



Me giving this talk is kind of like... a dog trying to mow a lawn.

I worked very hard with experts in DC and Ann Arbor to learn the rule and associated program well enough to describe it to you today. (Because I feel you deserve some outreach on the subject.)

Nevertheless, this is going to be a bit of a slog, there will be some confusing aspects, and I'll have to follow up with you later on some of your questions. But I hope you'll give me a biscuit for my effort, or at least not kick me for leaving some patches "unmown."

For those viewing this presentation after-the-fact: Keep in mind that this is not an official EPA publication. It should not be relied on for legal or financial purposes. This copy is provided as a courtesy since the information presented orally was too detailed to fully absorb during the presentation. To see the regulations and to contact the EPA experts, go to the last slide and look at the links and info provided in the Notes view.



EPA's Locomotive Emissions Rule

(and a bit about fuel)

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How did I get this point?

- I work on EPA's SmartWay Transport program (a voluntary partnership promoting freight efficiency) plus I offer compliance assistance with state idling limits (2 NE states— MA and RI— have locomotive limits).
- I've been working with RRs, idle reduction technology experts, and sister federal agencies (DOT & FRA & STB) to find ways to reduce idling, and to educate the public on how trains & RRs work.
- I'm not an engineer, so you will note some awkwardness in the way I talk about engines & equipment. At least I'm not a lawyer (OK, so I'm related to a few).

So here we go!



- *“Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression-Ignition Engines Less Than 30 Liters per Cylinder”*
- *“Control the Emissions of Air Pollution from Nonroad Diesel Engines and Fuel”*
 - What do the rules require and why?
 - To whom and to what equipment do they apply?
 - How is EPA insuring compliance?

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These are the names of the rules we'll cover today, and the questions we'll try to answer.

The purpose of the locomotive rule is to *gradually* improve emissions & reduce idling as older engines are overhauled, and as new “freshly manufactured” locomotives are designed & placed into service.

The fuel rule is aimed at more *quickly* reducing emissions from *all* engines, and enabling cleaner engine & engine control technology.

So, what do the rules require?

Who and what equipment are covered?

How is EPA making sure the rules are implemented?

TOPICS



- Context
- Locomotive rule requirements: Overview
- Locomotive standards and certification: Detail
- Illustrations
- Fuel requirements
- Locomotive rule: Compliance & Enforcement
- Q&A, Discussion

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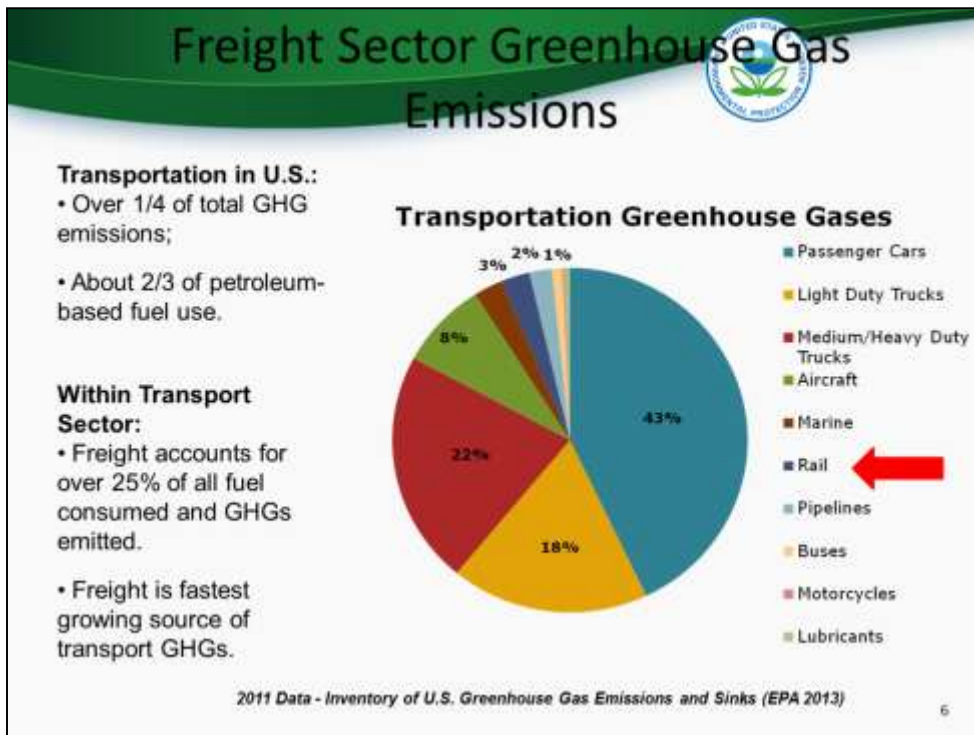
Here are our specific topics.



CONTEXT

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First, a bit of background to put things in perspective.



- What will most distinctly change life as we know it is climate change, so I'll mention that first. Greenhouse gases (mainly CO₂) are the big culprit in climate change.
- Freight accounts for about 1/16th of all U.S. GHG emissions. Since 1990, the rate of growth of GHG emissions from freight sources has been twice as fast as that for passenger travel (31.4 percent vs. 15.7 percent). Trucking accounted for the lion's share of freight emissions followed by freight rail, a distant second.
- EPA's main initiative for cutting carbon in the transportation sector is increasing fuel economy standards for onroad heavy duty vehicles—trucks & buses— and passenger vehicles.
- How is this relevant to today's topic? EPA's locomotive rule requires idle reduction devices (AESS or equivalent), which save fuel and cut GHGs.
- Source of freight emissions growth data: USDOT FHWA Freight Facts and Figures 2011, p. 63
- For HD vehicles (over 8500 lbs), the technologies employed have been tested by the SmartWay program & partners for the past 10 years, and should pay for themselves in 1 or 2 years. They kick in with the 2014

model year, and EPA has been told to propose new rules by one year from now to deepen standards and extend them longer-term. 10-25%+ GHG & fuel savings are projected, depending on vehicle type, use and MY.



This graphic is from the President's Climate Change Action Plan. (And our fearless leader Gina McCarthy.)

What does global climate change have to do with New England? Well, for example:

- From 1970 to 2012, New England's average annual temperature has increased by 2 degrees, and 4 degrees in the winter. By 2100, NH summers will feel more like North Carolina's.
- We have seen a 74% increase in extreme weather events between 1958 and 2011.
- Sea levels are expected to rise on the New England coast by 36-79 inches by 2100.

We can't prevent climate change from where we sit in New England, but we can do our fair share to slow it down.



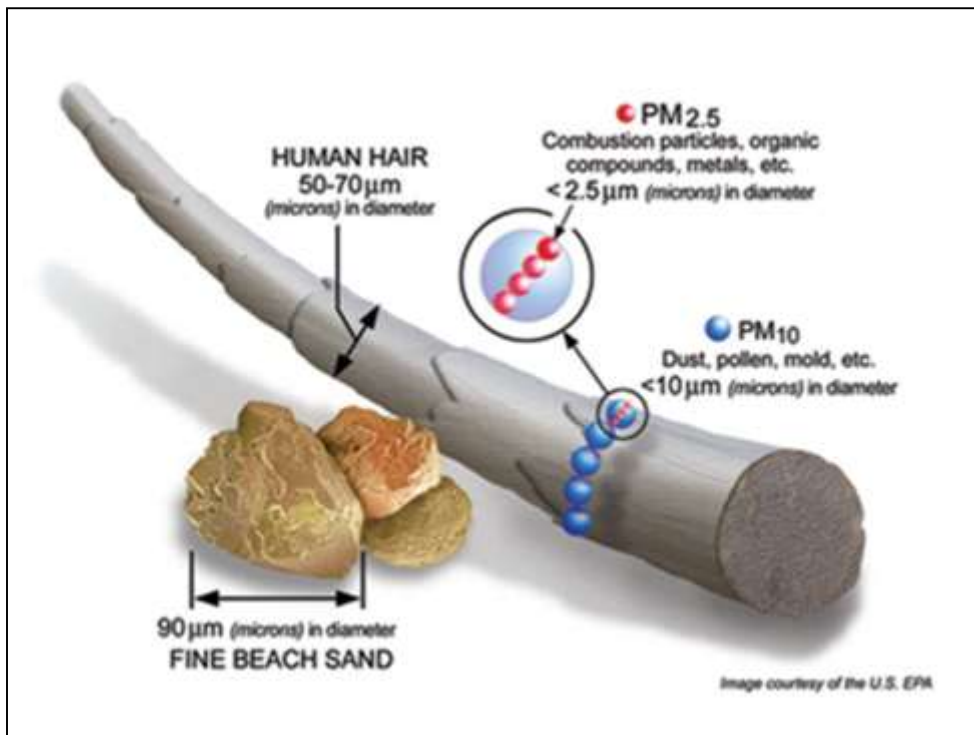
EPA's locomotive engine & fuels rules "live" in our program to reduce mobile sources of "criteria air pollutants," which cause localized air quality problems (e.g., smog) and are implicated in human disease. This graphic shows EPA's comprehensive program for regulating & improving the engines and fuels used by major classes of diesel- and gasoline-burning vehicles & equipment.

