Power Generation

What Tier 4 Regulations Mean to Operators of Large Stationary Generators

White Paper

By Ananth Parameswaran
Director, Power Systems and Global Marketing, Cummins Power Generation

It's hard to believe that we're already well into year four of the Environmental Protection Agency's (EPA) Tier 4 standards, and yet there still seems to be ambiguity surrounding the implications for large stationary generator systems.

Evolution of EPA Emissions Standards on Diesel Engines

On the surface, the EPA's emissions standards are fairly straightforward. Starting in the mid-1990s, the EPA had enforced progressive emissions reductions on diesel engines, both on-road and stationary engines. For large stationary generator systems, such as those used in critical protection segments for emergency standby power and non-emergency purposes, Tier 2 emissions standards went into effect in 2007 that significantly reduced nitrogen oxides (NOx), carbon monoxide (CO), particulate matter (PM) and non-methane hydrocarbons (NMHC).

As of January 1, 2011, the EPA graduated its emissions regulations to the Tier 4 interim (Tier 4i) requirement, imposing even stricter emissions reductions on large generator sets than previous Tier 2 limits. One important distinction with the Tier 4i standard is its firmer position on non-emergency use, requiring all new generator sets built after 2011 to meet Tier 4i certification to enable non-emergency

operation. It was at this time that questions about complying with Tier 4i arose, and operators became increasingly unclear about what constituted allowable use for large generators. Adding to the confusion are questions about the Tier 4 Final (Tier 4F) requirement that goes into effect in January 2015, and the increasing regulations found in high-pollution, high-population zones designated as "non-attainment areas" because of their inability to meet the EPA's clean air standards.

The intent of this white paper is to clear the air conclusively on the current Tier 4i regulations and explore the implications of the future Tier 4F standard. In the process, generator set owners and specifiers will gain the knowledge they need to make the right decisions on how to best comply with Tier 4 standards.

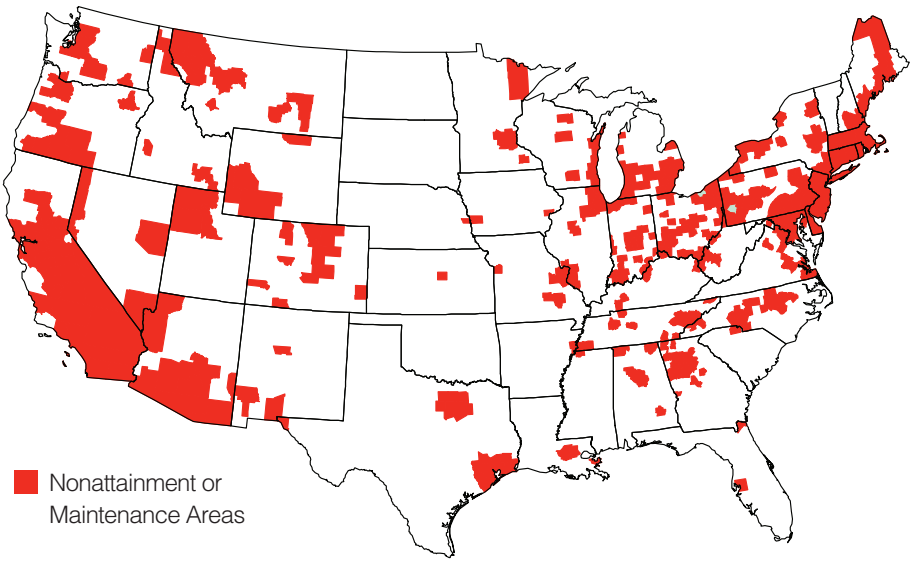
Emergency Versus Non-emergency: Important Definitions

Emergency Use: The EPA defines "stationary emergency applications" as those in which generator set operation is limited to emergency situations and required testing and maintenance. Examples of emergency use include: the ability to produce power for critical networks, equipment and facilities when electric power from the local utility is interrupted; the option to respond to disaster scenarios by powering emergency response equipment, such as pumping water in the case of fire or flood. There is a 100-hour run time limitation each year for maintenance and testing (otherwise known as "exercising") purposes — run time usage more than 100 annual hours will be subject to applicable fines (See section: *What Are the Operator's Responsibilities?*).

