

# For the Trenches

TIPS & NEWS FOR EQUIPMENT OWNERS AND OPERATORS

## Tier 4 – How it will affect your equipment, your business and your environment.



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**First, we need to clarify what “Tier 4” is – and what it is not.**

“Tier” regulations are federal standards exclusively focused on manufacturers. They place the responsibility for designing and producing engines that comply with increasingly stricter emission regulations on the engine manufacturers’ shoulders, not on equipment owners. “Tier” regulations have been introduced gradually, giving manufacturers a chance to design and produce the new engines in stages, generally depending on engine horsepower.

The first federal standards (Tier 1) for new off-road diesel engines over 50 hp were adopted in 1994. In 1996, a Statement of Principles (SOP) was signed between the EPA, California Air Resources Bureau (CARB) and engine makers (including Caterpillar, Cummins, Deere, Detroit Diesel, Deutz, Isuzu, Komatsu, Kubota, Mitsubishi, Navistar, New Holland, Wis-Con, and Yanmar) and in August 1998, the EPA signed the final rule reflecting the provisions of the SOP.

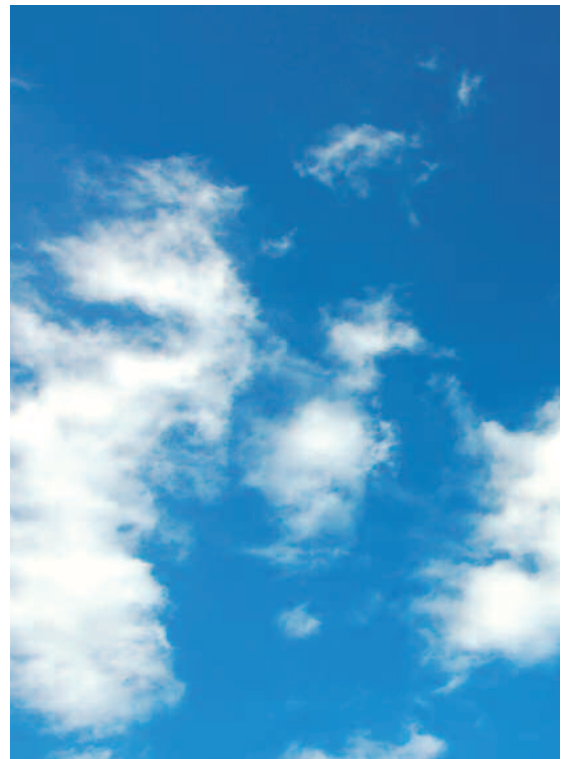
The 1998 regulation introduced Tier 1 standards for equipment under 50 hp as well as increasingly more stringent Tier 2 and Tier 3 standards for all equipment, with phase-in schedules from 2000 to 2008. The Tier 1 to 3 standards are met primarily through improvements in the combustion process with no, or only limited use of exhaust aftertreatment (oxidation catalysts).

In 2004, the EPA signed the final rule introducing Tier 4 emission standards, to be phased-in over the period of 2008 to 2015. Tier 4 standards require that emissions of Particulate Matter (PM) and Nitrogen Oxide (NOx), the prime targets of the Tier regulations, be further reduced by about 90%. From the point of view of engine manufacturers, Tier 4 standards are not easy to meet – actually, this is the stage that will achieve the least drastic reduction levels but is the toughest to reach in terms of engine and machine design. Manufacturers are currently undergoing “Tier 4 interim”, a ramp-up period that allows them to focus their resources on producing the larger compliant engines.