The locomotive rule is focused on NO_x and PM reduction, to address nonattainment of ambient air quality standards for PM and ozone. (About 150 million people are affected by one or the other.) Most of CT & Martha's Vineyard exceed ozone standards. New England is currently in attainment for PM.

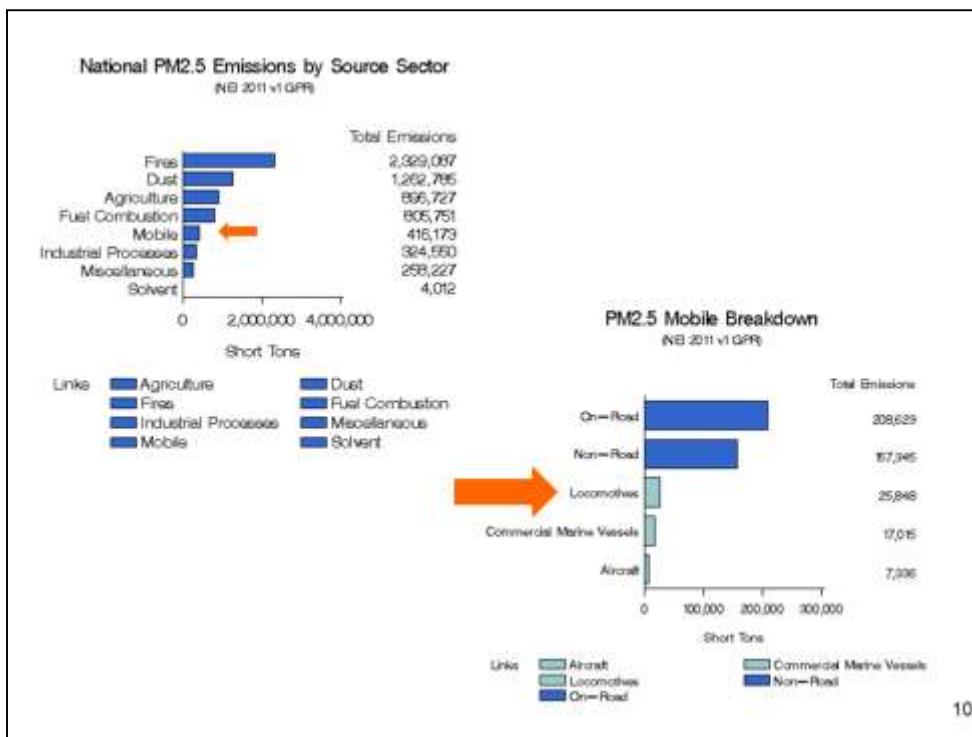
Locomotives aren't a huge source of particulate matter and nitrogen oxides, the criteria pollutants of most widespread concern, but because they have such long useful lives and acutely affect "hotspots," EPA is not ignoring them.

Heart & lung disease and cancer are the human health concerns. Railway workers and low-income neighborhoods are most affected.

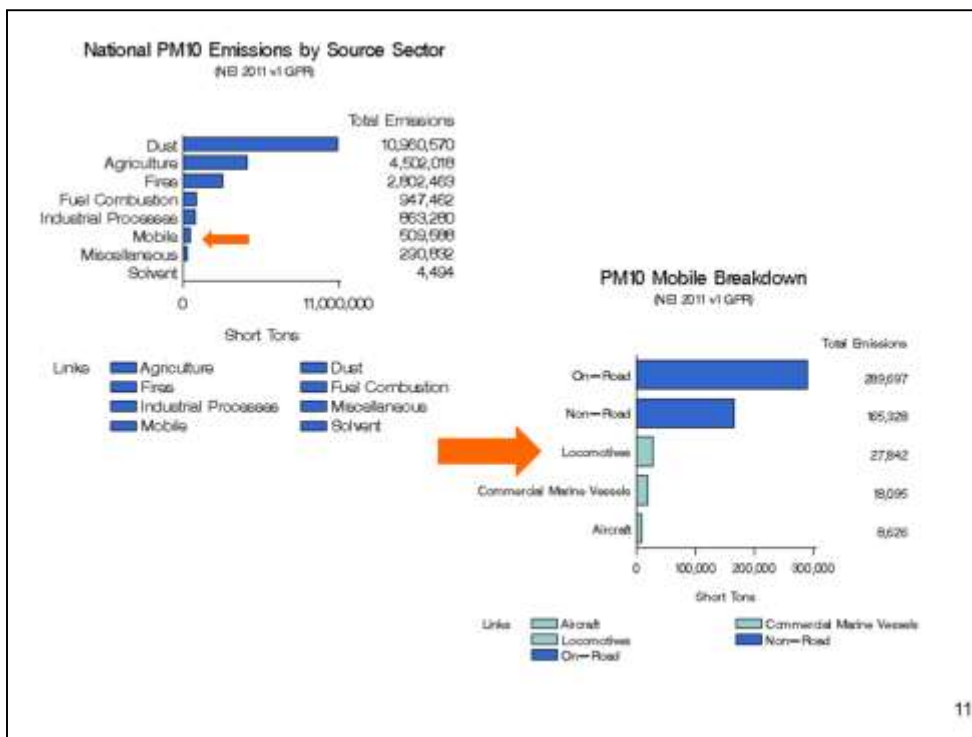
Studies of RR workers link diesel exhaust exposure to lung cancer, other lung diseases & symptoms, & neurobehavioral problems like slow reaction time.



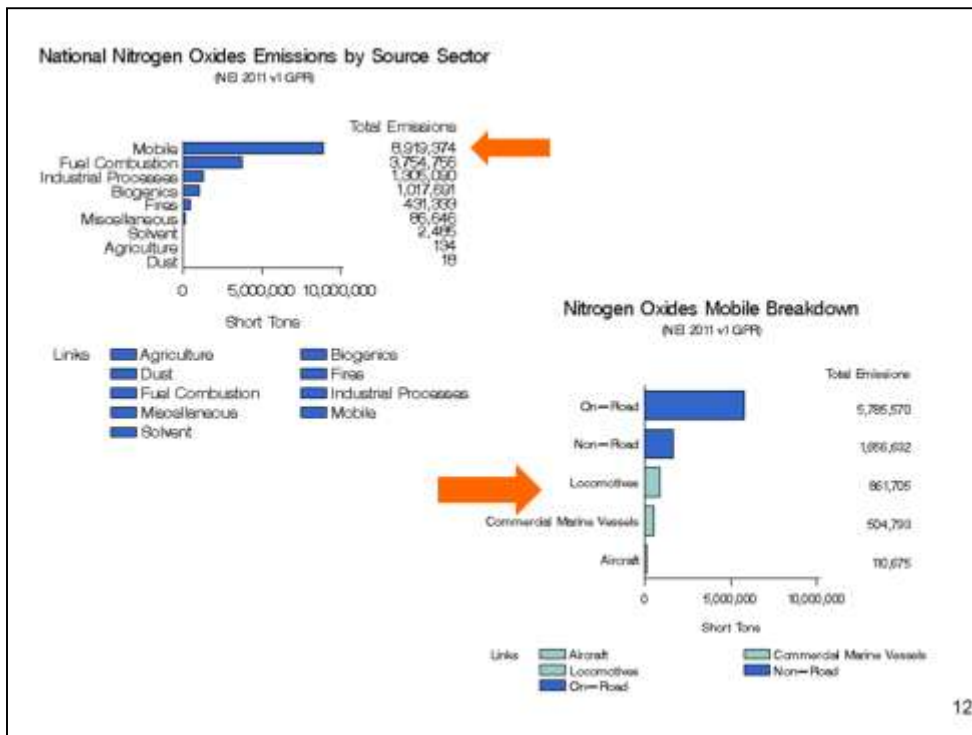
Two sizes of particulate matter are regulated by EPA. The tiniest can't be filtered by your respiratory system and penetrate deep into your lungs.



