery or Philadelphia Counties that emits or has PTE of at least 25 tpy of VOC or NO_x will be considered a major facility and shall be subject to the requirements applicable to a major facility located in a severe nonattainment area for ozone. While PTE must be calculated based on the source's physical and operational constraints, for emergency backup generators, the U.S. EPA allows PTE calculation at 500 hours per generator².³ Evaluate EJ considerations such as areas of concern and impacts on low-income and low-wealth communities, identifying potential impacts on the surrounding area and environment where the proposed data center is to be located. Pennsylvania's EJ Mapping and

² Memorandum from Director John Seitz at EPA, OAQPS Office. September 6, 1995.

³ <chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.epa.gov/sites/default/files/2015-08/documents/emgen.pdf>

Screening Tool (PennEnviroScreen) is available [online](#). The state-of-the-art mapping tool allows facilities to more accurately identify the surrounding communities facing environmental justice issues using more than 30 environmental, health, and socioeconomic indicators. **Public Participation** allows an avenue in which residents can share their opinions on proposed permits. **(EJ) Policy:** Evaluate EJ considerations such as areas of concern and impacts on low-income and low-wealth communities, identifying potential impacts on the surrounding area and environment where the proposed data center is to be located. Pennsylvania's EJ Mapping and Screening Tool (PennEnviroScreen) is available [online](#). The state-of-the-art mapping tool allows facilities to more accurately identify the surrounding communities facing environmental justice issues using more than 30 environmental, health, and socioeconomic indicators. **Public Participation** allows an avenue in which residents can share their opinions on proposed permits.

- **Identify Permit Type:** Based on the PTE, determine the required permit, which could range from a simple exemption to a major source Plan Approval. While U.S. EPA allows calculation of PTE at 500 hours, given the size of the data centers and the desired capacity, the PTE will usually exceed the MST. Therefore, a facility will propose an operational limit (i.e., hours of operation or fuel firing capacity) and corresponding PTE, which is incorporated into the permit as an enforceable limit. As a result, data centers usually do not qualify for exemptions and almost in all cases require a Plan Approval for construction.
- **Conduct Best Available Technology (BAT) Analysis:** For most new sources, prepare a BAT analysis to identify and implement the most effective emissions control strategies. Per 25 Pennsylvania Code (Pa. Code) 121.1, BAT is defined as equipment, devices, methods, or techniques that will prevent, reduce, or control emissions of air contaminants to the maximum degree possible, and which are available or may be made available. As noted above, data centers are often synthetic minor sources and not subject to U.S. EPA Best Available Control Technology (BACT) or Lowest Achievable Emission Rate (LAER) requirements. PADEP does not explicitly define a process for conducting a BAT analysis, but a top-down approach to review all potential control options is typically used to fulfill BAT, consistent with U.S. EPA's procedure for major sources.
- **Submit Application and Engage PADEP:** Prepare and submit the appropriate permit application and maintain open communication with the relevant PADEP regional office throughout the process.

CALCULATE POTENTIAL TO EMIT

The need for an air permit is determined by the facility's PTE, calculated as the maximum emissions if all equipment operates 24 hours a day, seven days a week for 365 days at full capacity, unless limited by an enforceable permit condition (i.e., hours of operation or total fuel firing capacity). For emergency generators, U.S. EPA allows for PTE calculation using 500 hours/year rather than 24/7, but even then, most data centers accept limits on total operation to restrict PTE to avoid more complex permitting programs.

MAJOR SOURCE THRESHOLD

As discussed above, Pennsylvania is in the OTR, which results in lower thresholds for ozone precursors (NO_x and VOCs). Exceeding MSTs triggers the most stringent permitting reviews under the New Source

Review (NSR) program and requires a TVOP. Data centers can use a combination of operational limits and/or BAT (e.g., control technology) to potentially avoid MSTs by lowering emissions.

Table 1
Major Source Thresholds

Pollutant	Emissions Threshold	
	Attainment Area (tons/year) ^(a)	Nonattainment Area (tons/year) ^(b)
NO _x	100	50 (as part of the OTR); 25 in severe nonattainment areas (e.g., Philadelphia Metro)
CO	250	100
VOC	50	50 (as part of the OTR); 25 in severe nonattainment areas (e.g., Philadelphia Metro)
PM ₁₀	250	100
PM _{2.5}	250	100
SO ₂	250	100
Single HAP	10	10
Total HAPs	25	25

Note: A single 2.5 MW diesel generator operating for 100 hours per year can emit over 2 tons of NO_x. A facility with 25 such generators could have a PTE of over 50 tons per year, triggering major source status for NO_x.

