



# Connecticut Department of Energy and Environmental Protection



# National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines (RICE Rule)



**40 CFR 63 Subpart ZZZZ**  
**Area Source Existing Non-Emergency Compression Ignition Engine**  
**300 <Horsepower ≤500**



Connecticut Department of Energy and Environmental Protection

# What emission standards apply?

•If engine was certified to meet the Tier 3\* emission standards in Table 1 of 40 CFR 89.112, you need only comply with the NSPS for CI engines. Therefore, owners of such engines need documentation of engine certification, and to adhere to the manufacturer's specifications for the engine. They are not required to perform any of the testing, monitoring, recordkeeping, or reporting described in this module.

\*Tier 2 for engines above 560 kW



# What emission standards apply?

- Tier 1 and Tier 2 certified engines subject to state and local requirements that call for replacement of the engine can meet management practices until 1/1/2015, or 12 years after installation date (whichever is later), but not later than 6/1/2018, after which time the CO emission standards discussed in this module apply (limit concentration of CO in the engine exhaust to 49 ppm at 15% O<sub>2</sub> or reduce CO emissions by 70% or more).

- Management practices are outlined in Table 2d.1 of the rule and include:

- Changing oil and filter every 1,000 hours of operation or annually, whichever comes first
- Inspecting air cleaner (and replacing as necessary) every 1,000 hours of operation or annually, whichever comes first
- Inspecting hoses and belts every 500 hours of operation or annually, whichever comes first, and replace as necessary
- Minimizing engine time spent at idle and startup time (no more than 30 min)

- If you intend to meet management practices rather than meet emission limits, you must submit a notification by 3/3/2013 stating that you intend to use this provision and identifying the state or local regulation that the RICE is subject to.



# Engines located on offshore drilling vessels on the Outer Continental Shelf

•If your engine is >300 HP *and* located on an offshore drilling vessel on the Outer Continental Shelf, you are subject to the following management practices:

–Change oil every 1,000 hours of operation or annually, whichever comes first

•You may use an oil analysis program in order to extend the specified oil change requirement.

•Program must at a minimum analyze: Total Base Number, viscosity, and percent water content.

•Analysis must be conducted at the same frequency specified for changing the engine oil. If the condemning limits are not exceeded, you are not required to change the oil. If any of the condemning limits are exceeded, you must change the oil within two business days or before continuing to use the engine, whichever is later. The condemning limits are as follows:

–Total Base Number is <30% of the Total Base Number of the oil when new; or

–Viscosity of the oil has changed by >20% from the viscosity of the oil when new; or

–Percent water content (by volume) is >0.5.

–Inspect and clean air filters every 750 hours of operation or annually, whichever comes first, and replace as necessary;

–Inspect fuel filters and belts, if installed, every 750 hours of operation or annually, whichever comes first, and replace as necessary; and

–Inspect all flexible hoses every 1,000 hours of operation or annually, whichever comes first, and replace as necessary.



# Engines located on offshore drilling vessels on the Outer Continental Shelf

- If subject to these management practices, develop a maintenance plan specifying how the management practices will be met and keep supporting documentation/records.



# What emission standards apply?

- If your engine was not certified as described and not on an offshore drilling vessel, you must limit concentration of CO in the engine exhaust to 49 ppm at 15% O<sub>2</sub> or reduce CO emissions by 70% or more
  - Compliance with the limit is based on the results of testing the average of three 1-hour runs
  - If engine is located in a remote area of Alaska, you do not have to meet limits; but, you must meet management practices.
- Engines will probably require an emissions control retrofit in order to achieve this standard. For CI engines, this is an **oxidation catalyst**.
  - Estimated capital cost of catalyst:  $\$27.4 * HP - \$939$
  - Estimated annual cost of catalyst:  $\$4.99 * HP + \$480$   
(where HP = horsepower of the engine)
- Comply with emission limits and operating limits at all times
- At all times, operate/maintain all equipment in a manner consistent with safety and good air pollution control practices for minimizing emissions. You don't need to make any further efforts to reduce emissions if levels required by this standard have been achieved.