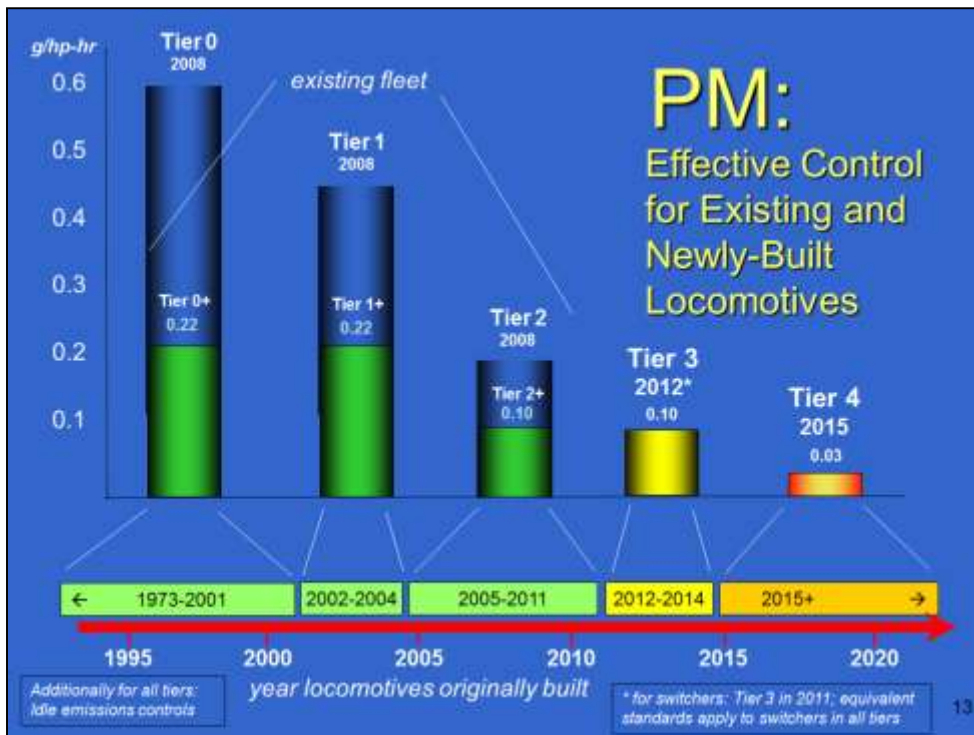
This just gives you an idea of the relative contribution of mobile sources to PM_{2.5} emissions, and among those mobile sources, locomotives.



Same here for PM 10.



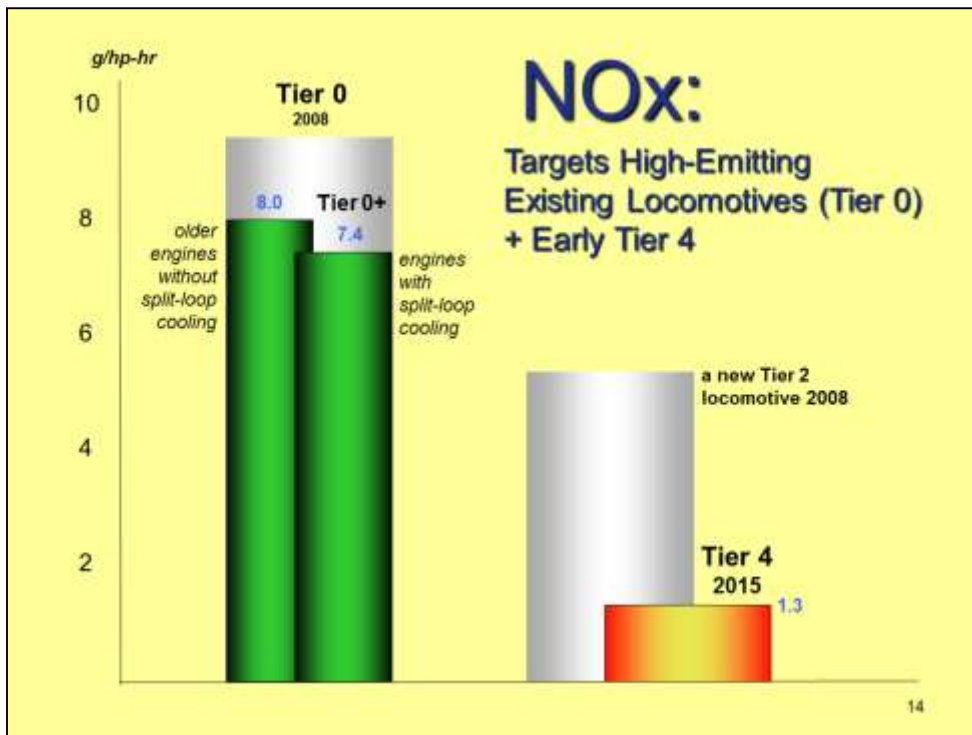
And now for NO_x. Mobile sources, including locomotives, are a bigger piece of the NO_x problem than the PM picture.



This is a very pretty slide showing how much engine standards are going to reduce PM output from locomotives over the years. Even middle-aged locomotives (labeled as “existing fleet” on the left half of the graph) can get a lot cleaner.

So here are the emissions reductions the 2008 rule is expected to accomplish:

- Remanufacturing a Tier 0, 1 or 2 locomotive to Tier 0+, 1+, or 2+ gets you a 50% reduction in PM.
- Refurbishing a locomotive triggers a requirement to meet even more stringent standards. Starting January 1, 2015 refurbished switch locomotives will have to meet Tier 3 and all line-hauls will have to meet Tier 4. (See right half of the graph.)
- Tier 4 squeezes out more emission improvements through exhaust aftertreatment. (As opposed to engine design.)



This slide on nitrogen oxide isn't as pretty, and doesn't show as much benefit from upgrading older locomotives, although in remanufacturing a Tier 0 engine to Tier 0+ with separate loop aftercooling, you get a 20% reduction in NOx. There is more benefit from building new engines.



As we go through the next bazillion slides, try to keep these potential benefits of the rules in the back of your mind:

- enhanced worker health
- fuel savings*
- increased reliability and lower maintenance (due to fewer engine-on hours and newer controls)**
- reduced chance of stack fire (due to soot buildup up during idling)
- increased public acceptance of rail operations due to cleaner exhaust and less idling??

This is a sculpture proposed by Jeff Koons, a replica of a 1943 Baldwin 2900 steam locomotive, for the High Line park (an elevated rail line donated by CSX) in NYC. The sculpture, to be constructed of steel and carbon fiber, would weigh several tons. It would also occasionally spin its wheels, blow its horn and emit steam. "Train" would employ a gyroscope to stabilize the sculpture to prevent it from swaying and scaring people. This just goes to show you that Artists are even crazier than Environmentalists.

*(through installing IR devices, even if Tier 0+ and Tier 4 engines entail a 1% FE penalty)

** (if not overwhelmed by costs associated with wear/tear on starter, and maintenance/malfunction of idle reduction and emissions control devices)



LOCOMOTIVE RULE REQUIREMENTS: OVERVIEW

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Learning what I'm about to tell you gave me even more gray hair– so please bear with me.

What standards must locomotives now meet?



- 1998: Original EPA standards for newly-manufactured locomotives (Tier 0, 1 & 2) and for remanufacturing existing locomotives built in 1973 or later.
- 2008: New EPA standards for locomotive & marine engines, including idle control for locomotives. Newly-manufactured locomotives meet Tier 3 & 4.
- 2010 & 2011: minor amendments to 2008 rule.

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- EPA's first standards for locomotive emissions date from 1998. They covered newly-manufactured locomotives (requiring them to meet Tier 0, 1 and 2 standards based on the year of manufacture), and set standards for remanufacturing existing locomotives built in 1973 or later.
- The 1998 rule also required all locomotives to be recertified at each subsequent remanufacture.
- Tiers are actually based on the year the *locomotive* was manufactured. A Tier 0 engine would be one that is in a Tier 0 locomotive.
- The 1998 rule did not include refurbishing.

- EPA's most recent standards for emissions from locomotive & marine engines, including idle control for locomotives, date from 2008. They cover:
 - Newly-manufactured line-haul locomotives (requiring Tier 3 and 4 engines)
 - Remanufactured/refurbished Tier 0, 1 and 2 locomotives (including switch locomotives), and
 - Mandate idling controls for all new locomotives and remanufactures.
- The June 30, 2008 Final Rule has the current emission standards.

- In 2010 & 2011, EPA made minor amendments to 2008 rule.
- The 2010 amendment clarifies that nonroad engines used in new and repowered switch locomotives can be older than 2008 if they are certified as conforming to 2008 (or applicable later-year) standards.
- The 2011 amendment acknowledges that new and repowered switch locomotives with nonroad engines may have slightly higher CO emissions than the equivalent-tier locomotive engines.

Something that the experts at HQ stressed to me is that EPA standards apply to the locomotive rather than the engine. There has always been confusion about this, but it is an important distinction. The space constraints on the actual locomotive chassis are often a limiting factor for emission controls. That is why the Tier 0 standards are so much less stringent than the Tier 4 standards – because you can't go back and create more room on the chassis.

TABLE 1 TO §1033.101—LINE-HAUL LOCOMOTIVE EMISSION STANDARDS

Year of original manufacture	Tier of standards	Standards (g/bhp-hr)			
		NO _x	PM	HC	CO
1973-1992 ^a	Tier 0 ^b	8.0	0.22	1.00	5.0
1993 ^a -2004	Tier 1 ^b	7.4	0.22	0.55	2.2
2005-2011	Tier 2 ^c	5.5	*0.10	0.30	1.5
2012-2014	Tier 3 ^c	5.5	0.10	0.30	1.5
2015 or later	Tier 4 ^d	1.3	0.03	0.14	1.5

^aLocomotive models that were originally manufactured in model years 1993 through 2001, but that were not originally equipped with a separate coolant system for intake air are subject to the Tier 0 rather than the Tier 1 standards.

