



Power to Data Centers Get the Air Permit!

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Webinar Topics

- Rise of the Hyperscale Data Center
- Siting and Major Source Air Permitting
- Power Generation Equipment
- Limiting Potential-to-Emit in Air Permits
- Data Center Air Permitting Topics & Tips
- Review an Air Permit Process Timeline
- Example Data Center Power Permitting Project

BlueScape Experience with Data Centers

- Working on large data center air permits in several states
- Strength in *Air Permit Strategy & Execution*
- Experience with permit technical studies
 - Turbines and engines; gas and diesel fuel
 - Best equipment fit and requirements
 - Emissions control technologies
 - Air emissions and dispersion modeling impacts
- Track record in driving a fast air permit process
- Environmental compliance programs for data centers

Rise of the Hyperscale Data Center!!



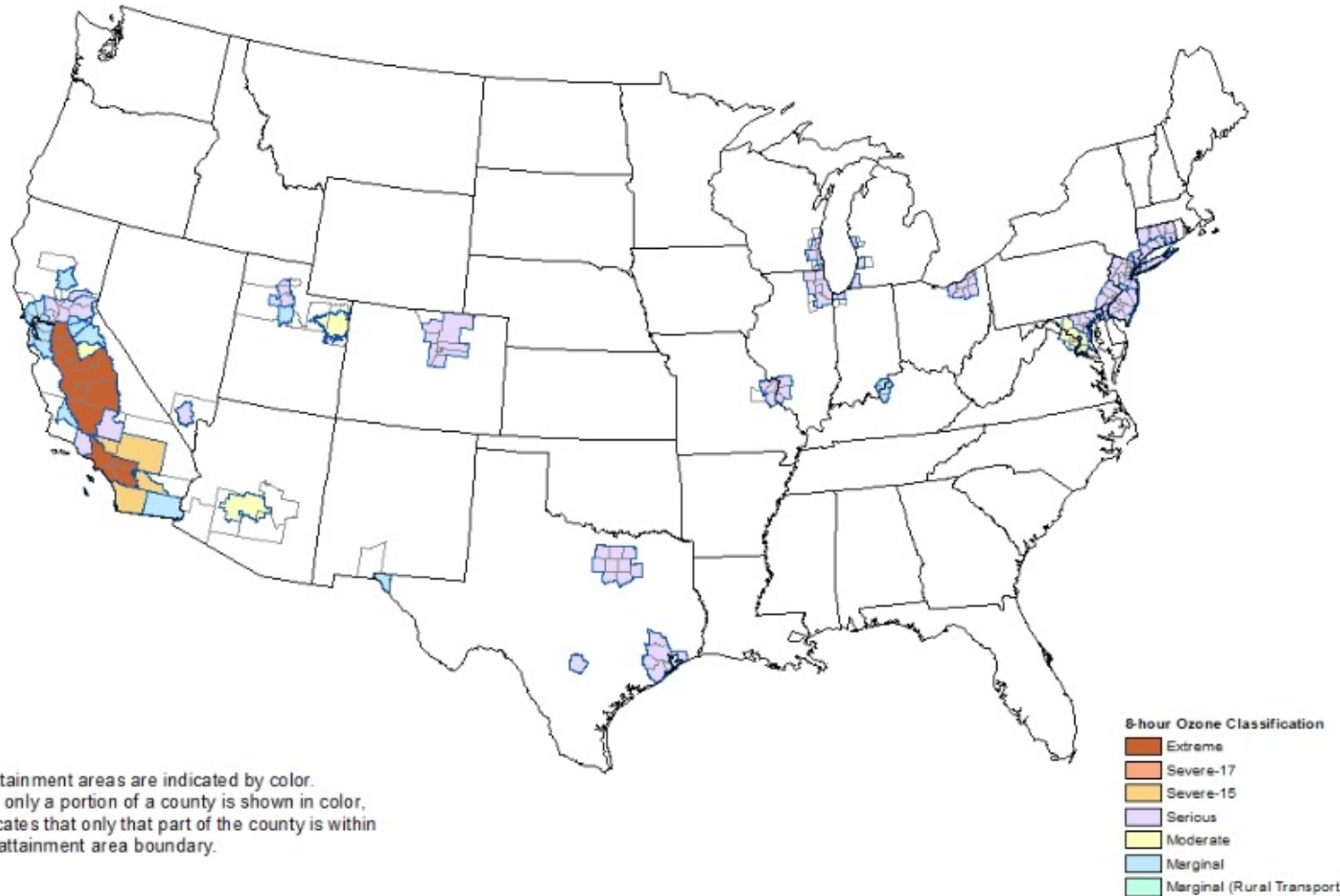
Siting and Major New Source Review

- Where can I (easily?) site a large data center?
- Air permitting focus is criteria pollutants:
 - National Ambient Air Quality Standards (NAAQS)
 - Ozone (NO_x and VOC precursors), PM₁₀, PM_{2.5}, CO, SO_x
- Attainment and Nonattainment Areas
 - Attainment Area: Prevention of Significant Deterioration (PSD) Major NSR
 - Nonattainment Area Major NSR (NNSR)

Ozone Nonattainment Areas

8-Hour Ozone Nonattainment Areas (2015 Standard)

05/31/2025



Nonattainment areas are indicated by color. When only a portion of a county is shown in color, it indicates that only that part of the county is within a nonattainment area boundary.

Reference: www3.epa.gov/airquality/greenbook/map8hr_2015.html

Major New Source Review

- Potential-to-Emit (PTE) sets permitted emissions
- PSD Major New Source Review
 - 250 tons/year (TPY) of a criteria pollutant
 - 100 TPY if one of 28 listed equipment/source categories
 - 100,000 TPY GHG, only if a major source of a criteria pollutant
 - Best Available Control Technology
 - Ambient Standards and Increments Modeling
 - Class I Area Analysis
- Major Nonattainment Area NSR:
 - Thresholds depend on attainment status
