

MACT 101

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Many have heard of the current MACT (Maximum Achievable Control Technology) regulations, but they may be unaware of its impact. What does it mean? How will it affect us? The MACT rule affects many aspects of the stationary engine owner/operator, from environmental permitting to daily operations and recordkeeping. The question is, who is affected, what engines are affected, what needs to be done and by when? This article is an introduction to MACT for existing and new reciprocating engines, explaining it from a high level, and providing answers to some of the questions above. This article does not address the gas turbines. Let's start with a little history.

Background:

MACT regulations are developed by the US Environmental Protection Agency (EPA), and address air toxics emissions from specific equipment categories and industrial operation. The final rule for RICE (Reciprocating internal combustion engine) MACT promulgated on February 26, 2004 by the EPA drives at reducing toxic air emissions from stationary engines found in pipeline compressor stations and other industrial facilities. The goal is to reduce air pollutants such as formaldehyde, acetaldehyde, acrolein and methanol. These emissions are categorized as "Hazardous Air Pollutants" (HAPs) or air toxics. The MACT regulation requires emissions controls for certain engines, depending upon the engine type, facility size, and whether the engine is new or existing. EPA projects that air toxics will be reduced nationally by 5600 tons in the fifth year after the promulgation of the rule.

Who:

There are several steps to determine MACT applicability for your reciprocating engines

1. Determine if your facility is considered a "Major Sources". A major source facility is one that emits greater than 25 tons per year (TPY) of a combination of toxic air pollutants or greater than 10 TPY of any single constituent. For facilities that include engines, 10 TPY of formaldehyde emissions will typically be the emission that triggers classification as a major source. A facility that is designated a major source can avoid MACT by being recategorized as a "synthetic minor" source if modifications are made to reduce the facility emissions below the major source threshold.
2. Determine if the specific engine in question has a site horsepower rating greater than 500.
3. Determine the category the engine falls under, for natural gas-fired engines:
 - a. 4-stroke rich burn (4SRB),
 - b. 4-stroke lean burn (4SLB),
 - c. 2-stroke lean burn (2SLB),
 - d. Emergency,

e. Limited Use.¹

The engine must fall under one of these categories. For example if the engine is a 4SRB that is a “Limited Use” engine, then it falls under the limited use category.

The 4SRB category is defined as an engine where the manufacturer’s recommended air/fuel ratio setpoint divided by the stoichiometric air/fuel ratio is less than or equal to 1.1. If there are no manufacturer’s standards for the air/fuel ratio setpoint, the engine is considered a rich burn if the oxygen content in the exhaust is less than or equal to 2%. The 4SLB category is defined as a 4-stroke engine that is not a rich burn. The 2SLB category includes any engine that is 2-stroke cycle. MACT does not recognize 2-stroke rich burn engines.

Engines defined under the Emergency category are units that are operated in an emergency such as production of power for critical systems if local utility power is lost or for pumping of water in case of flood or fire. These engines may be operated for maintenance/readiness checks and for up to an additional 50 hours per year in other non-emergency situations. During an emergency, there is no operational time limit. An engine that would fall under the Limited Use category would be a unit that is operated less than 100 hours per year.

Now that we have determine what type of engine you have, we must identify which engines are subject to MACT requirements. Table 1.0 outlines which categories are subject to MACT. Note that the only existing units subject to MACT are 4SRB units.

Table 1.0

Category	Engine Status Under MACT	MACT Requirements
4-Stroke Rich Burn	Existing	Full MACT Requirements
	New or Reconstructed	Full MACT Requirements
4-Stroke Lean Burn	Existing	No MACT Requirements
	New or Reconstructed	Full MACT Requirements
2-Stroke Lean Burn	Existing	No MACT Requirements
	New or Reconstructed	Full MACT Requirements
Emergency Use	Existing	No MACT Requirements
	New or Reconstructed	Initial Notification Only
Limited Use	Existing	No MACT Requirements
	New or Reconstructed	Initial Notification Only

How:

If an engine has “No MACT Requirement” then nothing is required by the owner/operator. However, the burden of compliance is on the owner. It is recommended that the owner keep on hand documentation explaining why the particular unit is not subject to MACT.