^bLine-haul locomotives subject to the Tier 0 through Tier 2 emission standards must also meet switch standards of the same tier.

^cTier 3 line-haul locomotives must also meet Tier 2 switch standards.

^dManufacturers may elect to meet a combined NO_x+HC standard of 1.4 g/bhp-hr instead of the otherwise applicable Tier 4 NO_x and HC standards, as described in paragraph (j) of this section.

*The PM standard for newly remanufactured Tier 2 line-haul locomotives is 0.20 g/bhp-hr until January 1, 2013, except as specified in §1033.150(a).

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The June 30, 2008 Final Rule has the current emission standards. Here they are, just as an eye test, or for later reference. First line-haul...

TABLE 2 TO §1033.101—SWITCH LOCOMOTIVE EMISSION STANDARDS

Year of original manufacture	Tier of standards	Standards (g/bhp-hr)			
		NO _x	PM	HC	CO
1973-2001	Tier 0	11.8	0.26	2.10	8.0
2002-2004	Tier 1 ^a	11.0	0.26	1.20	2.5
2005-2010	Tier 2 ^a	8.1	^b 0.13	0.60	2.4
2011-2014	Tier 3	5.0	0.10	0.60	2.4
2015 or later	Tier 4	^c 1.3	0.03	^c 0.14	2.4

^aSwitch locomotives subject to the Tier 1 through Tier 2 emission standards must also meet line-haul standards of the same tier.


^bThe PM standard for new Tier 2 switch locomotives is 0.24 g/bhp-hr until January 1, 2013.

^cManufacturers may elect to meet a combined NO_x+HC standard of 1.4 g/bhp-hr instead of the otherwise applicable Tier 4 NO_x and HC standards, as described in paragraph (j) of this section.

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...now switch.

Which is better? Line-haul...switch? Line-haul...switch? Eh, you need bifocals.




Who must comply?

- Manufacturers
- Remanufacturers
 - Suppliers
 - Installers
 - Owners who specify work
- Refurbishers
- Owners
 - Class I, II and IIIs (if owned by large parent co's)
 - Intercity passenger & commuter RRs

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Responsibility for implementing the rules falls upon:


- Manufacturers of new locomotives, who must certify the locomotive designs before they may be sold.
- Remanufacturers, who must certify the remanufactured locomotive designs before the locomotives may be placed back into service. Certifying remanufacturers may be any of the following:
 - Any person engaged in the manufacture or assembly of remanufactured locomotives or locomotive engines, such as persons who:
 - Manufacture **kits** used to bring older locomotives up to new standards.
 - Design or produce the emission-related **parts** used in remanufacturing.
 - Install** parts in an existing locomotive or locomotive engine to remanufacture it.
 - Own or operate** the locomotive or locomotive engine and **provide specifications** as to how an engine is to be remanufactured (i.e., specifying who will perform the work, when the work is to be performed, what parts are to be used, or how to calibrate the adjustable parameters of the engine).
 - Any person who **imports** remanufactured locomotives or remanufactured locomotive engines.
- Refurbishers must comply in the same way remanufacturers do. Only the standards they must adhere to are different.
- Owners (or RRs): Class I, II and some IIIs (those owned by large parent companies) are covered. Class III RRs meet the definition of small business in the rule if they fall below the annual revenue standard set by the STB, which at last update (April 3 2013) was \$36,212,260, and enjoy some exceptions.
- Intercity passenger/commuter RRs regardless of revenue.
- EPA makes no distinction for leased locomotives. Lessors and lessees are responsible just as with owner-operated locomotives.
- Only Class I RRs must perform in-use testing.



What locomotives are covered?

- Regardless of application
- Line haul and switch (< 2300 hp total)
- “Freshly manufactured” (less than 25% used parts)
- “Existing” regardless of age, when refurbished
- “Existing,” 1973 or later vintage, when remanufactured






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Now, what locomotives are covered?

- Those in any application: freight, passenger, commuter/intercity, industrial.
- Both line-haul and switch (less than 2300 hp total) locomotives.
- All new locomotives, and all locomotives containing a new locomotive engine. That is:
 - New (known in the rules as “freshly manufactured”) locomotives [I love that term— that’s why you see the lettuce], which are those containing less than 25% used parts by value.
 - line-haul locomotives must be built to Tier 3 as of 2012, and Tier 4 in 2015
 - switch locomotives must be built to Tier 3 as of 2011, and Tier 4 in 2015
 - An existing locomotive is covered, *regardless of its age*, when it is “refurbished.” When you refurbish a locomotive, you are adding a new engine, and making it on the whole more new than old. Details to follow.
 - Note that when you “upgrade” a locomotive not otherwise subject to the standards, you are making it subject to the standards. “Upgrading” includes refurbishing, repowering, and voluntarily meeting the standards.
- An existing locomotive originally manufactured in 1973 or later is covered when it is “remanufactured.” This is a somewhat less extensive procedure than refurbishing, so there is an age threshold. Details to follow.
- Not covered:
 - steam-powered locomotives used for historical purposes
 - locomotives powered only by external electricity
 - locomotives under 1000 HP or 750 kW
 - locomotives which have received an exemption for operating on “non-standard gauge rails”
 - Equipment that is not a locomotive, such as rail maintenance equipment (not by THIS rule).



Small business exemption

- From remanufacturing/refurbishing standards
- For locomotives never certified to any Tier
- Idea: avoid costs of reconfiguring locomotive
- Must be owned AND operated by small biz
- Status of NE shortlines and Class IIs??



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So what exceptions do small businesses enjoy?

- Class III RRs below the “small business” threshold are exempt from the remanufacturing & refurbishing requirements for locomotives in their existing fleets (i.e., used locomotives) that have *never before been certified to any “Tier”* (level 0 and up). By 2002, all newly-manufactured locomotives were certified to Tier 0 or better, so a 2002 or younger locomotive owned by a small business is not exempt.

- The assumption behind this provision is that Class III RRs tend to own old locomotives that were manufactured prior to engine certification standards kicking in. Therefore, EPA tried to avoid imposing the capital costs of reconfiguring a locomotive to achieve lower emissions on small businesses.

- However, if a locomotive has been certified already, subsequent compliance costs should be much lower because the locomotives should have already had a lot of the hardware reconfigured. So for those locomotives, no exception is necessary.

- For a locomotive to be exempt, it must be owned AND operated by a small business. If the operator is a small business leasing a locomotive, the lessor is not exempt, and the small business should not operate a noncompliant locomotive.

- EPA has not taken a hard look at the companies like Genesee & Wyoming that are “larger parent companies” of multiple shortlines. EPA also has not looked at Class II RRs that segment their business units in such a way that they might seek to claim the small biz exemption. That will come, in time.

What is “Refurbishing?”



- A form of remanufacturing
- Overhauling a locomotive so more new than old
 - > 50% new or reconditioned parts, by value
 - New engine
- One-time event
- Pretty drastic, so
 - all vintages covered
 - standard for new engine somewhat higher than for simple remanufacture

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•An existing locomotive is covered, *regardless of its age*, when it is “refurbished.”

•“Refurbishing” means to overhaul a locomotive so that it is more new than old. Refurbishing is usually considered to be a *form* of remanufacturing. Refurbished locomotives generally must meet more stringent standards than locomotives that are simply remanufactured.

•The definition of refurbishing in the 2008 rule is “To modify an existing locomotive such that the resulting locomotive contains 25%-50% (reconditioned) used parts, by value, and a new regulated engine.”

• After refurbishment, over half of the locomotive’s parts are new. Just add up the new parts and the old parts--weighted by the value of the parts--and calculate how much of the locomotive is new at the end of the process. If it’s more than 50% new, you have refurbished it. If it’s more than 75% new, it is treated the same as if it is 100% new, and subject to the “freshly manufactured” standards.


•Refurbishing a locomotive effectively removes an old, high-emitting locomotive from the fleet and replaces it with a cleaner one. Refurbishing is a one-time event (not cumulative over time). It is a more major overhaul than “remanufacturing,” which is why it is a trigger for the rule for locomotives 1972 and older. (Repowering is also a trigger for those older locomotives.) In other words, EPA is sort of grandfathering out these older locomotives unless they are substantially rebuilt with a high percentage of new parts or a new engine.

•If locomotive is refurbished up through 2014:

- Switchers, and locomotives between 2300 & 3000 hp, must meet Tier 0+
- Line-haul locomotives must meet Tier 2+ or 3

•If locomotive is refurbished in 2015 or later:

- Switchers must meet Tier 3
- Line-haul locomotives must meet Tier 4



What is “Remanufacturing”?