 - Emissions offsets required, ratio such as 1:15
- Lengthy permit process with substantial technical review, EPA and public review
- Avoid? Synthetic Minor NSR source, PTE limited with federally enforceable conditions
- What can I build with/without the major NSR construction permit?

Power Equipment Possibilities



Backup Diesel Engine



Gas Turbine



Gas Engine

Tale of Three Units: Backup Diesel Engines

- Purpose to run data center when unforeseen loss of grid (or onsite plant) power in an emergency
- Meet minimum EPA Tier 2 certified emission standards
- Vendors provide EPA-certified emissions, (g/kWh, g/bhp and gal/hour) at various engine loads
- New Source Performance Standard (NSPS) Subpart IIII allows 100 non-emergency hours
- PTE: State agencies use 100 hours/year for non-emergency up to 500 hours with emergencies
- EPA Tier 4 final emission standards:
 - Selective Catalytic Reduction (SCR) for NO_x, particulate filters with a diesel oxidation catalyst (DOC) for CO and VOC
 - Packaged, aftermarket

Backup Diesel Engines (cont)

g/kw-hr, > 560 kW	NOx	NOx + VOC	VOC	CO	PM
Tier 2	--	6.4	--	3.5	0.2
Tier 4	0.67	--	0.19	3.5	0.03

- Large Tier 2-certified engines easily become a NOx or CO Major Source
- **Solution** – Minor Source; Limit PTE with federally enforceable conditions:
 - Restrict the facility permit maximum total hours, *total engine hours or fuel even best*
 - Track emissions on a 12-month rolling average basis

Tale of Three Units: Gas Turbines

- Purpose to provide onsite prime power, bridge power
- Greater efficiency and cost-effectiveness if operating 24/7
- Not typical to operate at steady-state loads less than 80%
- Vendor emissions provided in ppm @15% O₂ and MMBtu/hr LHV (convert to HHV = LHV x 1.108)
- Subject to NSPS Subparts KKKK and TTTTa
- NSPS TTTTa requires 80-90% CO₂ emissions control by 2032
 - Baseload, greater than 250 MMBtu/hr or 25 MW generator
 - EPA proposal to repeal or modify rule released June 17, 2025
- Emission controls are SCR for NO_x and Oxidation Catalyst for CO and VOC (none for PM)
- What about startup and shutdown emissions?
- Dual-fuel capability for backup, diesel or propane