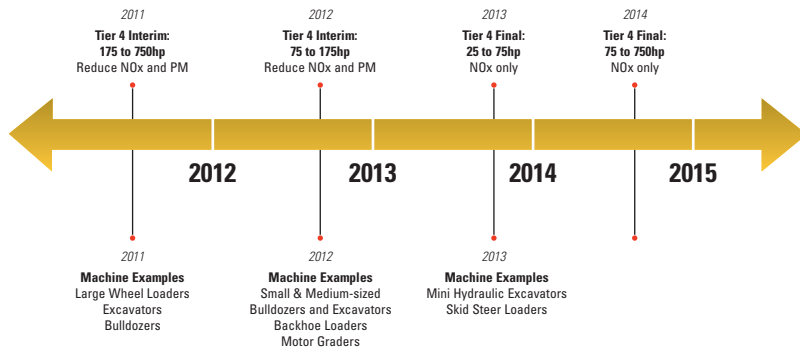
**How are manufacturers going to meet Tier 4 regulations?**

As of January 1st, 2011, all new machines between 175 and 750 horsepower will have to be Tier 4-compliant. These machines will have engines with advanced emission-control technologies similar to those used to meet the 2007-2010 standard for on-highway trucks and buses.

While the specific approach taken by each engine manufacturer may vary, many Tier 4 interim engines will include a Diesel Oxidation Catalyst (DOC) and/or a Diesel Particulate Filter (DPF) as part of the design. Those types of components were added to some Tier 1 and 2 machines as retrofits, to make them in-line with Tier 3 machines in terms of Particulate Matter, Hydrocarbon and Carbon Monoxide reductions. With Tier 4, however, those components will come as part of the machine, when it leaves the factory. In addition, Tier 4 engines will also include an Open Crankcase Ventilation or OCV filter that captures and controls crankcase emissions.

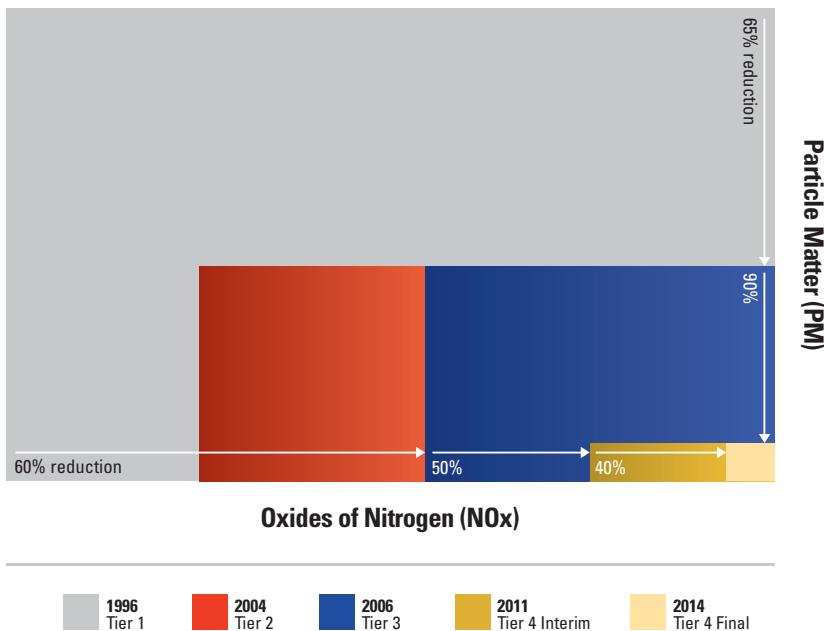


## Tier 4 Interim and Tier 4 Final Timeline



## Emissions Reduction Tier 1 (1996) – Tier 4 Final (2014)

Engines rated 130 – 560 bhp (175–750 bhp)



### How will this change the equipment itself?

As you can imagine, these new components being built into the engine, along with a bigger cooling package, will require a larger engine compartment, which translates into a larger machine. To insure good operator visibility, in some cases manufacturers have opted to modify cab and seat design.



