US: STATIONARY DIESEL ENGINES

History

The US Clean Air Act requires that New Source Performance Standards (NSPS) be established to control emissions from new stationary sources.[1] An NSPS requires these sources to control emissions to the level achievable by best demonstrated technology (BDT), considering costs and any non-air quality health and environmental impacts and energy requirements. New sources are defined as those whose construction, reconstruction, or modification begins after a standard for them is proposed.

In 1979, EPA proposed NSPS standards for stationary engines, but they were never finalized. In the absence of federal regulations, emissions from stationary engines gradually became subject to a complex system of state and/or local regulations and permit policies, such as those in California, Texas, or the eight NESCAUM states (Connecticut, Maine Massachusetts, New Hampshire, New Jersey, New York, Rhode Island and Vermont).

The NSPS standards for stationary engines were adopted through several regulations.

The following are some of the important regulatory steps:

- On 11 July 2006, EPA promulgated emission regulations for stationary diesel engines, which require that most new stationary diesel engines meet the Tier 1-4 emission standards for mobile nonroad engines.
- On 18 January 2008, EPA promulgated emission standards for stationary spark ignition (SI) internal combustion engines.
- On 28 June 2011, EPA amended the 2006 rule to strengthen the standards for engines of 10-30 liters per cylinder to levels required by marine engines of the same sizes. The final rule also aligns emission standards for engines above 30 liters per cylinder with those for marine engines. The proposal also includes minor revisions to the SI engine requirements.

In addition to the NSPS standards, emission requirements for certain categories of new stationary engines are also specified by the National Emission Standards for Hazardous Air Pollutants (NESHAP). Since the NSPS and NESHAP emission standards were adopted through a number of rules—in some cases prompted by court actions against EPA by various environmental or industry groups—the structure of the regulations is complex.

Emission regulations for stationary diesel engines are published in Title 40 Chapter I, Part 60 of the Code of Federal Regulations (CFR).

Applicability

The NSPS standards apply to stationary compression ignition internal combustion engines (CI ICE) as defined below:

- A stationary internal combustion engine refers to any internal combustion engine, except combustion turbines, that converts heat energy into mechanical work and is not mobile. Stationary ICE differ from mobile ICE in that a stationary internal combustion engine is not a nonroad engine as defined at 40 CFR 1068.30, and is not used to propel a motor vehicle or a vehicle used solely for competition. Stationary ICE include reciprocating ICE, rotary ICE, and other ICE, except combustion turbines.
- A compression ignition engine refers to a type of stationary internal combustion engine that is not a spark ignition (SI) engine. An SI engine means a gasoline, natural gas, or liquefied petroleum gas fueled engine or any other type of engine with a spark plug (or other sparking device) and with operating characteristics significantly similar to the theoretical Otto combustion cycle. Spark ignition engines usually use a throttle to regulate intake air flow to control power during normal operation. Dual fuel engines in which a liquid fuel (typically diesel fuel) is used for CI

and gaseous fuel (typically natural gas) is used as the primary fuel at an annual average ratio of less than 2 parts diesel fuel to 100 parts total fuel on an energy equivalent basis are SI engines.

Typical examples are stationary diesel engines used to generate electricity and operate compressors and pumps at power and manufacturing plants. The rule also covers stationary engines that are used in emergencies, including emergency generators of electricity and water pumps for fire and flood control. The emission standards apply to new, modified, and reconstructed stationary diesel engines (i.e., existing in-use engines are not affected).

Timing

The emission standards apply to engines whose construction, modification or reconstruction commenced after 11 July 2005—the date the proposed rule was published in the Federal Register. Compliance with Tier 1 standards was delayed to 1 April 2006 for non-fire pump engines and to 1 July 2006 for fire pump engines.

Technical Standards

The standards apply to emissions of NOx, PM, CO, and NMHC. They are expressed in units of g/kWh and smoke standards as a percentage. No new emission limits were developed for stationary engines.

Rather, the engines are required to meet emission standards for various types of mobile engines, depending on the engine size and application:

1. Engines of displacement below 10 liters per cylinder must meet Tier 1 through Tier 4 emission standards for mobile nonroad diesel engines (almost all stationary engines in the USA belong to this size category). Engines used only for emergencies, for example stand-by generator sets, are exempted from the most stringent Tier 4 emission requirements.
2. Engines of displacement above 10 liters per cylinder must meet emission standards for marine engines.