Non-emergency Use: The EPA considers all run time usage other than for emergency purposes "non-emergency" usage. All new generator sets intended for non-emergency use must be Tier 4i is; as of January 2015, Tier 4F certification required.

Non-attainment Areas: Refers to areas of the country that have not attained the current EPA air quality standards, and are subject to stricter emissions limits. In addition, these regions may also be governed by local environmental regulations boards (ERBs) that can enforce even more stringent emissions requirements. Some non-attainment areas and local ERB-designated zones may require Tier 4 certification to operate for both emergency and non-emergency situations. While within local or state governance, these ERBs have full authority to enforce EPA standards to the fullest extent, and often dictate stricter clean air requirements than national standards.

Areas Designated as Nonattainment or Maintenance by the EPA



Specific information and maps may be found in the EPA's Green Book
http://www.epa.gov/airquality/greenbook/index.html

Most Commonly Asked Operator Questions

As a result of evolving standards and regional considerations, operators of large generator sets today are considering several important Tier 4-related questions:

Q: Do storm avoidance and peak shaving constitute non-emergency use?

A: Yes. The EPA defines "stationary emergency applications" as those in which generator set operation is limited to emergency situations and required testing and maintenance. Storm avoidance and peak shaving are both considered non-emergency because operators typically self-generate power while the primary source of utility power is still available. Emergency uses refer to the ability to produce power for critical networks, equipment and facilities when electric power from the local utility is interrupted.

Q: If I am operating in a non-attainment zone, what are the acceptable emissions requirements for emergency standby power?

A: Since each non-attainment zone falls under the jurisdiction of its state or local environmental review board, each may have differing standards. You may even be required to operate a Tier 4-certified generator set for emergency uses in these areas.

Q: What is the difference between Tier 4 interim and Tier 4 Final?

A: Tier 4i, or interim, refers to the New Source Performance Standards (NSPS) emissions limitations that became effective on Jan. 1, 2011, for all new, stationary non-emergency diesel generator engines. The Tier 4i standard significantly cuts NOx and PM emissions and expands operational flexibility to also include non-emergency use with the achievement of Tier 4i certification.

Tier 4F, or Final, refers to the NSPS emissions standard that will become effective on all large stationary generator sets in 2015. Requiring additional, significant reductions in PM, Tier 4F represents the highest level of clean air regulations proposed to date.

Q: What are the specific Tier 4i and 4F emissions restrictions for high-horsepower, stationary generator sets?

A: Allowable emissions are dependent upon the size of the generator.

EPA Tier 4 Interim and Tier 4 Final Allowable Emissions

Generator Sets Greater Than 751 HP

Exhaust Constituent	Tier 4i (752–1,207 hp)	Tier 4i (>1,207 hp)	Tier 4F (>751 hp)
Effective on Jan. 1 of:	2011	2011	2015
NOx	3.50	0.67	0.67
HC	0.40	0.40	0.19
CO	3.50	3.50	3.50
PM	0.10	0.10	0.03

(All figures are in g/kW-hr.)

Exploring the Potential of Non-emergency Use

Many owners of large generator sets today are considering the vast potential that Tier 4 certification affords beyond traditional backup power. Taking into account the level of emissions reduction achieved and the many benefits gained from non-emergency operation, Tier 4 certification provides the opportunity to achieve total operational flexibility. A few common non-emergency applications include:

Prime power refers to the option for an owner to operate a generator set as needed to maintain uptime and increase reliability for any number of power generation purposes.

Rate curtailment (or peak shaving) is the process through which generator operators can participate in an arrangement with a local utility that allows the operator to activate self-generated power during the utility's peak demand periods, thus avoiding peak utility rates.

Storm avoidance is, as its name suggests, the option to engage generator power in anticipation of power interruption from the local utility due to incoming storms. If the power then does go out, they will have effectively avoided any disruption. In addition, the owner may also elect to run the generator after the power has been restored to allow time for proper utility stabilization (or a return to normal, stabilized power supply).