- Varieties
 - Overhauling engine-- replacing every power assembly
 - Upgrading engine
 - Replacing engine
 - Converting to run on alt fuel
- Single event, or cumulative (over ≤ 5 years)
- Less drastic / sudden than refurbishing, so
 - triggers rule only for 1973+ vintage locomotives
 - standard for new engine somewhat lower than for refurbishing

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•An existing locomotive, originally manufactured in 1973 or later, is covered when it is “remanufactured.”

•EPA’s definition of remanufacturing is “To replace each and every power assembly of a locomotive or locomotive engine, whether during a single maintenance event or cumulatively within a five-year period.” Replacement power assemblies can be new or reconditioned.

•“Remanufacturing” can involve overhauling an engine, upgrading it, replacing it, or converting it to run on a different fuel. “Repowering” a locomotive means replacing the existing engine with a brand new engine, and can be part of a remanufacturing or refurbishing process.

•Because remanufacturing can be a less major, and sometimes more gradual, overhaul than “refurbishing,” this work is a trigger for the rule for locomotives 1973 or newer, but not for older locomotives. EPA sought to bring more of these younger locomotives under the rule by using both refurbishing and remanufacturing as triggers.

•Regulated parties must comply at the time when the locomotive is remanufactured, *provided that an EPA-certified remanufacturing kit is available* for that engine. In 2009, several passenger RRs received exemptions for certain locomotives (mostly GE) for which kits were not available. Those exemptions will expire, approximately within the next 5 years (based on a 10-year default overhaul interval).

•The new emission standards for remanufactured locomotives phased in over time, based on the year the locomotive was originally manufactured (for both line-haul & switch locomotives)

- By Jan 1, 2010, locomotives with Tier 0 engines, built between 1973 & 2001, were covered
- Also by Jan 1, 2010, locomotives with Tier 1 engines, built between 2002 & 2004, were covered
- By Jan 1, 2013, locomotives with Tier 2 engines, built from 2005 on, were covered



What does the rule require?

- Certification to current applicable Tier
- Use a certified kit
- An idle reduction device that:
 - Shuts down engine after ≤ 30 min idling
 - Can stop/start ≥ 6 times/day without damage
 - Allows continued idling to
 - Prevent freezing
 - Maintain air pressure
 - Maintain battery
 - Perform maintenance
 - Comply with government regs
 - Heat or cool cab when necessary

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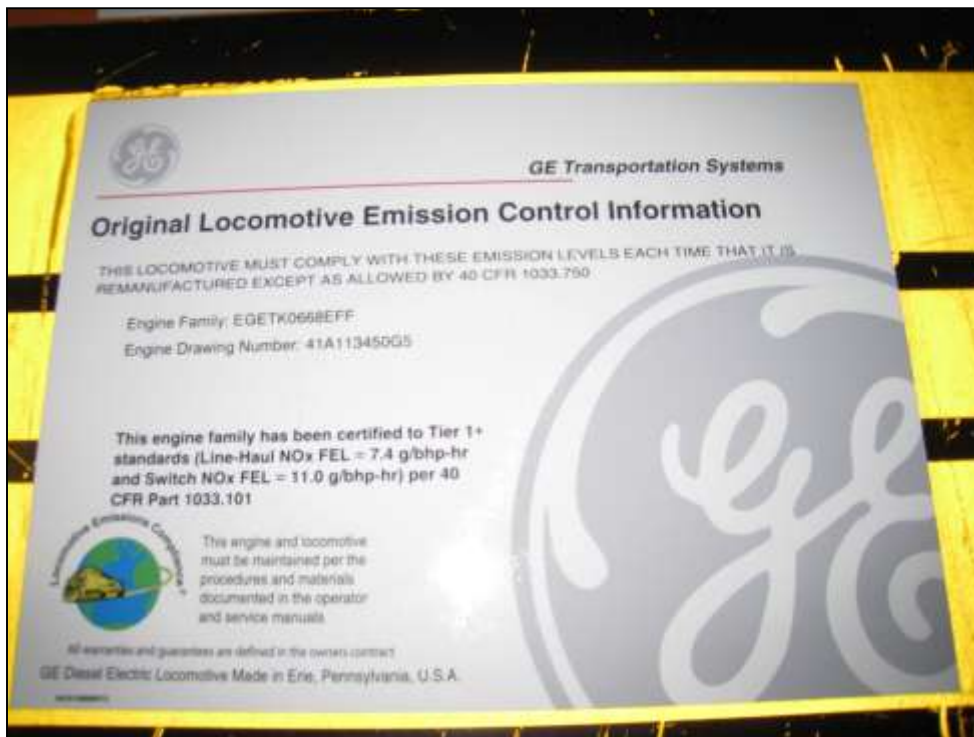
So what do those who must comply need to **do** when they are refurbishing or remanufacturing a covered locomotive?

- It must be certified to meet the current applicable Tier of emission standards, which may be more stringent than those that applied when the locomotive was previously certified. This is usually done by using an EPA-certified rebuild kit, but can involve substituting certified nonroad engines.


- If the certified rebuild kit doesn't already include an idle reduction system, one must be obtained and installed before the locomotive is placed back into service.

- A proper idle reduction system (referred to as automatic engine start-stop or AESS device) is one that:

- shuts down the locomotive engine after no more than 30 continuous minutes of idling
- is able to stop and start the engine at least six times per day without causing engine damage or other serious problems.
- may allow engine to continue idling to
 - prevent engine damage such as that caused by cooling water freezing
 - maintain air pressure for brakes or starter reservoirs/systems
 - maintain the locomotive battery charge
 - perform necessary maintenance
 - otherwise comply with applicable government regulations (e.g., FRA safety testing)
 - heat or cool the cab when "necessary" (which is defined by RR policy-- for operator comfort, facilities, & to protect delicate electronic instruments, etc)




This locomotive label illustrates remanufacturing standards, Tier 1+ in this case.



AESS or APU or FOH or...?

- Default is AESS, but specific hardware can vary
- APUs encouraged to reduce AESS restarts
- APU challenges:
 - Initial cost
 - Maintenance
 - Installation
 - Brake pressure
- APU success varies by:
 - Application & operations
 - Climate



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•The idle reduction provision of the 2008 rule defaults to AESS, but the specific hardware used in AESS systems could vary. Small-displacement engines (aka auxiliary power units of fuel operated heaters) may be used as part of the system. These engines may turn on when the AESS system tells the locomotive engine to turn off, and when they are on, they may drive a pump which circulates warm fluids through the locomotive engine, generate electricity, or perform other functions.

•Why did EPA specify AESS? Why not APUs?

•The amount of idle reduction an APU can provide is dependent on a number of variables, they cost more to buy and maintain, and can present installation complexities, so requiring them in addition to AESS on every subject locomotive would not be fair. Some of the variables that influence APU effectiveness include:

- Whether the locomotive is a switcher vs line-haul-- if equipment is stationary only for short periods of time, it is inefficient to repeatedly shut the engine down manually and activate the APU, then turn the engine on again to resume work.
 - The geographical area where the locomotive operates-- in cold climates, an APU will do much more good than in moderate climates, but line haul locomotives may not be dedicated to one zone.
 - The locomotive's operating characteristics-- those that are idle for significant periods benefit from APUs more than those that work all day or every day.
 - Typical APUs cannot satisfy all locomotive parameters, including brake pressure (especially for multi-car trains), wherever they operate.
 - Fuel-operated heaters or diesel warming systems require shorepower or extra battery power.
 - The rule encourages manufacturers to add APUs to AESS systems to help meet emissions standards, recognizing that APUs can substantially reduce necessary idling time, especially in cold weather climates, by reducing the number of times AESS has to come on to:
 - heat engine coolant and engine oil
 - charge the batteries
 - provide hotel power & run accessories such as those required for cab comfort
 - The rule also recognizes that APUs are powered by nonroad engines, so emit at much lower levels than do idling locomotives.
 - Some Class I RRs (example: CSX) have developed & certified their own AESS/APU combination idle reduction technologies. Other AESS, APU and FOH manufacturers offer models that integrate with complementary equipment for more fuel savings. Find them on the SmartWay technology resources page.
 - Other ways to save fuel:
 - Keep the locomotive in good repair. Weak batteries, leaky brakes, etc can call for the AESS to restart the engine too often.
 - Monitor how idle reduction technology is working in the field to make sure it's not malfunctioning or being overridden unnecessarily by operators.
 - Think about supplementing idle-reduction equipment with other technologies and strategies like ground air, keeping yard locomotives indoors overnight, shutting down "extra" locomotives in a consist not needed to supply air pressure in good weather, staffing up for faster crew changes...ETC
- (EPA expected a 1% fuel consumption increase for Tier 4 engines due to higher exhaust backpressure from aftertreatment devices.)



LOCOMOTIVE STANDARDS & CERTIFICATION: DETAIL

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Here's a bit more detail on the standards and certification process.

What standards apply?

