

The Reciprocating Internal Combustion Engine (RICE) MACT Summary

MACT 40 CFR 63, Subpart ZZZZ (4Z)



What is the RICE MACT?



- ❑ The National Emission Standards for Hazardous Air Pollutants (NESHAP) for Reciprocating Internal Combustion Engines (RICE)
- ❑ The purpose of RICE MACT is to reduce the emissions of Hazardous Air Pollutants (HAPs) from reciprocating internal combustion engines (RICE) located at major industrial sources of air HAPs or area sources.
- ❑ Major industrial sources emits 10 tons a year or more of a single Hazardous Air Pollutant or 25 tons a year or more of a combination of Hazardous Air Pollutants.

HAPs emitted from engines



Organic HAP From Natural Gas or Diesel-fired RICE

- Formaldehyde
- Acetaldehyde
- Acrolein
- Methanol
- Benzene
- Toluene
- 1,3-butadiene
- 2,2,4-trimethylpentane
- Hexane
- Xylene
- Naphthalene
- PAH
- Methyl Chloride
- Ethylbenzene

Metallic HAP from Diesel-fired RICE

- Cadmium
- Chromium
- Lead
- Manganese
- Mercury
- Nickel
- Selenium



Helpful Definitions

Major Source – a source with greater than 10 tpy of any single HAP or 25 tpy of combined HAPs

Area Source – any source that is not a major source of HAPs

Emergency Stationary RICE – any stationary internal combustion engine whose operation is limited to emergency situations and required testing and maintenance.

Emergency engines cannot be used for peak shaving or to sell non-emergency power under a financial arrangement *except as permitted under §63.6640(f)*.



The DEP loves Acronyms

- ❑ Some Acronyms you should know.
 - ❑ CI – Compression Ignition (diesel)
 - ❑ SI – Spark Ignition (natural gas)
 - ❑ 4SLB – 4 stroke lean burn
 - ❑ 2SLB – 2 stroke lean burn
 - ❑ 4SRB – 4 stroke rich burn



Source: NAPC, Inc.

Stationary RICE

source categories



- ❑ 1. Emergency stationary RICE
- ❑ 2. Limited use stationary RICE
- ❑ 3. Stationary RICE that combust landfill gas or digester gas equivalent to 10 percent or more of the gross heat input on an annual basis
- ❑ 4. Compression ignition (CI)
- ❑ 5. Spark ignition 4-stroke rich burn (4SRB);
- ❑ 6. Spark ignition 2-stroke lean burn (2SLB);
and
- ❑ 7. Spark ignition 4-stroke lean burn (4SLB).

*The final rule does not apply to stationary RICE test cells/stands since these facilities are covered by another NESHAP, subpart P of 40 CFR part 63



Applicability Variables

- ❑ Type of Engine: 4SRB, 2SLB, 4SLB, CI
- ❑ Installation date of RICE equipment
- ❑ Type of Facility Major Source or Area Source
- ❑ Type of Use: emergency, limited use, non-emergency usage, mechanical or electrical
- ❑ Fuel Type: gas, oil, landfill gas or digester gas equivalent
- ❑ Size of Engine: >300 HP, >500HP of <500 HP