# What fuel requirements must I meet?

- If engine has a displacement of <math><30\text{ l/cyl}</math>, you must use ultra low sulfur diesel (ULSD) that meets the following per-gallon standards:

- Sulfur content: 15 ppm maximum

- Cetane index or aromatic content:

- A minimum cetane index of 40; or

- A maximum aromatic content of 35 volume percent.

\* Engines located in Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, areas of Alaska that are not accessible by the Federal Aid Highway System, remote areas of Alaska, or on offshore vessels (that meet 63.6603(c)) are exempt from the requirements of this section.



# What tests must I perform?

## You must perform the following:

–Initial emission performance test within 180 days after May 3, 2013

•You are not required to conduct an initial test on units for which a test has been previously conducted, but the test must meet the following conditions:

–Test must have been conducted using the same methods specified in the rule, and the methods must have been followed correctly.

–Test must not be older than 2 years.

–Test must be reviewed and accepted by EPA.

–Either no process or equipment changes must have been made since the test was performed,

OR you must be able to demonstrate that the results of the performance test, with or without adjustments, reliably demonstrate compliance despite process or equipment changes.

\*If your RICE is currently non-operational:

-Do not startup the engine solely to conduct the performance test; conduct the test when the engine is started up again.



# After the initial test, what subsequent tests must I perform?



Photo credit: EPA

You are not required to perform subsequent testing.



# What are my testing requirements?

COMPLYING WITH THE REQUIREMENT TO...	YOU MUST...	USING...	ACCORDING TO THE FOLLOWING REQUIREMENTS...
Reduce CO emissions	Measure the O <sub>2</sub> at the inlet and outlet of the control device; and	Method 3 or 3A or 3B of 40 CFR part 60, appendix A, or ASTM Method D6522-00 (Re-approved 2005) <sup>a</sup>	Measurements to determine O <sub>2</sub> must be made at the same time as the measurements for CO concentration.
	Measure the CO at the inlet and the outlet of the control device	ASTM D6522-00 (Re-approved 2005) <sup>a,b</sup> or Method 10 of 40 CFR part 60, appendix A	The CO concentration must be at 15% O <sub>2</sub> , dry basis.
Limit the concentration of CO in the engine exhaust	Select the sampling port location and the number of traverse points; and	Method 1 or 1A of 40 CFR part 60, appendix A 63.7(d)(1)(i)	If using a control device, the sampling site must be located at the outlet of the control device.
	Determine the O <sub>2</sub> concentration of the engine exhaust at the sampling port location; and	Method 3 or 3A or 3B of 40 CFR part 60, appendix A, or ASTM Method D6522-00 (Re-approved 2005) <sup>a</sup>	Measurements to determine O <sub>2</sub> concentration must be made at the same time and location as the measurements for CO concentration.
	Measure moisture content of the engine exhaust at the sampling port location; and	Method 4 of 40 CFR part 60, appendix A, or Test Method 320 of 40 CFR part 63, appendix A, or ASTM D6348-03 <sup>a</sup>	Measurements to determine moisture content must be made at the same time and location as the measurements for CO concentration.
	Measure CO at the exhaust of the engine	Method 10 of 40 CFR part 60, appendix A, ASTM Method D6522-00 (2005), <sup>a</sup> Method 320 of 40 CFR part 63, Appendix A, or ASTM D6348-03 <sup>a</sup>	CO concentration must be at 15% O <sub>2</sub> , dry basis. Results of this test consist of the average of the three 1-hour or longer runs.

a. Incorporated by reference, see 40 CFR 63.14. You may also obtain copies from University Microfilms International, 300 North Zeeb Road, Ann Arbor, MI 48106.

b. You may also use Method 320 of 40 CFR part 63, Appendix A, or ASTM D6348-03.



# Testing Procedures

- You must conduct three separate test runs for each performance test required. Each run must last at least 1 hour.