Depends on:

- Year locomotive was manufactured
- Tier of engine in the locomotive
- Power rating (> or < 2300 hp)
- Calendar year (if refurbishing).

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In brief, the emission standards that apply when remanufacturing or refurbishing a locomotive depend on:

- The year the locomotive was originally manufactured.
- The Tier to which its engine was previously certified, which is listed in the “Locomotive Emission Control Information” label on the engine.
 - Note that there are two types of labels, one for the locomotive and one for the engine.* The locomotive label is usually located (for GE and EMD’s) on the front outside chassis, with a duplicate in the cabin. The engine label is on the engine.
- The power rating (above or below 2300 HP).
- The calendar year during which the work is completed, if you’re refurbishing (not relevant if you’re remanufacturing).

Here are a couple of tables that show the engine Tiers that apply depending on the age of the locomotive, and when the work is done. I’m very proud of them because I compiled them based on the regs, and the guy who wrote the regs blessed them!

*(See section 1033.135 for details.)

Line Haul



Year of Original Manufacture	Original Locomotive Tier	Minimum Tier for Remanufacture	Minimum Tier for Refurbishment	
			Through 2014	2015 & later
Pre-1973	Unregulated	n/a*	2+	4
1973-1992	Tier 0	0+	2+	4
1993-2004	0 or 1	1+	2+	4
2005-2011	2	2+	2+	4
2012-2014	3	3	3	4
2015 & later	4	4	n/a	4

*Don't have to meet any standards for a simple remanufacture, but have to meet Tier 0+ for a repower (new engine).

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What does “+” mean? Just an enhanced standard for the engine from that locomotive vintage. For grams per brake-horsepower-hour values, we’d go back to the eye test charts.

You see that which year you refurbish a locomotive has bearing on how clean the replacement engine needs to be. When 2015 rolls around, the “through 2014” column will go away.

Switch Locomotives				
Year of Original Manufacture	Original Locomotive Tier	Minimum Tier for Remanufacture	Minimum Tier for Refurbishment	
			Through 2014	2015 & later
Pre-1973	Unregulated	n/a*	0+	3
1973-2001	Tier 0	0+	0+	3
2002-2004	1	1+	1+	3
2005-2010	2	2+	2+	3
2011-2014	3	3	3	3
2015 & later	4	4	n/a	4

* Don't have to meet any standards for a simple remanufacture, but have to meet Tier 0+ for a repower (new engine).

You'll notice that the standards for switch locomotives are more lenient, the idea being that they emit less, because they burn less fuel as a "fleet" than line haul locomotives do. (Although they can have an outsized impact in the immediate vicinity of where they work.)

An alternative for switch locomotives is to use certain nonroad engines meeting the standards that are required in whatever year the locomotive is being refurbished.*

* (To find out about these standards, see 40 CFR part 1039.)



Here's a pretty picture of a remanufactured GE locomotive engine, just because we need one at this point.




OK, now for some examples of who does what, and when, in complying with the 2008 rule's requirements for Remanufacturing and Refurbishing.

I tried to think of all the basic ways this could play out. It hurt, believe me, it hurt.

Keep in mind: this is not about requirements for brand new locomotives (defined as having less than 25% used parts).

Class III RR



- Pre-1973 locomotive, never before refurbished/certified: **exempt because owner is small biz, but won't be if sold to larger biz**
- Pre-1973 locomotive, already refurbished: same
- 1973+ locomotive, never before certified: same
- 1973+ locomotive, remanufactured/refurbished but not certified: same
- 1973+ locomotive, certified: **standards apply**

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These examples apply to Class III (“Short Line”) RRs NOT owned by a larger parent company. Remember that if the locomotive is leased from a larger businesses, it is not exempt.

For a locomotive originally manufactured in **1972 or earlier**, and **never before refurbished or otherwise certified**: the rule does not apply because the owner is a small business. *If the locomotive is sold to a larger business, the rule will apply at the time when the locomotive is remanufactured or refurbished.*

For a locomotive originally manufactured in 1972 or earlier, that **has been refurbished**: the rule does not apply because the owner is small business. *If the locomotive is sold to a larger business, and the refurbishment took place **after** the 2008 rule went into effect (even if it was conducted while owned by the small business), the locomotive must comply when it is put into service.* (Because this rule is supposed to be less onerous for small businesses, refurbishment conducted after 2008 only “counts” if it is conducted after the locomotive is sold to a larger business.) *If the refurbishment took place **before** the 2008 rule went into effect, the rule will apply when the locomotive is next remanufactured or refurbished.*

(continued on next page in Notes view)

(continued from previous page in Notes view)

For a locomotive originally manufactured in **1973 or later**, and **never before certified**: the rule does not apply because the owner is small business. *If the locomotive is sold to a larger business, the rule will apply at the time when the locomotive is remanufactured or refurbished.*

For a locomotive originally manufactured in 1973 or later, that **has been remanufactured or refurbished, but not certified**: *(You may ask, how can it NOT have been certified? Imagine that replacing the traction motors and generator amounted to 51% of the cost of the work, meaning that the requirement to upgrade the engine was not triggered.)* The rule does not apply because the owner is a small business. *If the locomotive is sold to a larger business, and any step* of the remanufacture or refurbishment process took place **after** the 2008 rule went into effect (even if it was conducted while owned by the small business), the locomotive must comply when it is put into service. If the remanufacture or refurbishment took place wholly* **before** the 2008 rule went into effect, the rule will apply when the locomotive is next remanufactured or refurbished.*

For a locomotive originally manufactured in 1973 or later, that **has been certified** (as originally manufactured, or remanufactured/refurbished): the standards apply.

*("Any step" and "wholly" refer to the possible scenario that a remanufacture began before the rule took effect and finished afterward.)

Other RRs



- Pre-1973 locomotive, never before refurbished/certified: standards apply
- Pre-1973 locomotive, already refurbished: standards apply. Should be in compliance if refurb done after July 2008. Otherwise: next time
- 1973+ locomotive, never before certified: standards apply
- 1973+ locomotive, never before remanufactured/refurbished: standards apply
- 1973+ locomotive, reman/refurb: standards apply, and should be in compliance if > July 2008. Otherwise: next time.

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These examples apply to Class III (“Short Line”) RRs owned by larger parent company that trips the annual revenue threshold, any Class II (“Regional”) RR, any Class I RR, and any passenger or commuter RR.

They apply to any locomotive they own or lease.

For a locomotive originally manufactured in **1972 or earlier**, and **never before refurbished or otherwise certified**: the rule will apply at the time when the locomotive is remanufactured or refurbished. Even if the lessor (the owner) is a small business, the locomotive is subject by virtue of being operated by a non-small business.

For a locomotive originally manufactured in 1972 or earlier, that **has been refurbished**: the rule applies, and the locomotive should already be in compliance if refurbishment was done after the 2008 rule went into effect. Otherwise, the locomotive must be brought into compliance when it is next remanufactured or refurbished.

For a locomotive originally manufactured in **1973 or later**, and **never before certified**: the rule applies when the locomotive is remanufactured/refurbished.

For a locomotive originally manufactured in 1973 or later, and **never before remanufactured or refurbished**: the rule applies at the time when the locomotive is remanufactured or refurbished.


For a locomotive originally manufactured in 1973 or later, that **has been remanufactured or refurbished**: If any step of the remanufacture or refurbishment process took place *after* the 2008 rule went into effect, the locomotive must be in compliance with the rule. If the remanufacture or refurbishment took place wholly *before* the 2008 rule went into effect, the rule will apply when the locomotive is next remanufactured or refurbished.



FUEL

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After that ordeal, this is going to seem relatively easy! Later I'll give you contacts who can help you determine whether you, your locomotives and your activities are covered.



What fuel can you use?

- Earlier transition to ULSD in Northeast/Mid-Atlantic and AK than in rest of country
- As of 2012, everyone should be using only ULSD in any locomotive
- Transmix?
- Winter mix OK if ≤ 15 ppm sulfur
- 97% cleaner— better for people & engines

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•EPA's nonroad diesel rule (promulgated in 2004, amended in 2005) required refiners and importers to make ULSD (15 ppm sulfur) available for locomotives as of June 1, 2012 and to produce nothing but ULSD for locomotives after June 1, 2014.

•However, in the Northeast/Mid-Atlantic and Alaska, a quicker transition was feasible because producers and distributors could sell higher-sulfur stock to the oil heat market. So, around here, June 1 2012 was the deadline for ending production of any diesel other than ULSD for any market other than heating.

•The downstream phase-in dates when ULSD became mandatory in this area were:

- August 1, 2012: for terminals and distributors
- October 1, 2012: for retail and fleet operators
- December 1, 2012: for all locations including individual locomotives

•So, because the "downstream flexibility" and hardship provisions of the rule do not apply in the Northeast/Mid-Atlantic and Alaska, December 1, 2012 was the deadline for using nothing but ULSD in locomotives. (In other parts of the country, LSD can be used in locomotives until December 1, 2014.)