Source: Univ. of Tennessee



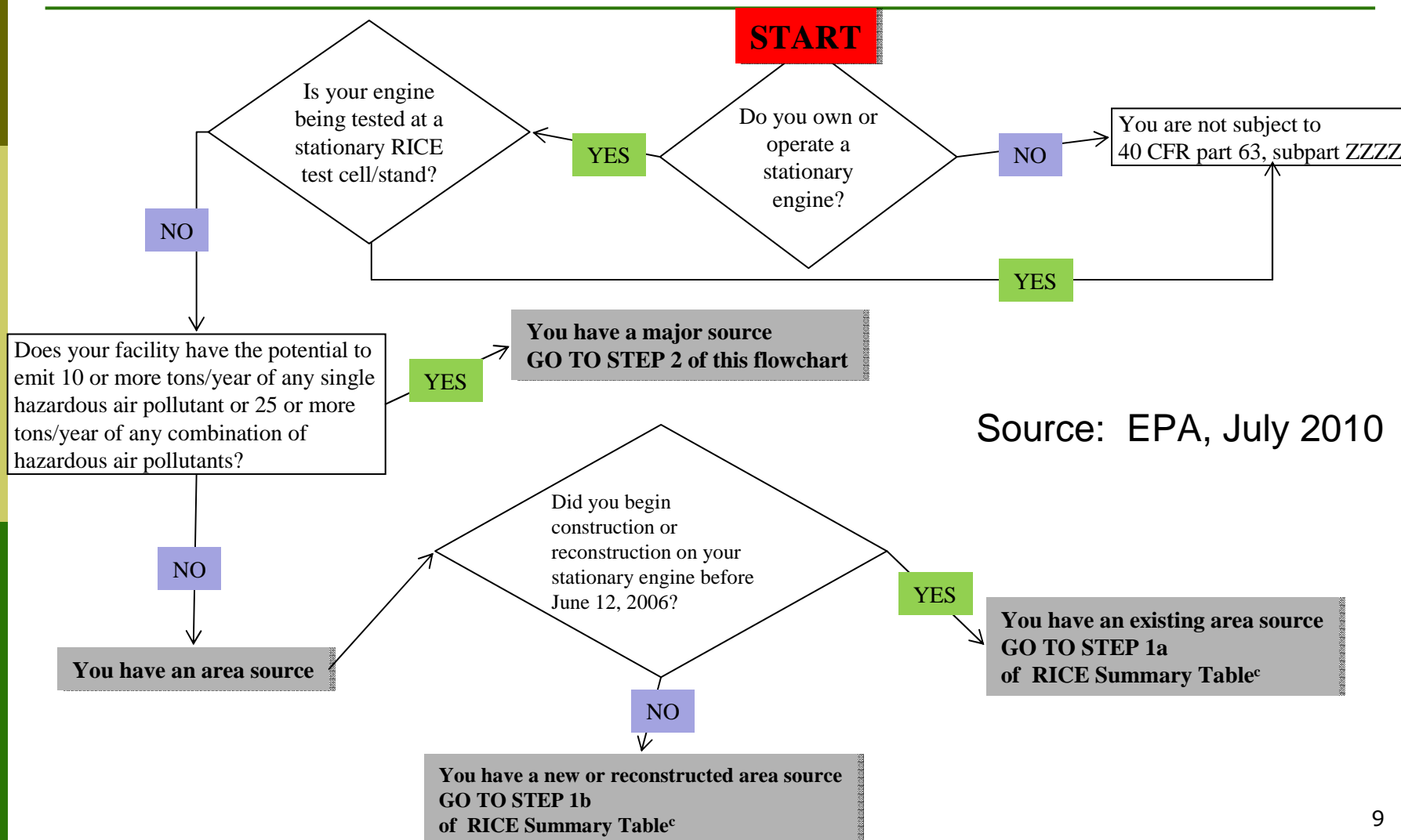
Compliance Dates

- The schedule can be found in a matrix format under an Excel spreadsheet at the EPA website under the heading: **RICE Summary Table of Requirements**

<http://www.epa.gov/ttn/atw/rice/ricepg.html>

Engine Category	Date Constructed	Compliance Date	Emission Limitations	Operating Limitations	Fuel Requirements
Stationary RICE at Area Sources					
S					
Existing Sta					
Emergency CI	Before 6/12/2006	5/3/2013	63.6603 Table 2d	No Requirements	No Requirements
Non-Emergency CI 300<HP≤500	Before 6/12/2006	5/3/2013	63.6603 Table 2d	No Requirements	>300 HP with displacement <30 l/cyl: 63.6604