For “Initial Notification” for emergency and limited use engines, the owner/operator is required to submit documentation to the EPA Region and/or delegated authority outlining the specifics of the unit/owner and also clearly state that the RICE is for limited or emergency use only, therefore not subject to the MACT

¹ For the purpose of this article, categories for compression ignition (CI) and engines that combust on landfill or digester gas have not been included.

requirements. Note that Initial Notification is also a requirement for units subject to Full MACT Requirements.

For the purpose of a MACT overview, we will focus on the “Full MACT Requirements” for a 4-stroke rich burn. We will briefly discuss the differences between the 4SRB, 4SLB and 2SLB following this section. The requirements for a 4SRB engine are broken into seven sections:

1. Emissions Limits
2. Emission Test Requirements
3. Operating Limits and Parameter Monitoring Requirements if using a NSCR catalyst
4. Operating Limits and Parameter Monitoring Requirements if not using a NSCR catalyst
5. Startup, Shutdown, Malfunction Plan Requirements
6. Reporting & Notification Requirements
7. Recordkeeping Requirements

Emissions Limits: 4SRB engines that are subject to MACT must comply with one of the following emissions limitations; reduce formaldehyde by 76% (pre-catalyst to post catalyst) or more, or limit the concentration of formaldehyde in the exhaust to 350 ppbvd or less (at 15% O₂).

Emissions Test Requirements: An initial emissions performance test must be conducted on all 4SRB engines subject to MACT. A semi-annual test must be performed on all units greater than or equal to 5000 bhp (regardless of compliance method) or if the method of MACT compliance is the formaldehyde concentration limit (regardless of size). If a catalyst is being used for compliance, a performance test must be completed any time the catalyst element is changed.²

Operating Limits and Parameter Monitoring Requirements if using a NSCR catalyst: When operating a 4SRB engine with an NSCR catalyst, two operating parameters apply: (1) the differential pressure across the catalyst does not change more than ± 2 ” H₂O from the initial performance test. This differential pressure test must be performed monthly at 100% ($\pm 10\%$) load; (2) the catalyst inlet temperature must be maintained at or above 750°F and less than or equal to 1250°F. Both operating limits require parameter monitoring. The pressure drop across the catalyst limit must be measured once per month. The catalyst inlet temperature must be a continuous measurement, with at least one data sample/poll every 15 minutes. The continuous data points are then reduced into a 4-hour rolling average, and that average must be greater than or equal to 750°F and less than or equal to 1250°F.

Operating Limits and Parameter Monitoring Requirements if not using a NSCR catalyst: If an owner/operator chooses to meet the formaldehyde concentration limits using an alternative control they must submit a petition to the delegating authority. As part of this petition, the owner/operator must define the specific operational limitations (i.e. catalyst temperature as used in the NSCR application) to be used and the relationship they have with formaldehyde. Also to be included is how these operating limits will be measured, i.e. the type of equipment, precision and method.

Startup, Shutdown, Malfunction Plan Requirements (SSMP): For each 4SRB subject engine, a Startup, Shutdown, Malfunction Plan (SSMP) must be created. The purpose of the SSMP is to minimize emissions during these events, create procedures to correct them as soon as possible, and to minimize the reporting burden. Startup is defined as “the setting in operation of an affected source”, shutdown is defined as “the cessation of operation of any affected source”, and malfunction is defined as “any sudden, infrequent and not reasonably preventable failure of air pollution control and monitoring devices that has the potential to cause the emissions limitation to be exceeded”. Failures that are caused by poor maintenance or careless operation are not malfunctions, and cannot be covered under the SSMP. During

² More complete test procedures, please refer to the MACT Handbook.