   Two groups of standards have been adopted: (1) for engine manufacturers, and (2) for engine owners/operators. Beginning with model year (MY) 2007, engine manufactures are required to emission certify stationary engines, and so they are responsible for compliance. During the transitional period before the MY 2007, engines can be sold that are not emission certified. In that case, the engine owner/operator is responsible for emission compliance.

Standards for Engine Manufacturers

Emission certification requirements for stationary non-emergency diesel engines are summarized below. From 2007, all stationary engines below 30 liters per cylinder must be certified to the respective standards, as applicable for the model

year and maximum engine power (and displacement per cylinder in marine standards).

Emission Requirements for Non-Emergency Stationary Engines			
Displacement (D)	**Power**	**Year**	**Emission Certification**
D < 10 L per cylinder	≤ 3000 hp	2007+	Nonroad Tier 2/3/4
	> 3000 hp	2007-2010	Nonroad Tier 1
		2011+	Nonroad Tier 2/4
10 ≤ D < 30 L per cylinder	All	2007+	Marine Cat. 2 Tier 2/3/4
D ≥ 30 L per cylinder	All	2010-2011	Marine Cat. 3 Tier 1
		2012+	Marine Cat. 3 Tier 2/3

Emission certification requirements also apply to emergency engines from 2007, but the certification levels are less stringent:

- Emergency engines that are not fire pump engines must be certified to the standards shown in the table above, with the exception of standards (including nonroad Tier 4 and marine Category 3 Tier 3) that require “add-on” controls such as diesel particulate filters or NOx reduction catalysts.
- Emergency fire pump engines must be certified to standards that are generally based on nonroad Tier 1 and Tier 2, with Tier 2 effective in the 2008-2011 timeframe, depending on the engine power category.

  The time allowed for maintenance and testing of emergency engines is 100 hours per year.

Standards for Engine Owners/Operators

Depending on the engine category, owners and operators are responsible for emission compliance as follows:

- Engines < 30 liters per cylinder
    - Pre-2007:
        - Engines < 10 liters per cylinder must meet nonroad emission standards.
        - Engines ≥ 10 liters per cylinder must meet MARPOL Annex VI NOx limits (Tier 1 marine standards)
    - 2007 and later: owners/operators must buy emission certified engines
- Engines ≥ 30 liters per cylinder:
    - Under the 2006 rule, owners/operators are required to reduce NOx emissions by 90%, or alternatively they must limit NOx to 1.6 g/kWh (1.2 g/hp-hr). Owners/operators are also required to reduce PM emissions by 60%, or alternatively they must limit PM to 0.15 g/kWh (0.11 g/hp-hr).
    - Under the 2011 rule, engines must be certified to the standards shown in the table above.

Owners/operators of pre-2007 engines < 30 liters per cylinder can demonstrate compliance by purchasing a certified engine. If a non-certified engine is purchased, compliance may be demonstrated using emission test results from a test conducted on a similar engine; data from the engine manufacturer; data from the control device vendor; or conducting a performance test. If in-use performance test is conducted, the owner would be required to meet not-to-exceed (NTE) emission standards instead of the respective certification emission standards. Pre-2007 engines must meet NTE standards of 1.25 × the applicable certification emission standard. The information which demonstrates engine compliance and the appropriate maintenance records must be kept on site.

Owners/operators of engines ≥ 30 liters per cylinder must conduct an initial performance test to demonstrate emissions compliance (NOx is measured using EPA Method 7E, PM using EPA Method 5 (40 CFR part 60 appendix A). The NTE standards do not apply to engines ≥ 30 liters per cylinder.

Fuel Program - The affected engines would also have to switch to low sulfur fuels:

- Engines below 30 liters per cylinder:
    - No more than 500 ppm sulfur by October 2007,
    - Ultra-low sulfur diesel (15 ppm sulfur) by October 2010.
- Engines ≥ 30 liters per cylinder: 1,000 ppm sulfur fuel from 2014 (proposed).

  These fuel requirements are consistent with those for mobile nonroad engines and marine engines. Some of the fuel quality requirements are delayed in areas of Alaska.

Source: http://transportpolicy.net/index.php?title=US:_Stationary_Diesel_Engines_(NSPS)