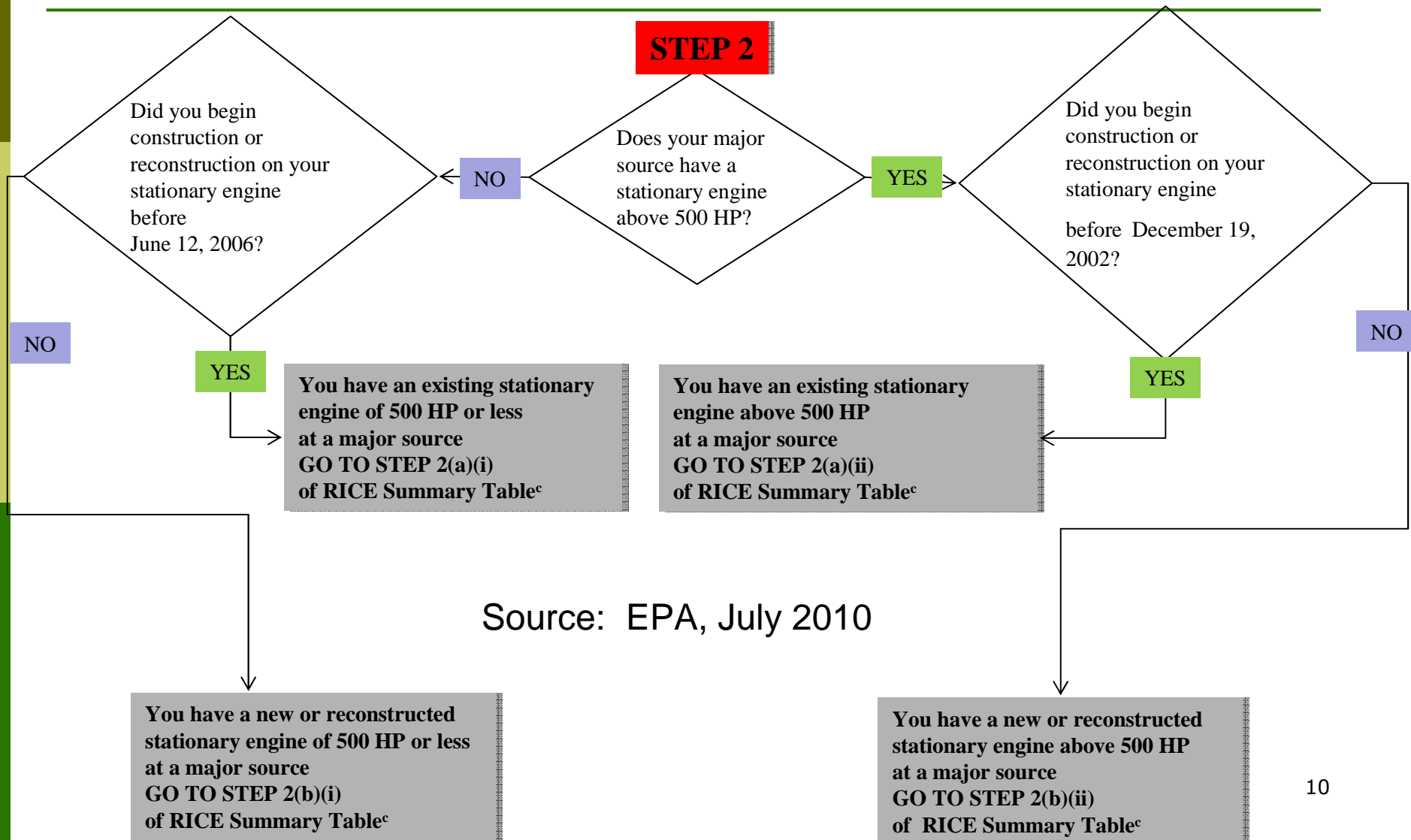
How do I know what applies to my engine?



Source: EPA, July 2010

EPA's Applicability Flowchart

Step 2





Rice Summary Table

□ RICE Summary Table of Requirements

<http://www.epa.gov/ttn/atw/rice/ricepg.html>

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Types of Requirements

- Notifications
- Emission Limitations
- Controls
- Operating Limitations
- Fuel Requirements
- Performance Tests
- Monitoring
- Recordkeeping
- Reporting



Source: Komatpillar.com

Limited use and emergency stationary RICE



- What qualifies a limited use stationary RICE?
 - Less than 100 hours per year.