- You must use the following equation to determine compliance with the percent reduction requirement:

$$(C_i - C_o) / C_i \times 100 = R$$

$C_i$  = concentration of CO at the control device inlet,

$C_o$  = concentration of CO at the control device outlet, and

R = percent reduction of CO emissions.



# Testing Procedures

•You must normalize the CO concentrations at the inlet and outlet of the control device to a dry basis and to 15% O<sub>2</sub>, or an equivalent percent CO<sub>2</sub>. If pollutant concentrations are to be corrected to 15% O<sub>2</sub> and CO<sub>2</sub> concentration is measured in lieu of O<sub>2</sub> concentration measurement, a CO<sub>2</sub> correction factor is needed. Calculate the CO<sub>2</sub> correction factor as described in paragraphs (i) through (iii):

(i) Calculate the fuel-specific F<sub>O</sub> value for the fuel burned during the test using values obtained from Method 19, section 5.2, and the equation:  $F_o = (0.209F_d)/F_c$

F<sub>O</sub>= Fuel factor based on the ratio of O<sub>2</sub> volume to the ultimate CO<sub>2</sub> volume produced by the fuel at 0% excess air.

0.209 = Fraction of air that is O<sub>2</sub>, percent/100.

F<sub>d</sub>= Ratio of the volume of dry effluent gas to the gross calorific value of the fuel from Method 19, dsm<sup>3</sup> / J (dscf/10<sup>6</sup> Btu).

F<sub>c</sub>= Ratio of the volume of CO<sub>2</sub> produced to the gross calorific value of the fuel from Method 19, dsm<sup>3</sup> / J (dscf/10<sup>6</sup> Btu).

(ii) Calculate the CO<sub>2</sub> correction factor for correcting measurement data to 15% O<sub>2</sub>, as follows:  $X_{CO_2} = 5.9/F_o$

X<sub>CO<sub>2</sub></sub>= CO<sub>2</sub> correction factor, percent.

5.9 = 20.9% O<sub>2</sub>-15% O<sub>2</sub>, the defined O<sub>2</sub> correction value, percent.

(iii) Calculate the CO gas concentrations adjusted to 15% O<sub>2</sub> using CO<sub>2</sub> as follows:  $C_{adj} = C_d(X_{CO_2}/\%CO_2)$

C<sub>adj</sub>= Calculated concentration of CO adjusted to 15% O<sub>2</sub>.

C<sub>d</sub>= Measured concentration of CO, uncorrected.

%CO<sub>2</sub>= Measured CO<sub>2</sub> concentration measured, dry basis, percent.



# Testing Procedures

- Engine percent load during a performance test must be determined by documenting the calculations, assumptions, and measurement devices used to measure or estimate the percent load in a specific application. A report of the average percent load determination must be included in the Notification of Compliance Status. The following must be included in the report:
  - Engine model number
  - Engine manufacturer
  - Year of purchase
  - Manufacturer's site-rated brake HP
  - Ambient temperature, pressure, and humidity during the performance test
  - Explanation of all assumptions that were made to estimate or calculate percent load during the performance test
  - If measurement devices such as flow meters, kilowatt meters, beta analyzers, stain gauges, etc. are used, the model number of the measurement device, and an estimate of its accuracy in percentage of true value



# How do I demonstrate initial compliance with the emission limits and operating limits?

## Complying with the requirement to limit the concentration of CO in the engine exhaust:

- You have demonstrated initial compliance if the average CO concentration determined from the initial performance test is  $\leq$  CO emission limit

OR

## Complying with the requirement to reduce CO emissions:

- You have demonstrated initial compliance if the average reduction of CO emissions determined from the initial performance test achieves the required CO percent reduction



# How do I demonstrate initial compliance with the emission limits and operating limits?

Submit the Notification of Compliance Status containing the results of the initial compliance demonstration.

**Example Notification of Compliance Status Report<sup>a</sup>**

National Emission Standards for Hazardous Air Pollutants:  
 Stationary Reciprocating Internal Combustion Engines  
 40 CFR part 63, subpart ZZZZ

**Note:** The information to be provided in the Notification of Compliance Status Report will vary depending on the engine type. Affected sources should refer to 40 CFR part 63, subpart ZZZZ for engine-specific compliance requirements. The sample responses provided in this report are for existing stationary spark ignition (SI) 4-stroke rich burn (4SRB) engines above 600 horsepower (HP) located at an area source.