ENVIRONMENTAL JUSTICE POLICY

Environmental Justice is a crucial step in the construction and air permitting process in Pennsylvania. PADEP has published an [Environmental Regulatory Process](#), established to allow access to the public to view regulatory updates and access for Public Participation to allow for feedback from stakeholders. As part of the EJ process, PADEP has developed [PennEnviroScreen](#) Tool, which can be used to identify communities facing EJ issues and determine if a project is viable in a proposed location.

IDENTIFY PERMIT TYPE

Once PTE calculations and threshold determinations are complete, permit applicability can be used to identify the appropriate permit type. Depending upon the PTE threshold exceedances, Pennsylvania specific permits and/or a Federal TVOP may be required.

PERMITTING & PERMITTING TYPES IN PENNSYLVANIA

As part of the permitting process, Pennsylvania has established two programs, the [Pennsylvania Permit Fast Track Program \(Fast Track\)](#) and [Streamlining Permits for Economic Expansion and Development \(SPEED\)](#). The Fast Track program allows for public engagement and expedited reviews during the application process. Fast Track was developed to allow for governmental entities and private stakeholders to collaborate during the permitting, licensing, and other authorizations for projects of significant economic development and critical infrastructure projects. The SPEED program was designed to expedite the permitting process by using PADEP-approved qualified professionals to complete the initial review of an application to determine completeness and if there are any technical deficiencies.

PADEP permit applications require application forms; PTE calculations and basis documentation (i.e., equipment specification sheets); BAT analysis; and notification letters to the local municipality and county. PADEP also requires a [General Information Form \(GIF\)](#) to be completed. The GIF is used by PADEP to inform other departments at PADEP in the event other authorizations and permits may be required to complete the proposed project or activity, which could include zoning or conservation efforts. Within the GIF, client, site, facility, project, land use, and historical information of the land use are listed to support the application process and coordinate with other PADEP departments.

AIR QUALITY PERMIT EXEMPTIONS

In accordance with [25 Pa. Code § 127.14](#), PADEP has defined limited exemptions from PADEP Plan Approval. Most large installations of emergency generators at data centers would not qualify for permit exemptions and these exemptions often do not apply.

Request for Determination (RFD)

RFDs are a formal request to PADEP to determine if a Plan Approval is required for a small project. PADEP RFDs are unlikely to apply for any data center with new generators.

General Permit (GP-9): Stationary Internal Combustion Engines

GP-9 is a streamlined permit for certain diesel engines but limited applicability for large data centers and unlikely for onsite generation. This permit has specific engine size and emissions limits that a large generator fleet will likely exceed. It is more suitable for single-engine installations or very small facilities and may not apply to data centers.

Plan Approval

Pennsylvania's primary pre-construction permit is the Plan Approval. It is required before installing, constructing, or modifying any air contamination source unless exempt. **This is the most common and necessary permit for a new data center.** The application must include detailed engineering plans, PTE calculations, and a BAT analysis.

- **Major vs. Minor:** If the facility's PTE exceeds the MSTs (Table 1), the Plan Approval review will be subject to PSD requirements for attainment pollutants and/or NNSR for nonattainment pollutants. NNSR is more stringent and requires emissions offsets.

State-Only Operating Permit (SOOP)

Once construction under the Plan Approval is complete, the facility must obtain an operating permit for facilities with emissions above [Pennsylvania de minimis](#) levels but below Title V MSTs. The Plan Approval often rolls into a SOOP.

FEDERALLY ENFORCEABLE OPERATING PERMIT

Title V Operating Permit

Once construction under the Plan Approval is complete, the facility must obtain an operating permit. For all major sources, this is a federally enforceable permit that consolidates all applicable air quality requirements into a single document. It involves significant ongoing compliance, monitoring, and reporting obligations.

CONDUCT BEST AVAILABLE TECHNOLOGY ANALYSIS

A Plan Approval application typically includes a "top-down" BAT analysis to demonstrate that the proposed emission controls are effective and available, considering economic, energy, and environmental impacts.