•We can talk about transmix fuel if anyone is using it or being offered it.*

•The practice of mixing lighter distillates into diesel fuel for winter use is OK as long as the winter additive is a distillate fuel with less than 15 ppm sulfur content. (ULSD fuels and Ultra Low Sulfur Kerosenes that meet this requirement are available.)

•ULSD may cost a bit more than LSD, but because it contains 97% less sulfur, there are a few silver linings:

- Lower sulfur means less particulate matter & other pollutants, so less health risk to your workers & neighbors.
- A cleaner fuel means less soot buildup in the stack and less contamination of engine oil and other components.
- Tier 4 locomotives won't work on anything but ULSD, and some Tier 3 locomotives work better on it.

*There's an exception for transmix:

•2012 revisions to the rule provide for the production of transmix-derived locomotive and marine fuel. "Transmix" is a mixture of finished fuels, such as those that abut each other during pipeline shipment, that no longer meets the specifications for a fuel that can be used or sold without further processing.

•If a railroad wants to receive and use transmix-derived LSD in their older locomotives, they should be aware of the need to obtain a special waiver ahead of time. EPA requires RRs to be on record as transmix users, and to make sure that any tier 4 locomotive engines (or any engine with sulfur sensitive aftertreatment devices) are not exposed to it.

•A processor wanting to market transmix has to submit a compliance plan to EPA that includes how they will meet all of the segregation and use requirements, including confirming with downstream parties that transmix will not be used in new technology engines. The waiver process puts any railroad on notice that they may be receiving LSD fuel, and the product transfer documents will confirm when the fuel is LSD grade, as opposed to ULSD grade.

•In 2013, one waiver was granted, for a Virginia distribution area. There is a transmix processor in Sewaren, NJ but info in hand at EPA does not indicate that they have a waiver or would be distributing in New England.

•Bottom line: Starting on June 1, 2014, the only way you can accept and use transmix-derived LSD rather than ULSD is 1) if you operate an older locomotive with non sulfur-sensitive technology, AND 2) your supplier of provides you with proof that he has a waiver and a compliance plan on file with EPA. The compliance plan includes keeping this transmix-derived LSD separate and labeled differently from ULSD, and insuring that customers don't use LSD in new-technology engines. This waiver provision does not apply in Alaska.

Fuel compliance issues



- Keep receipts
- Don't mix
- Label properly
- Provide spill protection
- EPA inspections: locomotives, yard equipment, storage tanks
 - Contamination
 - Mislabeling

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RRs need to be able to prove that they are using ULSD exclusively.

- Keep documentation of fuel deliveries showing the grade/type of fuel delivered.
- Other fuels and oils (e.g., used motor oil) can't be mixed with ULSD in tanks or barrels used for fueling locomotives & other equipment. (Except winter mix, as just described.)
- RRs need to store fuel in tanks labeled "ULSD," with no contradictory duplicate labels.
- The American Petroleum Institute (API) developed a set of labels for fuel dispensers that are EPA approved. To view/download the "Ultra-Low Sulfur Non-Highway Diesel Fuel" label go to: <http://www.api.org/oil-and-natural-gas-overview/fuels-and-refining/diesel/suggested-diesel-pump-labels>
- As always, tanks should have spill protection. See <http://www.tercenter.org/pages/dieselstorage.cfm>
- As part of its ongoing review of the Class I RRs, EPA has conducted sampling of locomotive tanks and yard storage tanks for both locomotive refueling and yard equipment use. EPA has also been checking tank labeling to assess compliance. Problems found to date have included:
 - Some contamination of ULSD with older fuel, possibly from pipeline transmix or from failure to empty and clean LSD tanks before introduction of ULSD.
 - ULSD labels have also been found to be missing, have the wrong text, or placed alongside old labels instead of removing the old labels.
 - EPA has notified the RR companies of these findings so that they can correct the non-compliant fuel use and labeling.



Here's an example of contradictory labels.



No label



Another unlabeled tank— what kind of diesel?



A proper label. This is EPA-approved language.

Frankly, I find the label confusing. The language seems to imply that if your locomotive is older than 2011, you do not need to use ULSD, which is wrong. Instead, the statement is intended to protect 2011 or newer engines. The text that was approved during the transition from LSD to ULSD, and EPA has not seen fit to declare that ULSD labels with this language are no longer valid. Similarly, the "Low Sulfur Locomotive and Marine Diesel Fuel" label posted on the American Petroleum Institute's website is outdated.



LOCOMOTIVE RULE: COMPLIANCE & ENFORCEMENT

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So how do you stay out of trouble?



Ways to stay out of trouble

- Verify proper remanufacture/refurbish
 - Broad liability
 - Idle control
 - Certification
 - Labels
- Maintain engines & equipment

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- Make sure your locomotive is or has been refurbished or remanufactured properly.

- The compliance liability net is broad. If an uncertified remanufactured locomotive is put into service, everyone involved is potentially liable. Each is responsible to ensure that someone got a certificate. This includes RRs.

- Be aware: Manufacturers can get an EPA certificate for a rebuild kit that does not include idle control. If you use one of these kits, you have to address the idle requirement yourself, and procure an AESS system that's certified.

- Certification for both the engine and the idle reduction component need to be in hand before the locomotive can be put back into service. So, ask the shop that is remanufacturing or refurbishing your locomotive, or the company you're leasing the locomotive from, to show you that the engine label indicates a *complete* certified system has been installed, *or that there are two labels*, one for a certified engine and another for a certified idle reduction device. As authorized by section 208 of the Clean Air Act, EPA can ask RRs to prove that the remanufactured engines they're putting into service have the proper certifications and have been maintained.

- A remanufactured/refurbished locomotive can be covered by a certificate of conformity obtained by anyone for whom the definition of "remanufacturer" applies, which could include an OEM or supplier, the company that performed the work, or you if you did the work yourself. In any case, you are responsible for making sure the certificate is applicable to your locomotive, based on the model, date of original manufacture, Tier or "family emissions limit" to which its engine was previously certified, and power rating. You must make sure the locomotive is covered before you reintroduce it into service.

- Maintain your engines and idle control equipment as specified by the certifying manufacturer/remanufacturer. Perform unscheduled maintenance (that is, fix problems) no later than the locomotive's next periodic inspection (92 or 184 days, depending on age), but earlier if warranted.



OK, here are some photos from EPA inspections that illustrate labeling.

There are two types of labels, one for the locomotive and one for the engine.*

- The locomotive labels are usually located (for GE and EMD's) on the front outside chassis, with a duplicate in the cabin.
- The engine labels are on the engine.

The Tier to which its engine has been certified is listed in the "Locomotive Emission Control Information" label on the engine.

Here's an engine label.

*(See section 1033.135 for the details.)



Closer in...



Say cheese!



A supplemental label on an engine.



Another engine label.



A locomotive label on a chassis.



A close-up of that locomotive label.



Locomotive label in the cab.



Supplemental labels on the engine cabinet door.



EPA labels in the cab.



Recordkeeping Roles

- **Manufacturers:** certificates for engines & kits
- **Repair shops:**
 - Remanufacture/refurbish:
 - Proper procedures & parts
 - Track all power assembly replacements
 - Maintenance
- **Owner/operator:**
 - Repair records
 - Maintenance records
 - “Small business” status

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What recordkeeping is necessary to prove you're in compliance? Who holds the certificate? Who documents the work? Here are the roles:

• Manufacturers that furnish engines and kits that enable locomotives to be upgraded in accordance with EPA standards usually “hold the certificate,” meaning that they applied for and received a certificate of conformity (COC) from EPA. Sometimes, but not often, a remanufacturer holds the certificate instead.

• Repair shops that perform work subject to the rule need to be able to produce records upon request for each subject locomotive that they've remanufactured or refurbished. EPA does not expect remanufacturers to produce a copy of the actual certificate. Instead, their records need to track all remanufacturing/refurbishing events, including itemization of parts used. Typically, documentation for each event is kept in its own folder.

• The remanufacturer/refurbisher must be able to show that the remanufacture or refurbishment of the locomotives was conducted in accordance with the certification requirements—that they followed the certificate holder's instructions in conducting the remanufacturing process, and used the correct parts. EPA evaluates this by reviewing their records of the remanufacture for each locomotive (there should be computer or paper files for each remanufacturing event).

• EPA also looks at remanufactured locomotives and checks the part numbers of key emission related components against the part numbers listed in the application for the certificate of conformity.

• What about remanufacturing processes that happen in stages, yet might be considered one event triggering rule applicability—where there's more than one folder? In EPA's observation, Class 1 RRs seem not to “pace” remanufactures over a number of years; they tend to do them all at once. (Unless they are deceiving us.) If EPA gets suspicious, we could ask for documentation of all power assembly replacement events to see if they collectively amount to a remanufacture.

• Repair shops should also keep records of maintenance they perform for 8 years.