SSM events, a violation does not occur as long as operation of the engine follows the SSMP. Corrections to these events must take place as soon as practicable. The SSMP must be in place by the engine's compliance date, and must be kept at the facility with the subject engine.

Reporting & Notification Requirements³: The following list outlines the reporting and notification requirements for distribution to your state air pollution control office and your EPA regional office:

- Initial Notification: This notification states that your affected source is subject to MACT. Note that the deadline for Initial Notification for units currently affected by the rule has passed.
- Notification of Intent to Conduct a Performance Test: This notice is submitted 60 days prior to a performance test to notify the state office and EPA regional office of your intent to test.
- Performance Test Report: This report must be submitted within 60 days of testing and include an analysis of samples, emissions levels, and raw data.
- Notification of Compliance Status: This notification is submitted following the completion of a performance test to certify that the unit meets the emissions limitations.
- Semi-annual Compliance Reports: The semi-annual report must contain information on any instances of a startup, shutdown or malfunction during the reporting period⁴, and any actions taken that were not consistent with your SSMP, but kept emissions within limits. Also, the number and duration of each malfunction that may or may not have caused the engine to exceed the emissions limitation must be reported. If a revision to the SSMP was created, that must be submitted. A statement verifying the functionality of the parameter monitoring system must be reported. This document must be submitted with a statement from a responsible official within the company, certifying the contents and the accuracy of the document.
- Immediate Startup, Shutdown, or Malfunction Reports: This report must be submitted immediately if any actions taken during a SSM event were not consistent with the SSMP. This document must explain why the actions were different and include a description of any emissions or operating limits exceeded.

Recordkeeping Requirements: The owner/operator is required to keep record of all activities required for MACT compliance at the facility for two years and off-site for three additional years. All reports and notification outlined above must be kept including maintenance and O & M records, engine operating times, and Continuous Parameter Monitoring System (CPMS) records. The records must be stored in a format that is suitable for review.

4-Stroke Lean Burn, 2-Stroke Lean Burn: The MACT requirements for a 4SLB and 2SLB are very similar, differing primarily in the emissions limits that apply to each category. Also, only new engines are subject to MACT. The emissions limit for a 4SLB engine is 93% reduction in carbon monoxide (CO) or limit formaldehyde concentration to 14ppmvd @ 15% O₂. The emission limit for a 2SLB engine is 58% reduction in CO or limit formaldehyde concentration to 12 ppmvd @ 15% O₂. The same emissions test procedures are required for these engines, and, semi-annual testing is required regardless of size or compliance method. The operating limits and parameter monitoring requirements are the same with regards to the use of a catalyst. One difference is the temperature range for the catalyst inlet temperature: for these engine types, the temperature range is 450°F - 1350°F. If other methods of compliance are used, the same petitioning procedure is required. For 4SLB and 2SLB, the SSMP, reporting & notification requirements, and the recordkeeping section are identical to the 4SRB requirements.

When:

³ This is a high level overview of the reporting and notification requirements, for details please refer to the MACT Handbook that can be found on EPA's Website.

⁴ Note that an EPA proposed revision to the MACT General Provisions would eliminate the requirement to report startups and shutdowns that occur consistent with the SSMP. This proposed change may be final in late 2005.

Existing engines subject to the rule must comply by 3 years following the publishing of the rule; the rule was finalized and published in the Federal Register on June 15, 2004, so existing 4SRB engines at a major source must comply by June 2007. Units are defined as “New engines” if construction began after the rule proposal date - December 19, 2002, and they must meet the rule when they are brought online. However, they do have 6 months to demonstrate compliance. Reconstructed engines would fall under the same timeline as new engines.

Hopefully this has given you more insight into MACT, if you are affected by it and what must be done to comply. Please remember, this document is meant as a high level overview of the applicability and requirements of RICE MACT. For complete details, reference the “MACT Compliance Handbook for the Reciprocating Internal Combustion Engines NESHAP” by US EPA.