Tale of Three Units: Gas Engines

- Purpose to provide prime power, or peaking power when grid prices high
- Engines tend to be more cost-effective than turbines
- Greater flexibility for variable loads
- Vendor emissions provided in ppm @15% O₂ and MMBtu/hr LHV (convert to HHV)
- PTE: subject to NSPS Subpart JJJJ emission limits
- Emission controls are SCR for NO_x and Oxidation Catalyst for CO and VOC (none for PM)
- Startup and shutdown emissions also a consideration

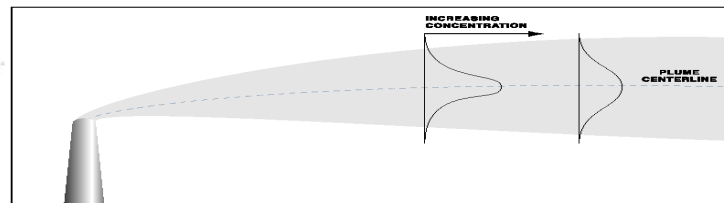
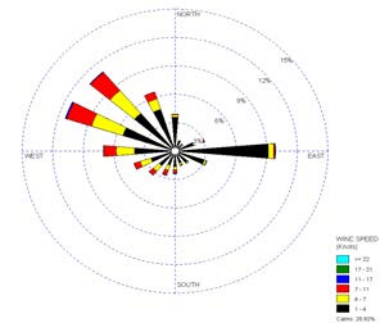
BACT Emissions Control Requirements

- Best Available Control Technology (BACT)
 - Required for PSD major source permits and in certain nonattainment areas
 - Achieved-in-Practice, but “top-down” review may be required
 - Can consider cost-effectiveness in attainment areas
 - Major source in nonattainment area: Lowest Achievable Emission Rate (LAER)
- If BACT not required, flexibility in setting emission limits
- Role in limiting PTE, but capital and O&M cost trade-off
- Strategy to limit need for BACT emissions controls

Air Quality Modeling

Meeting Ambient Health Standards

- National and state ambient air quality standards
 - NO₂, PM₁₀, PM_{2.5}, SO₂, CO and VOC (ozone)
 - 1-hour/annual NO₂, 24-hour PM₁₀ and PM_{2.5}
 - Special consideration for intermittent sources
 - Can't pass? emission controls, limit operations, stack height changes, move stacks
- Air dispersion modeling to show compliance
- Understand requirements and do modeling feasibility review early on
- Submit your own modeling analysis to agency?



The Other Major Source Threshold & Title V Operating Permits

- Title V is a federal operating permit
- EPA Title V Permit Major Source Thresholds
 - 100 TPY criteria pollutants in attainment areas
 - Lower thresholds in nonattainment areas
 - 100,000 TPY GHG, only if major source of a criteria pollutant
 - 10 TPY of one hazardous air pollutant (HAP) or 25 TPY total HAPs
- Other triggers: Acid Rain Permit, specific industry emission standards
- Applicability triggered before construction?
- Title V permit includes additional monitoring, recordkeeping and reporting
- Synthetic Minor permit is an option
- Is a Title V permit so bad?

Reference: www.epa.gov/title-v-operating-permits/who-has-obtain-title-v-permit



Ways to Limit Potential-to-Emit

- Limit PTE to:
 - Establish “synthetic minor” federal permit status (NSR or Title V), or
 - Avoid need for emissions offsets
 - Reduce air quality modeling impacts to compliance
- Operational controls – limit hourly, daily or annual hours at 100% load, fuel-based equivalent
- Flexibility: establish an annual limit “bubble” across all units
- Add emission controls
 - BACT is applicable no choice; otherwise you have flexibility
 - Diesel engines: Tier 4 controls
 - Gas Turbine or engine units: SCR and OxCat
- Other permit strategies:
 - Break up project sites
 - Bring in 3rd party power plant operator
- Or... just *GO BIG* and get a PSD air permit!