COMMON BAT FOR DATA CENTER GENERATORS

For Diesel Engines (typical for backup power):

- **Baseline:** Use of Ultra-Low Sulfur Diesel (ULSD) fuel is standard.
- **Tier Certification:** At a minimum, engines must meet the latest applicable U.S. EPA Tier standards. Facilities have the option to install emissions control technology to retain minor source status if operational limits alone are not sufficient (e.g., Tier 4 equivalent engines or Tier 4 certified engines).
- **NO_x Control:** Selective Catalytic Reduction (SCR) is a common control for NO_x, involving the injection of a urea solution (Diesel Exhaust Fluid or DEF) into the exhaust stream, which in conjunction with the catalyst, reduces NO_x emissions.
- **PM/CO/VOC Control:** A Diesel Oxidation Catalyst (DOC) and/or Diesel Particulate Filter (DPF) are standard BAT for these pollutants.
- **Greenhouse Gases (GHGs):** Large stationary sources commonly emit pollutants categorized under GHGs, which include carbon dioxide (CO₂) and sulfur hexafluoride (SF₆). As part of BAT, a facility must quantify CO₂ emissions from fuel combustion. Additionally, if the facility owns an electric substation or substation connections, quantities of SF₆ must be considered and included in the carbon dioxide equivalent (CO₂e) potential emissions.

SUBMIT APPLICATION AND ENGAGE PADEP

Permitting timelines are a critical component of project scheduling. The following are target timeframes under PADEP's "Permit Decision Guarantee" policy, but complex projects often take longer.

Table 2
Agency Processing Times

Permit/Action Type	Target Processing Time	Realistic Timeline/Notes
RFD	30 days	Generally accurate for simple requests.
GP-9	30-45 days	Generally accurate if the application is complete and clearly meets all GP-9 conditions.

Minor Source Plan Approval	~4-6 months	Can extend to 9+ months depending on PADEP regional workload and application complexity.
Major Source Plan Approval (PSD/NNSR)	~9-12 months (could be shortened using SPEED)	Can easily extend to 18+months . These reviews are complex, often involve federal U.S. EPA oversight, and may require a public hearing
TVOP (Initial)	Up to 18 months (by statute)	The process begins after construction is complete. The facility can typically operate under the Plan Approval conditions while the TVOP is being processed.

BEST PRACTICES FOR PERMITTING DATA CENTERS IN PENNSYLVANIA

For a data center to best set themselves up for a successful permitting experience, ALL4 recommends the following items as Best Practices for air permitting in Pennsylvania:

- **Engage Early and Often:** Schedule a pre-application meeting with the appropriate PADEP regional office to introduce the project, discuss potential emissions, and understand the specific concerns of the regional office. This can identify major issues early and streamline the review process. Once the application is submitted, maintain an open line of communication during the application and permit review process. The environmental landscape for data centers is changing regularly; early engagement allows stakeholders to stay current on the latest. For example, there are efforts to require municipality engagement much sooner than has been required historically, sharing information such as full build, electric/fiber/water/sewer commitments, and more to gain approval in the pre-development process. Stay turned to see if this becomes a reality.
- **Prepare a Strategy:** Prepare an air permitting strategy (in-house or with a consultant) to find the best balance of the three levers available once a location has been selected: operational flexibility (e.g., hours of operation or fuel consumption limits), capital expenditure (e.g., emissions controls), and regulatory burden (which permitting programs are the facility willing to accept). This starts with the PTE calculations, using vendor-guaranteed emission rates and a realistic but defensible operational limit to provide stakeholders with scenarios to consider. The strategy also walks through permitting program options, potential BAT applicability, permitting timeline, EJ applicability, permitting risks, and more.
- **Negotiate BAT with PADEP:** Plan for conversations with PADEP to discuss BAT and control technology possibilities and their financial impacts on the project from the beginning.
- **Hire Experienced Consultants:** Navigating the PADEP permitting process requires expertise. Engage an environmental consulting firm strong data center experience and a proven track record of permitting large sources in Pennsylvania. This is particularly important if a nonattainment area and/or onsite generation is being considered.



- **Plan for Long Lead Times:** Build the permitting timeline into your overall project schedule from day one to avoid costly delays and can help anticipate longer wait times during the permitting process.

If you have any questions or would like assistance in evaluating how your facility may be subject to air permitting requirements as a data center, please reach out to **Merritt McGlynn** at mmcglynn@all4inc.com, **Sharon Sadler** at ssadler@all4inc.com, and **Colleen Nagel** at cnagel@all4inc.com. ALL4 will continue to track updates to additional guidance or rulemaking regarding the construction and permitting requirements for data centers not only in Pennsylvania, but for other U.S. states as well; check out our website routinely or subscribe for our newsletter to stay up-to-date.