**SECTION I: GENERAL INFORMATION**

- A. If you have been issued a Title V permit, do not complete this form. Submit your NOCS in accordance with your Title V permit. [§63.9(h)(3)]
- B. If you have not been issued a Title V permit, complete the remaining portions of this section and also complete Sections II-IX. [§63.9(h)(2)(i)]
- C. Print or type the following information for each facility for which you are making notification of compliance status:

Permit Number (OPTIONAL)		Facility I.D. Number (OPTIONAL)	
Responsible Official's Name/Title			
Street Address			
City	State	ZIP Code	
Facility Name (if different from Responsible Official's Name)			
Facility Street Address (if different than Responsible Official's Street Address)			
Facility Local Contact Name		Title	Phone (OPTIONAL)
City	State	ZIP Code	

- D. Indicate the relevant standard or other requirement that is the basis for this notification and the source's compliance date: (§63.9(b)(2)(iii))

<sup>a</sup> This is an example of the type of information that must be submitted to fulfill the Notification of Compliance Status requirement of 40 CFR part 63, subpart ZZZZ. This Notification of Compliance Status is being made in accordance with 40 CFR §63.9(n).



# Monitoring Requirements

- **If engine is not equipped with a closed crankcase ventilation system, comply with either (1) or (2) of this section.**

Follow the manufacturer's requirements for operating and maintaining the crankcase ventilation systems and replacing the filters, or you can request that EPA approve different maintenance requirements that are as protective as manufacturer requirements.

(If your engine is located in a remote area of Alaska, you do not have to meet the requirements of (1) or (2) of this section.)

- (1) Install a closed crankcase ventilation system or

- (2) Install an open crankcase filtration emission control system that reduces emissions from the crankcase by filtering the exhaust stream to remove oil, mist particulates, and metals.

- Minimize the engine's time spent at idle during startup and minimize the engine's startup time to a period needed for appropriate and safe loading of the engine, not to exceed 30 minutes, after which time the emission standards applicable to all times other than startup apply.



How do I demonstrate continuous compliance?

**Comply with the emission standards at all times.**



# What records must I keep?

You must keep records of:

- Each notification and report, and all supporting documentation
- Occurrence and duration of each malfunction
- Performance tests and evaluations
- Required maintenance performed on air pollution control and monitoring equipment
- Actions taken during malfunctions to minimize emissions and corrective actions

Keep records for 5 years from the date of creation.



# What notifications should I submit?

## Notification of:

- Applicability (120 days after effective date) or construction/reconstruction – was due 8/31/2010
- Intent to Conduct Performance Test (60 days prior to test)
- Compliance Status (60 days after compliance demonstrated)



# What reports should I submit?

## Semi-Annual Compliance Report (annual if engine is for limited use)

### • Due January 31<sup>st</sup> and July 31<sup>st</sup> each year:

– First report must cover the period beginning on May 3, 2013 and ending on June 30, 2013, and must be postmarked or delivered by July 31, 2013.

– Covers the period from January 1-June 30 or July 1-December 31

– Report must contain:

- Statement by responsible official certifying the accuracy of the report

- If any malfunctions occurred during the reporting period, including the number, duration, and a brief description for each type of malfunction which occurred and which caused or may have caused any limits to be exceeded. Also include actions taken during malfunction to minimize emissions and correct malfunctions.

- If no deviations occurred, a statement indicating this.

- If there were no periods during which the CMS was out-of-control, a statement indicating this.

### • For each deviation that occurs where you are not using a CMS the report must *also* contain:

- Total operating time of the engine at which the deviation occurred

- Information on the number duration, and cause of deviations, and the corrective action taken.