• An owner/operator who is subject to the rule rarely holds the certificate for a subject locomotive, but does need to be able to show that he has performed due diligence to insure that the certificate exists and is accurate.

• For example, EMD might hold the original certificates for the engines and kits installed on subject locomotives owned by a subject RR, even if that RR performs remanufactures/refurbishments, but the RR should have complete repair records, and make sure engine labels match the information on the certificates.

• RRs should keep maintenance records for 8 years.

• A “small businesses” only has to be able to supply financial info to prove they are eligible for an exemption.



EPA checks to see that the part numbers and part specifications match those that are shown in the application for the certificate of conformity for the engine family or kit.

Here's a camshaft ID.



Here's a power assembly ID.



Another power assembly ID.



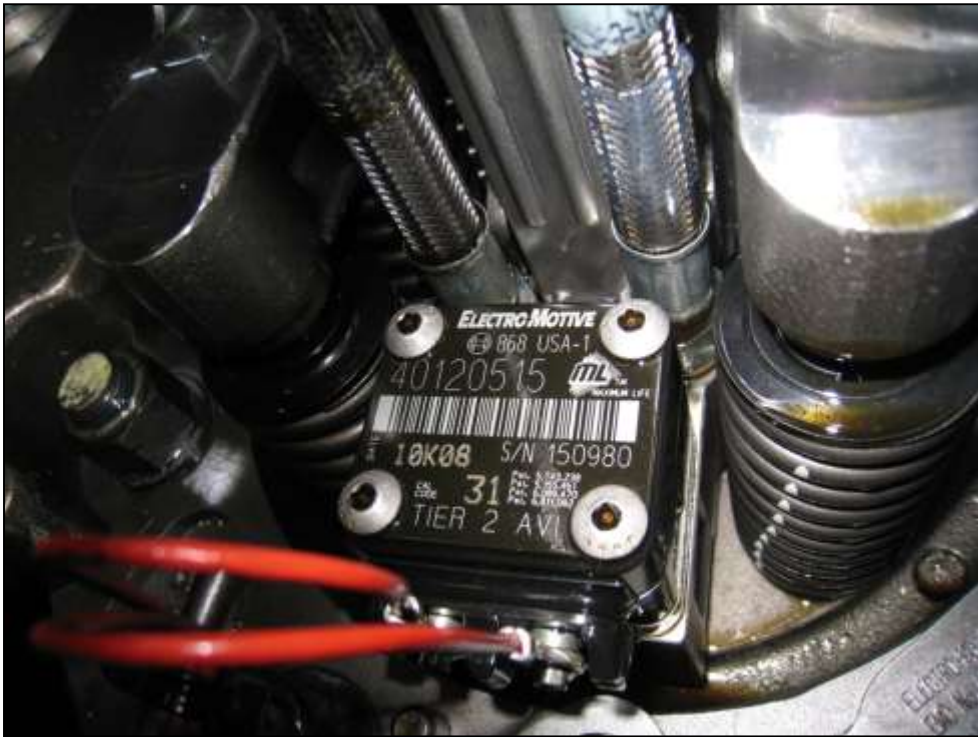
One more power assembly.



Mechanical engine governor ID.



Turbocharger ID.



Fuel injector part #.



Engine control room. (Which, in turn, is inside the engine room within the locomotive.)

This is where you find the engine control unit (ECU). EPA checks to see that the ECU, which is part of the certified configuration for the rebuilt locomotive, has been replaced during remanufacturing. Higher Tiers all require electronic ECUs, which were not commonly used the last time locomotives being manufactured in 2014 were last remanufactured (approximately 10 years ago).



Engine control unit or computer– a pretty black box.



APUs must also have labels showing they are certified.



Inspections & Enforcement



- Inspecting certificate holders
- Complaints
- Announced vs .unannounced
- Penalties based on # locomotives, HP, etc
- HELP!
 - Larry Oeler 202-343-9289 or Michelle Ibarra 202-343-9318 (OTAQ)
- Self-disclosure and tips
 - Mario Jorquera 202-564-1079 (OECA)

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What is the likelihood I'll be inspected or asked to prove compliance? What would an inquiry or inspection look like?

•EPA is currently in the process of inspecting the primary locomotive remanufacturing/refurbishing shops of all Class I RRs, and all major manufacturers, parts suppliers, and for-hire locomotive maintenance facilities—all entities that EPA designates as certificate holders.

•EPA has no specific plan to inspect Class II and III for compliance with the locomotive rule, but could. So far, the focus has been on the largest companies and highest emitters. But it's early on in the enforcement stage of rule implementation. Complaints could trigger an inspection. Diesel/PM "hotspots," particularly in EJ areas, are likely to be a high priority.

•If a complaint triggers the inspection, it could be unannounced and brief. An EPA-driven audit would be announced and exhaustive; could take a couple of days, and involve looking at both records and locomotives.

What penalties for noncompliance might be levied?

•EPA has found some problems during Class I RR inspections; most were resolved without a need for penalties. RRs were not used to seeing EPA, so they discovered problems with their recordkeeping in the course of the inspection. In preparing for an EPA inspection, one Class I RR (CSX) discovered that it had failed to certify their rebuild kit, which meant 16 locomotives were in an uncertified configuration. They admitted fault, installed AESS retroactively, and settled for a low-six-figure penalty including a supplemental project to add AESS to 16 more locomotives. (Announcement pending.)

•The EPA Mobile Source Penalty Policy applies. The size of the proposed penalty will be based on the number of locomotives, HP (bigger = worse), and other factors.

Who can help you figure out if you and/or your locomotives are covered by the rule, and whether you are in compliance?

•Call OTAQ with your questions about applicability and for other assistance. Larry Oeler and Michelle are both engineers in the Office of Transportation & Air Quality at EPA HQ in DC.

•The major locomotive manufacturers (eg., GE, EMD) and parts suppliers (eg, MotivePower, HK Engine Components LLC) are well-versed in the rule and can also assist you in understanding the EPA requirements.

What do you do if you suspect or discover you are not in compliance?

•If you discover you are out of compliance and disclose your violation before you receive notice that EPA is going to inspect you, you may qualify for voluntary self-disclosure benefits—see

www.epa.gov/compliance/incentives/auditing/auditpolicy.html

•To self-disclose or report a "tip" call Mario Jorquera in OECA's Air Enforcement Division.



THANK YOU – QUESTIONS / DISCUSSION?

swaine.abby@epa.gov
617-918-1841

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EPA LOCOMOTIVE EMISSIONS & FUEL RULE REFERENCES

Locomotives homepage: <http://www.epa.gov/otaq/locomotives.htm>
Final Locomotive Rule: <http://www.gpo.gov/fdsys/pkg/FR-2008-06-30/pdf/R8-7999.pdf>
Locomotive Rule fact sheet: <http://www.epa.gov/otaq/regs/nonroad/420f08004.pdf>
Idling Locomotives fact sheet: <http://www.epa.gov/otaq/regs/nonroad/locomotiv/420f08014.pdf>
Locomotive Emission Standards summary: <http://www.epa.gov/otaq/standards/nonroad/locomotives.htm>
Certified Locomotive Remanufacture Systems: <http://www.epa.gov/otaq/certdata.htm>
Verify engine and vehicle compliance info system: <http://www.epa.gov/otaq/verify/>
Diesel Fuel Regulations and Standards: <http://www.epa.gov/otaq/fuels/dieselfuels/regulations.htm>
Transmix amendments: <http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=27e92597791f3c5cb9d729f136e9782d&rgn=div6&view=text&node=40:17.0.1.1.9.9&idno=40#40:17.0.1.1.9.9.62.8>
Mobile Source Penalty Policy: <http://www2.epa.gov/enforcement/policy-vehicle-and-engine-certification-requirements>
Self Audit Policy: www.epa.gov/compliance/incentives/auditing/auditpolicy.html
SmartWay Transport Partnership Technology Resources (verified locomotive idle reduction systems): <http://www.epa.gov/smartway/forpartners/technology.htm>
Transportation Environmental Resource Center: <http://www.tercenter.org>
Office of Transportation & Air Quality contacts: <http://www.epa.gov/otaq/consumer/otaqcontacts.pdf>

EXTRA

Best practices and strategies for improving rail energy efficiency
<http://www.volpe.dot.gov/our-work/environmental-and-energy-systems/energy-analysis-and-sustainability/rail-energy-efficiency-and-sustainability>

CONTACTS

Office of Transportation & Air Quality -- Questions about applicability and other assistance

- Larry Oeler 202-343-9289 oeler.larry@epa.gov
- Michelle Ibarra 202-343-9318 ibarra.michelle@epa.gov

Office of Enforcement & Compliance Assurance -- Self-disclosure; tips & complaints

- Mario Jorquera 202-564-1079 jorquera.mario@epa.gov

EPA Region 1 - New England -- Local assistance

- Abby Swaine 617-918-1841 swaine.abby@epa.gov