Non-attainment zone generator operators are often subject to the strictest emissions-reduction standards in order to meet the clean air objectives of the designated region, for both emergency and non-emergency uses. At the very least, Tier 4i certification is required to comply with these stringent regulations. And in some cases, Tier 4F-certified generators are the only technologically viable system to provide this degree of emissions scrubbing.

For all new generator sets built since 2011, only Tier 4i-certified systems offer the operational flexibility to run during all emergency and non-emergency applications, with no limitations or concerns about allowable run time. As of January 2015, Tier 4F certification will be required for this degree of flexibility.

Keeping an Eye on the 2015 Tier 4 Final Standard

Even though the EPA's Tier 4 Final standard doesn't take effect until January 1, 2015, many operators of large generator sets are already considering the implications of the stricter emissions limits. The dramatic reduction in particulate matter (PM differentiates Tier 4F from the current Tier 4i standard, prompting generator set manufacturers to develop PM removal techniques. Even though Tier 4i certification is acceptable through 2014, many operators are deciding to go with Tier 4F-certified generator sets today.

Industries that seek to reduce their environmental footprint, such as the data center segment, are interested in Tier 4F-certified generator systems because they represent the best available control technology (BACT) for emissions reduction. Generator operators who are subject to the strict emissions limits imposed in non-attainment areas may already be required to use a system that provides protection equal to Tier 4F levels. And, as emissions restrictions in non-attainment areas are likely to increase as time goes on, having a system that is Tier 4F-certified is an advantage to those operators who require a flexible generator set architecture that can adapt to changing requirements.

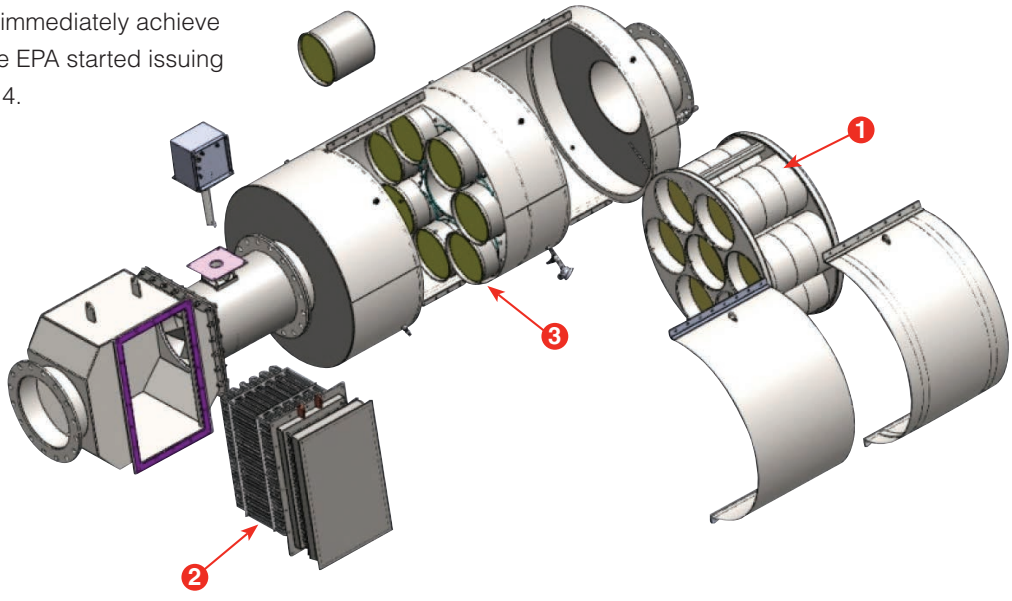
In response to the increasing Tier 4 standards and customer demands, some generator set manufacturers began offering generator sets meeting the Tier 4F standards several years ago. These manufacturers were able to immediately achieve Tier 4F certification when the EPA started issuing certifications in January 2014.

Aftertreatment Systems Provide Tier 4F Certification

Aftertreatment systems used on large stationary diesel generator sets rely on a combination of proven selective catalytic reduction (SCR) technology and new innovations to reduce emissions by removing exhaust constituents to acceptable Tier 4F levels.