Topic 1: Phasing and Major Source Triggers

- A permit that *avoids* major source status is a *federally enforceable permit*
- NSR circumvention is illegal or “sham permitting”
- Do you want to violate the federal Clean Air Act?
 - Fines and/or Jail, oh my!
 - Lawsuits
 - Abatement of your Facility construction or operations until compliant
 - What was your knowing intent, what did you actually do?
- EPA presumes any phased development within 3 years could presumed be aggregated
- Tips:
 - Be up front with regulatory agencies on known phasing, all the way
 - Prepare to “permit back to zero” with new phases

Reference: www.epa.gov/enforcement/criminal-provisions-clean-air-act



Topic 2: Emission Unit Aggregation

For a Stationary Source, emission units are:

- Contiguous property
- Under common control
- Same industrial grouping
- Interdependent?



Q1: Do data center backup engines and a prime power plant on same site need to be aggregated?

Q2: Can I break up data center phases into parcels ¼ mile apart?

Tip: Get an agency determination on whether emission units must be aggregated.

Topic 3: Changes and Death by 1,000 What Ifs

- What if I ... change scenarios/equipment, fuels, up- or downsize rating, less/more, 3rd party contracts? Phew!
- Tips:
 - *IF* getting the initial facility construction permit is your priority:
 - Run design scenarios for equipment very early; dial in on the issues
 - Design to GO BIG ... and don't change your "placeholder equipment"
 - Make no changes in middle of permit process
 - Modify your permit when plans settle; best emissions and impacts go down not up

Typical Air Permitting Schedule

- Allow at least ONE YEAR maybe TWO for the permit to construct
- Design feasibility review 1-2 months; permit application 2-3 months.
- Draft permit issuance
 - Synthetic Minor source permit – 6-9 months from application submittal
 - PSD or Major NSR permit – 1 to 2 years from submittal
- Expect several iterations with the State air agency on the application
- Public hearing – 30 to 60-day period
- EPA Admin Review: for major source permits, 45 days
- Title V permit application – usually 18 months after operations start

Typical Air Permitting Schedule (cont)

- Developers' biggest mistakes causing delays?
 - Not knowing the importance and value of the air permit
 - Assuming the air permit easy to get; not realizing there are constraints
 - Not starting the design and feasibility process early
 - Not lining up equipment and controls vendors early to have good information
 - Changing up the project too much
- Goal is to find your best path to minimize constraints and expedite the process

blueAI Data Center Project - Design

blueAI Project Description:

- 1.2 GW Data Center project in 2 Phases over 2.5 years
- 1.35 GW in emergency backup engines
- Baseload power plant will also sell power to the Grid
- Project proponent will own/operate all equipment

Phase 1:

- 200 x 3 MW = 600 MW Cummins QSK95-G9 emergency backup diesel engines
- 10 x 37 MW = 370 MW prime power, Siemens SGT-750 simple-cycle gas turbines with SCR & OxCat (meets BACT)
- Gas turbines phase in for bridge power 24/7 while substation built

Phase 2:

- 250 x 3 MW = 750 MW Cummins backup diesel engines

State Requirements:

- Attainment area for all pollutants
- For PTE, 100 hours/year assumed for non-emergency use, diesel engines
- BACT only if a PSD source, but gas engine/turbine controls are necessary
- Air quality modeling for NAAQS is required

blueAI Data Center Project

Initial Emissions

					Phase 1 Emissions (TPY)			
Phase 1	Count	Unit Power (MW)	Total Power (MW)	Hours of Operation Per Unit Per Year	NOx	CO	VOC	PM10/PM2.5
3 MW Backup Diesel - Cummins QSK95-G9 (Tier 2)	200	3	600	100	402	231	21	13
38 MW Simple Cycle Turbine - Siemens SGT750 (SCR + OxCat)	10	37	370	8760	144	106	60	101
Total Phase 1			970		546	338	81	114