- What qualifies an emergency stationary RICE?
 - No limit on use during emergency situations.
 - Maintenance checks and readiness testing are limited to 100 hours/year
 - Up to 50 hours/year of non-emergency operation is allowable (counts toward the 100 hours/year)

**The 50 hours/year cannot be used for peak shaving or to generate income except for up to 15 hours/year for demand response when a regional transmission operator is in danger of a blackout*

Stationary RICE that combust landfill gas or digester gas equivalent to 10% or more of the gross heat input



- ❑ Landfill gas is the gaseous by-product of the land application of municipal refuse typically formed through the anaerobic decomposition of waste materials and is composed primarily of methane and CO₂.
- ❑ Digester gas is the gaseous by-product of wastewater treatment typically formed through the anaerobic decomposition of organic waste materials and is composed primarily of methane and CO₂.
- ❑ For each Stationary RICE that combust landfill gas or digester gas equivalent to 10 percent or more of the gross heat input on an annual basis installed after the compliance date is subject to Subpart ZZZZ (4Z), you must submit an initial notification and monitor, record and report annual fuel usage.



Initial Notification

- ❑ You are required to provide the following information in the initial notification [40 CFR 63.9(b)(2)]:
 1. The name and address of the owner or operator of your facility;
 2. The address (i.e., physical location) of your facility;
 3. An identification of the relevant standard (in this case, 40 CFR subpart ZZZZ), that is the basis of the notification and the your compliance date;
 4. A brief description of the nature, size, design, and method of operation of the source and an identification of the types of emission points within the affected source subject to the relevant standard and types of HAP emitted; and
 5. A statement of whether your facility is a major source or an area source.



Emission Requirements:

- The final rule requires that:
 - Existing and new 4-stroke rich burn (4SRB) engines either reduce formaldehyde by 76 percent or limit the formaldehyde concentration to 350 parts per billion (ppb)
 - New 2-stroke lean burn (2SLB) engines either reduce carbon monoxide (CO) by 58 percent or limit the formaldehyde concentration to 12 parts per million (ppm)
 - New 4-stroke lean burn (4SLB) engines either reduce CO by 93 percent or limit the formaldehyde concentration to 14 parts per million (ppm)
 - New compression ignition (CI) engines either reduce CO by 70 percent or limit the formaldehyde concentration to 580 parts per billion (ppb)

How to comply with emission limits



- ❑ Formaldehyde and CO are surrogates for reducing the air toxics of concern from RICE. Therefore, by reducing formaldehyde and CO, facilities also will reduce the other air toxics to similar levels.
 - EPA expects owners or operators of 4SRB engines to install air pollution control devices known as Anon-selective catalyst reduction. These systems not only reduce CO emissions, they also reduce air toxics emissions such as formaldehyde, acrolein and methano.
 - Owners or operators of 2SLB, 4SLB, and CI engines likely will install devices known as ACO catalytic oxidation systems to meet the formaldehyde and CO requirements.
- ❑ The source must conduct the initial performance test or other initial compliance demonstrations that apply to them within 180 days after the compliance date that is specified for their stationary RICE.
- ❑ The source must initially comply with the emission and operating limitations specified for the size of their RICE. Facilities must comply with continuous emission/operating limits and continuous stack monitoring or recording of operating parameters. Sources must submit reports semiannually and/or annually in most cases. Some reports are due within¹⁷ 2 days.

Scenario 1: Small diesel engine (CI ICE) at an Area Source



- ❑ Superwidgets, Inc. operates a 350 hp diesel-fired engine in case of power outages. They exercise the engine monthly for approximately 20 minutes. Superwidgets is not a major source of HAP emissions.

What will their NESHAP requirements be?

- ❑ Was the engine installed prior to June 12, 2006? **Yes, 1998**
- ❑ Have they rebuilt the engine, spending more on new components than 50% of the price of a comparable new engine? **No**
- ❑ This unit is an *existing emergency area source engine*

Existing Area Source Requirements for Emergency Engines



Starting May 3, 2013:

- ❑ Change oil and filters every 500 hours or annually (whichever happens first)
- ❑ Inspect the air cleaner every 1,000 hours or annually
- ❑ Inspect all hoses and belts every 500 hours (Table 2d)

Also:

- ❑ Operate and maintain the engine according to manufacturer's instructions
- ❑ Must install a **non-resettable hour meter**
- ❑ Must minimize time spent at idle during startup (Not exceed 30 minutes)

Records:

- ❑ Keep written records of the hours spent operating for emergencies/non-emergency
- ❑ Keep maintenance records

Scenario 2: A Natural Gas Engine (SI ICE) at a Major Source



- ❑ Supermetal, Inc. operates a 450 hp natural gas-fired engine in case of power outages. They cannot meet the definition of emergency engine, and Supermetal is a major source of HAP emissions.