# What reports should I submit?

## Semi-Annual Compliance Report (annual if engine is for limited use)

- For each deviation from an emission or operating limitation occurring for an engine where you are using a CMS to comply with the limits, you must *also* include:
  - Date and time each malfunction started and stopped.
  - Date, time, and duration that each CMS was inoperative, except for zero (low-level) and high-level checks.
  - Date, time, and duration that each CMS was out-of-control, using the information in 63.8(c)(8).
  - Date and time that each deviation started and stopped, and whether each deviation occurred during a period of malfunction or during another period.
  - Summary of the total duration of the deviation during the reporting period, and the total duration as a percent of the total source operating time during that reporting period.
  - Breakdown of the total duration of the deviations during the reporting period into those that are due to control equipment problems, process problems, other known causes, and other unknown causes.
  - Summary of the total duration of CMS downtime during the reporting period, and the total duration of CMS downtime as a percent of the total operating time of the engine at which the CMS downtime occurred during that reporting period.
  - Identification of each parameter and pollutant (CO or formaldehyde) that was monitored at the engine.
  - Brief description of the engine and CMS.
  - Date of the latest CMS certification or audit.
  - Description of any changes in CMS, processes, or controls since the last reporting period.



# What reports should I submit?

## Semi-Annual Compliance Report (annual if engine is for limited use)

- You must report each instance in which you did not meet each emission limit or operating limit.
- Report each instance in which you did not meet the requirements of any of the General Provisions



## Where do I send notifications and reports?



EPA REGION 1:

US Environmental Protection Agency

5 Post Office Square, Suite 100, Mail code: OES04-2

Boston, MA 02109-3912

Attention: Air Clerk



Connecticut Department of Energy and Environmental Protection

# By when must I comply with the rule?

Your compliance date is:  
**May 3, 2013**



Photo credit: EPA

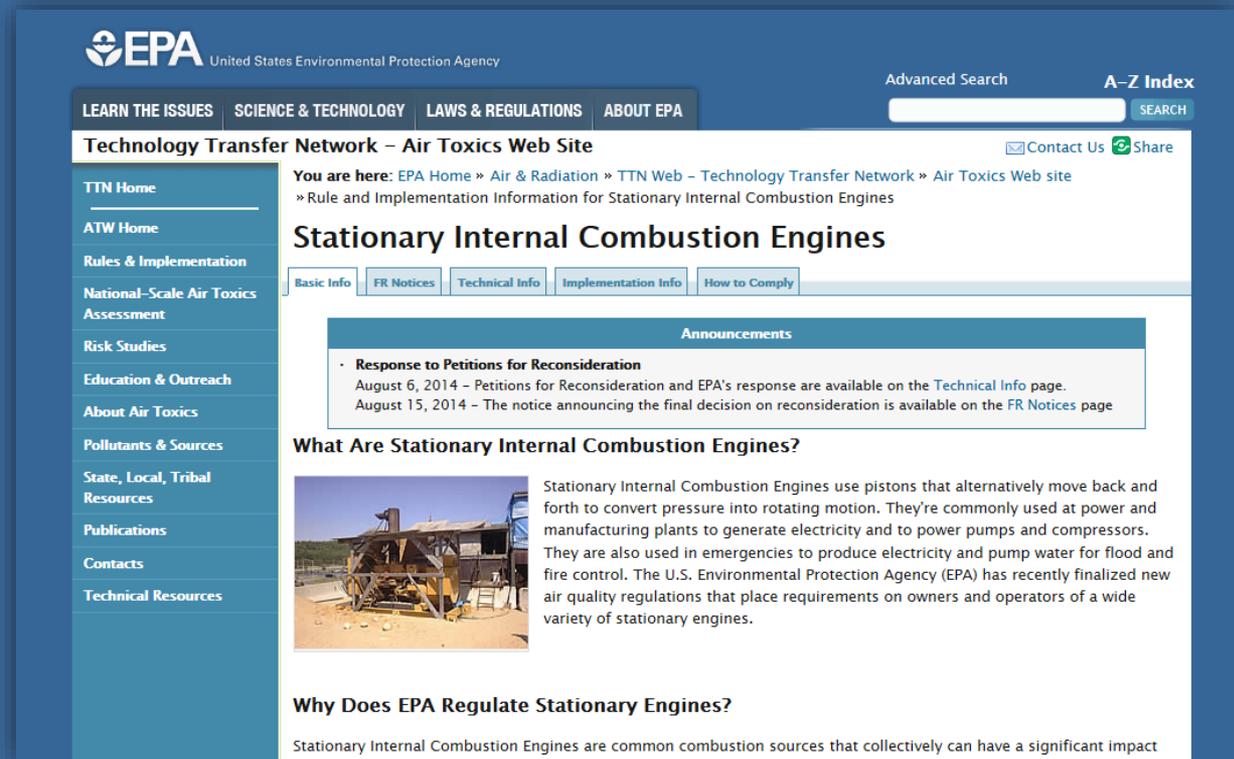


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# Visit the EPA RICE Compliance Page

[www.epa.gov/ttn/atw/icengines/](http://www.epa.gov/ttn/atw/icengines/)

- ▶ Fact sheets
- ▶ Regulations
- ▶ Example notifications
- ▶ Announcements
- ▶ Q & A documents
- ▶ Testing advice
- ▶ Recorded webinars
- ▶ ...and more!



The screenshot shows the EPA website's Technology Transfer Network (TTN) Air Toxics Web Site. The page is titled "Stationary Internal Combustion Engines" and is part of the "Rule and Implementation Information for Stationary Internal Combustion Engines" section. The page features a navigation menu on the left with categories like "TTN Home", "ATW Home", "Rules & Implementation", "National-Scale Air Toxics Assessment", "Risk Studies", "Education & Outreach", "About Air Toxics", "Pollutants & Sources", "State, Local, Tribal Resources", "Publications", "Contacts", and "Technical Resources". The main content area includes a "Response to Petitions for Reconsideration" announcement dated August 6, 2014, and a section titled "What Are Stationary Internal Combustion Engines?" which includes a photograph of a large industrial engine and a brief description of its function. Below this is a section titled "Why Does EPA Regulate Stationary Engines?" with a sub-header "Stationary Internal Combustion Engines are common combustion sources that collectively can have a significant impact".



Connecticut Department of Energy and Environmental Protection

# Take Aways

## Engine Type:

- An existing non-emergency compression ignition engine at an area source with a site rating greater than 300 and less than or equal to 500 horsepower

## Emission Standards:

- If engine was certified to meet Tier 3 (Tier 2 for engines >560 kW) emission standards in Table 1 of 40 CFR 89.112, your engine is considered in compliance with the rule. You need only maintain documentation of certification and to follow the manufacturer's specifications.
- Tier 1 and Tier 2 certified engines subject to state and local requirements that call for replacement of the engine can meet management practices until 1/1/2015, or 12 years after installation date (whichever is later), but not later than 6/1/2018, after which time the CO emission standards below apply.
- If >300 HP *and* on an offshore drilling vessel on the Outer Continental Shelf, follow management practices
- If engine was not certified as described above and not on an offshore drilling vessel, limit concentration of CO in the exhaust to 49 ppm at 15% O<sub>2</sub> **or** reduce CO emissions by 70% or more
- Engine will probably require an emissions control retrofit- oxidation catalyst
- If displacement <30 l/cyl, use ULSD

## Testing:

- Initial emission performance test within 180 days after May 3, 2013



# Take Aways

## Monitoring:

- Operate/maintain engine according to manufacturer's instructions or develop your own maintenance plan

## Recordkeeping:

- Keep records of notifications, testing, maintenance, malfunction and corrective actions taken, etc.
- Retain records for 5 years

## Notifications:

- Applicability
- Intent to Conduct Performance Test
- Compliance Status
- If Tier 1 or Tier 2 certified, submit Notification of Intent to Use Management Practices, including applicable state/local regulation

## Reporting:

- Semi-annual Compliance Report (annual if engine is for limited use)

## Compliance Date:

- May 3, 2013