❶ ***Selective Catalytic Reduction (SCR)*** — To remove the NOx required to achieve Tier 4 certification, generator set manufacturers have adapted proven on-road, emissions-reduction technology for stationary applications. SCR works in combination with a diesel exhaust fluid (DEF) injection system to introduce DEF into the exhaust stream, monitor NOx surrounding the catalyst, and reduce it to less than 0.67 g/kW-hr on average throughout the EPA test cycle.

❷ ***Exhaust Pre-heater and*** ❸ ***Diesel Particulate Filter (DPF)*** — The addition of an exhaust pre-heater and DPF is required on some larger stationary generator sets to meet the Tier 4 PM and NOx reduction levels. Pre-heaters are designed to rapidly heat exhaust to 450° F, beginning the NOx conversion process in as little as nine minutes. In addition, DPF technology reduces PM up to 94 percent, bringing PM down to acceptable Tier 4F levels.



What Are the Operator's Responsibilities?

Emergency and non-emergency generator set operators are subject to the EPA's notification and reporting requirements. With the EPA issuing penalties of $37,500 per engine for emissions violations, it's important for owners to understand what's required of them.

Stationary non-emergency engines

Owners of non-emergency engines greater than 3,000 hp must register with the EPA and submit an initial notification of operation, including:

- Name and address of the owner or operator
- The address of the affected source
- Engine information: make, model, engine family, serial number, model year, maximum engine power and engine displacement
- Emission control equipment
- Fuel used

Owners are responsible for keeping the following records for the EPA:

- All notifications submitted to the EPA
- Maintenance conducted on the engine
- Documentation from the manufacturer that the engine is certified to meet emission standards

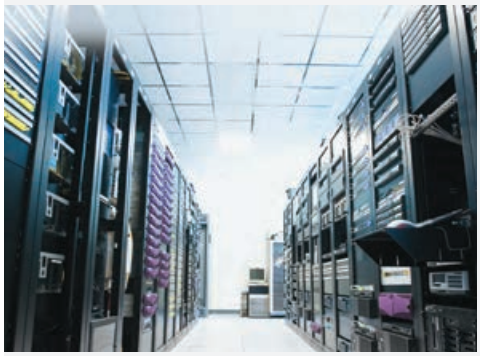
Operators of Tier 4-certified large generator sets between 751–2,999 hp do not have to submit notification or reporting to the EPA.

Stationary emergency engines

Owners of stationary emergency engines are not required to submit an initial notification. The owner must keep records of the engine's operation in emergency and non-emergency service. This data must be recorded through the unit's non-resettable hour meter. The owner must also record the time of operation of the engine and the reason it was in operation during that time.

Engines with DPF

If the stationary engine is equipped with a diesel particulate filter, the owner must keep records of any corrective action taken after the back-pressure monitor notifies the owner that the engine is approaching its high back-pressure limit.



Tier 4 Certification Enables Operational Flexibility

In conclusion, the most important thing generator set operators need to understand — in order to meet their individual requirements and comply with EPA regulations — is that Tier 4F certification is the only way to ensure total operational flexibility. Some operators may seek Tier 4F certification and BACT to improve their green position. Others may need additional emissions reductions to comply with stricter regional mandates. Regardless of individual requirements, the primary obligation that must be met is Tier 4 certification. This first step is critical for all new generator set applications, opening the door to the unlimited possibilities of non-emergency use, and removing all doubt of the operator's ability to achieve Tier 4F compliance … and peace of mind.

For everything you need to know about EPA Tier 4 emissions regulations, go to www.tier4answers.com

About the author

Ananth Parameswaran is director — Power Systems and Global Marketing at Cummins Power Generation. In this role, he has global responsibility for marketing and product planning for integrated power systems, power distribution and power plants. Prior to Cummins, Ananth was an entrepreneur in India and also worked with the Tata Group. He has a bachelor's degree in mechanical engineering from the College of Engineering, Pune and an MBA from Harvard University.

Cummins Power Generation
3850 Victoria Street North
Shoreview, MN 55126
USA

Phone 763 574 5000
USA toll-free 877 769 7669
Fax 763 574 5298

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power.cummins.com

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