What will their NESHAP requirements be?

- ❑ Was the engine installed prior to June 12, 2006? **Yes, 1975**
- ❑ Have they rebuilt the engine, spending more on new components than 50% of the price of a comparable new engine? **No**
- ❑ The engine is an *existing non-emergency, non-black start SI ICE <500 hp at a major source*

Non-Emergency Engines <500 hp at a Major Source



- What limits must this engine at Supermetal, Inc. meet?
 - By **October 19, 2013**
- 2SLB: Limit exhaust CO to 225 ppmvd at 15% O₂
- 4SLB: Limit exhaust CO to 47 ppmvd at 15% O₂
- 4SRB: Limit exhaust formaldehyde to 10.3 ppmvd at 15% O₂
- (From Table 2c in the Appendix)

How would compliance be demonstrated?



- ❑ Compliance with the CO or formaldehyde reduction or limitation is demonstrated in the initial performance test.
- ❑ Continuing compliance is demonstrated through the monitoring and recordkeeping practices
- ❑ Notifications and semi-annual reporting are required

Scenario 3: Existing 4SRB SI ICE at an Area Source



- ❑ Superprocessors, Inc. is an area source that operates a 4SRB 600 hp natural gas engine. They exercise the engine monthly for approximately 120 minutes; they also periodically supply power to the grid under an arrangement with the local utility. Superprocessors is not a major source of HAP emissions.
 - *What will their NESHAP requirements be?*

- ❑ Was the engine installed prior to June 12, 2006? **Yes, 2002**
- ❑ Have they rebuilt the engine, spending more on new components than 50% of the price of a comparable new engine? **No**

- ❑ The engine is an *existing non-emergency SI 4SRB engine that operates more than 24 hours/year at an area source*

Existing Non-Emergency Engines >500 hp at Area Sources



- What limits must this 4SRB engine at Superprocessors, Inc. meet?
 - By **October 19, 2013**

- Limit exhaust formaldehyde to 2.7 ppmvd at 15% O₂; or

- Reduce formaldehyde emissions by 76 percent or more.
 - (From Table 2d)



How is Compliance Demonstrated? (4SRB SI ICE >500 hp at an Area Source)



- ❑ Initial compliance is demonstrated if the initial performance test (conducted within 180 days of October 19, 2013) shows the average reduction in formaldehyde is equal to or greater than the required reduction; and
- ❑ A continuous parameter monitoring system (CPMS) has been installed to continuously monitor catalyst inlet temperature; and
- ❑ The catalyst pressure drop and catalyst inlet temperature have been recorded during the initial performance test.
- ❑ Subsequent performance tests must be performed every 8,760 hours or every 3 years, whichever comes first.

What else is required?

(4SRB SI ICE >500 hp at an Area Source)



□ Reporting:

- Submission of notifications
- Semi-annual reporting, identifying any deviations from the limits or requirements

□ General:

- Comply with the General Duty clause
- Minimize the idle time at startup (not to exceed 30 mins)

Things to Remember



- ❑ Anyone with a gas- or diesel-fired internal combustion engine should look closely at Subpart ZZZZ
- ❑ EPA's Applicability Flowchart and the associated table are useful tools
- ❑ Always perform a thorough regulatory review for each case

Need Help?



- Web Site:
<http://www.epa.gov/ttn/atw/rice/ricepg.html>
- Contact them at:
<http://www.epa.gov/ttn/atw/contact.html>
or
Email: pate.nancy@epa.gov

EPA Webinar on December 7, 2011

- To Register:
<https://www1.gotomeeting.com/register/873392224>