					Phase 2 Emissions (TPY)			
Phase 2	Count	Unit Power (MW)	Total Power (MW)	Hours of Operation Per Unit Per Year	NOx	CO	VOC	PM10/PM2.5
3 MW Backup Diesel - Cummins QSK95-G9 (Tier 4)	250	3	750	100	55	289	16	2
Total Phase 2			750		55	289	16	2

Total Project Emissions (TPY)					
Phase	Total Power (MW)	NOx	CO	VOC	PM10/PM2.5
Phase 1	970	546	338	81	114
Phase 2	750	55	289	16	2
Total Emissions	1720	601	627	97	117
<i>PSD Thresholds</i>		250	250	250	250

blueAI Data Center Project Emissions after Limiting PTE

					Phase 1 Emissions (TPY)			
Phase 1	Count	Unit Power (MW)	Total Power (MW)	Hours of Operation Per Unit Per Year	NOx	CO	VOC	PM10/PM2.5
3 MW Backup Diesel - Cummins QSK95-G9 (Tier 2)	200	3	600	35	141	81	7.4	4.6
38 MW Simple Cycle Turbine - Siemens SGT-750 (SCR + OxCat)	10	37	370	5000	82	62	34	58
Total Phase 1			970		223	143	42	62

					Phase 2 Emissions (TPY)			
Phase 2	Count	Unit Power (MW)	Total Power (MW)	Hours of Operation Per Unit Per Year	NOx	CO	VOC	PM10/PM2.5
3 MW Backup Diesel - Cummins QSK95-G9 (Tier 4)	250	3	750	35	19	101	5.5	0.9
Total Phase 2			750		19	101	5.5	0.9

Total Project Emissions (TPY)					
Phase	Total Power (MW)	NOx	CO	VOC	PM10/PM2.5
Phase 1	970	223	143	42	62
Phase 2	750	19	101	5.5	0.9
Total Emissions	1720	243	244	47	63
<i>PSD Thresholds</i>		<i>250</i>	<i>250</i>	<i>250</i>	<i>250</i>

blueAI Data Center Project - Outcome

- One Stationary Source, all units in both phases will be aggregated
- Synthetic Minor (non-PSD) Permit for New Source Review:
 - Started with BACT controls for gas turbines
 - Limit engines to 35 hours/year for testing and maintenance
15,750 hrs/yr at 100% load, total gallons fuel-equivalent
 - Limit gas turbines to 50,000 hours/year 100% load, MMBtu/yr HHV equivalent
 - Tier 2 diesel engines for Phase 1 saves \$80 million
 - Tier 4 diesel engines will be required for Phase 2
- Acid Rain Permit application required for “utility units”
- NSPS Subpart TTTTa currently requires 80-90% CO2 control by 2032 for turbines
- A Title V Permit will be required, but within 12-18 months from initial operation
- Air quality modeling required to pass NAAQS for NO2:
 - Turbine and engine stack height increases
 - Limit the number diesel engines tested any hour and only in daytime hours

Summary – Air Permitting for Data Centers

- Big data centers need lots of power!!
- Site in an attainment or nonattainment area, Major Source NSR threshold constraints
- Decide best equipment fit, run emissions scenarios as needed against constraints
- Include backup scenarios, different backup fuels, startup/shutdown emissions
- Know what emissions controls are required up front as BACT, or by applicable rules
- See how you can limit PTE to get the permit faster and avoid compliance issues
- Complete feasibility emissions and air quality modeling early to be sure no design constraints
- Plot your air permit strategy, be careful with project phasing and illegal circumvention
- Things will change, but avoid that to get your initial permit to construct
- A Title V permit or even PSD permit might be required
- Give BlueScape a call if you'd like us to run permit scenarios for you!

Questions?



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