**New Tier 4 engines require a new engine oil formulation to operate properly. CJ-4 engine oil is required for proper engine operation, and has been formulated with oil additives necessary to reduce ash deposit.**

With new Tier 4 components and technologies come some new maintenance practices. The Open Crankcase Ventilation filter will need to be replaced every 2,000 hours, and the Diesel Particulate Filter will need to be cleaned every 5,000 hours by your equipment dealer. Belts, hoses, radiators and alternators may also require more frequent inspection due to higher temperatures and operating pressures. In addition, the EPA requires that Ultra Low Sulfur Diesel (ULSD) be used in Tier 4 machines as well as a new engine oil, CJ-4, which has been formulated to reduce ash deposit. Many other maintenance requirements and service intervals will remain unchanged.

In addition, regardless of the manufacturer, you can expect higher purchase costs (8% +/-) for Tier 4 machines. Keep in mind though that by incorporating new reduction technologies in the right way, engine manufacturers have been able to claim up to 5% improved fuel efficiency, as well as boosted power and performance across applications.

### How else will owning and operating change with Tier 4 compliant equipment?

To ensure the best performance and longevity, there are important considerations when it comes to Tier 4 machines. They include:

- The operators familiarizing themselves with the technologies, monitoring systems, dashboard symbols and alarms.
- Optimal operating ranges may change for some machines, so be sure to consult with your equipment dealer.

### Who will be affected first and most by Tier 4 standards?

If your work involves public sector jobs and/or jobs for universities and other large organizations that have adopted Tier 4 standards, or if you are working in a non-compliance zone which is an area that the EPA has determined has poor air quality, you should expect that



the machines that you plan on using for that job will have to consist exclusively of Tier 4-compliant machines.

If you currently don't work on those type of projects, then for the most part you can avoid being affected by Tier 4 for the near future. In the longer term, of course, Tier 4 will affect every company that owns off-road equipment. Why is that? There will be no new machines available for sale in the United States other than Tier 4-compliant, and unlike with previous Tiers, it is not possible to retrofit a Tier 3 machine to Tier 4 standards with currently available technologies.

#### **How can your equipment dealer help you?**

As in most cases, it's a good idea to take as much control as possible; to ask questions and to be ready to demand straight answers.



Inside the DPF, particulate matter, sometimes referred to as "soot" is trapped until it is burned off through regeneration.

The DOC does not require maintenance because it is a "flow-through" device and the pollutants do not get trapped in the component.



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- Ask your equipment dealer which technology the manufacturers they represent will be using. Then, learn as much as possible about it.

- Understand what your dealer has done to ready themselves to service Tier 4 fleets, including salesperson and technician training, specialized tooling and inventoried parts.

- Consider having your equipment dealer conduct a fleet audit of your equipment. This is a process that matches your machines and business mix with current and upcoming emissions standards, to make sure that you'll be able to continue working on current projects – and to make sure you are in a position to take advantage of future opportunities.

- Make sure that your dealer has a large inventory of Tier 4-compliant machines, whether for purchase or for rental. You need to know whether you have access to the right equipment, before you win a "Tier 4 job."

- Be active in associations – more voices count and you will have access to resources not available to those who aren't involved.

## "It's our turn."

I recently attended an association meeting where the speaker ended his presentations by reminding us that this is not a plot directed to undermine companies doing off-road work; every vehicle running on our roads and highways has had to comply with, and be built to, increasingly stricter emission regulations. Yes, it's our turn now. And let's finish by looking at the big picture – or the big numbers, in this case:

## THE CAT CLEAN EMISSIONS MODULE (CEM)

The CEM is a flexible, Caterpillar designed module system that can include the following components: DOC, DPF, CAT Regeneration System, muffler and air cleaner. The CEM protects the components, minimizes the aftertreatment footprint and simplifies maintenance.

The EPA states that "by 2030, controlling these emissions would annually prevent 12,000 premature deaths, 8,900 hospitalizations, and one million workdays lost, so continued reduction and enforcement measures only make sense."

**Milton**



*This article is part of a series of articles designed to help equipment owners and operators lower owning and operating costs. Other article topics include:*

*Scheduled Oil Sampling • Parts Options  
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