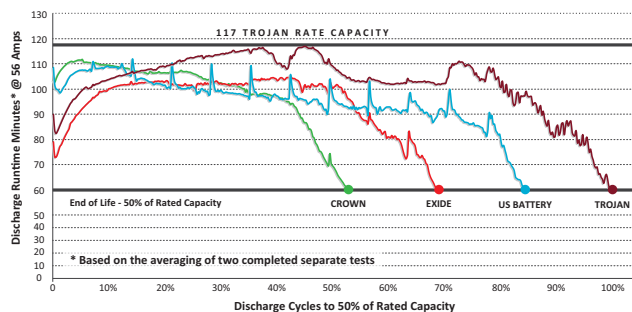




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**F**rom the beginning of the season until the turf stops growing in the fall, *Helminthosporium* leaf, crown and root rot diseases are active on all turfgrass species. Without going any further, I am

already uncomfortable with my first sentence and the use of the generic word “*Helminthosporium*.” Although widely used, the pathogens that cause the leaf, crown and root rot diseases are not *Helminthosporium* type fungi.

In 1809 the genus “*Helminthosporium*” was established and over the first 120 years was a dumping ground for imperfect fungi. Imperfect fungi are fungi that do not fit into a taxonomic class due to the absence of a sexual stage. As time progressed fungi were placed in more appropriate genera like *Alternaria* and *Cercosporidium*.

In 1930 the genus *Drechslera* was created by Ito and then confirmed in 1959 by Shoemaker, who established the genus *Bipolaris*. Leonard and Suggs established the genus *Exserohilum* in 1974. Thus, the pathogens that cause “*Helminthosporium*” leaf, crown and root diseases are in the genera of *Drechslera*, *Bipolaris* and *Exserohilum*.

Since the three genera were once grouped as *Helminthosporium*, you could assume the spores are quite similar. For those of you with a microscope and good eyesight, the differences in conidia (asexual spore) among the genera are:

- 1) *Drechslera* – “cylindrical, not curved conidia, germinating from every cell...”
- 2) *Bipolaris* – “fusoid (spindle shaped) straight or curved and germinating by one germ tube from each end”
- 3) *Exserohilum* – “conidial hilum was strongly protuberant”

(reference – Alcorn, 1988, *Ann. Rev. Phytopathology*, 26:37-56)

On turf the primary leaf, crown and root rot pathogens collectively called *Helminthosporium* are found in the genera of *Drechslera* and *Bipolaris*.

At this point you may be thinking that this is just an academic issue and does not really apply to my problems in the field. I would probably have to agree with you to some extent. However,

## What is in a Name?

BY KARL DANNEBERGER, PH.D.



IT'S LIKE ASKING  
SOMEONE WHAT  
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the generic term of *Helminthosporium* gives the impression that a singular fungus (or species group) causes leaf, crown and root rot disease across all turfgrass species and weather conditions, which is not the case.

For example, under cool wet conditions *Drechslera poae*, *D. siccans* and *Bipolaris cynodontis* are able to infect Kentucky bluegrass, perennial ryegrass and bermudagrass, respectively. *Drechslera gigantea* and *Bipolaris sorokiniana*, however, cause disease under hot humid conditions.

From a control standpoint cultural and chemical practices are similar, so maybe the differences are not that significant. For me, however, it is like asking someone what they are driving. And the reply is “a car.” It is a correct answer but does not tell you much. From a long enough distance all cars look the same, but we all know there is a difference between a Kia Soul and an Audi R8.

The second concern is the name “*Helminthosporium*.” We do have several disease names that have an associated fungal genus. A few examples include *Microdochium* Patch, *Ascochyta* Leaf Blight, *Curvularia* and *Cercospora* Leaf Spot. It seems odd, however, to name a group of diseases with a fungal genera — *Helminthosporium* — that is not even associated with turfgrasses.

We often misuse words that have appeared to have lost their original meaning. Words like refute, enormity, decimate and ultimate are commonly misused. In my opinion, “*Helminthosporium*” is the turfgrass profession's everyday word that is misused.

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Karl Danneberger, Ph.D., *Golfdom's* science editor and a professor from The Ohio State University, can be reached at danneberger.1@osu.edu.



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# PREPARE FOR TIER 4

**A** greener mower can mean two things: It's more environmentally friendly to use, and it costs more to buy. Both are true with the new mowers that meet Tier 4 emission standards.

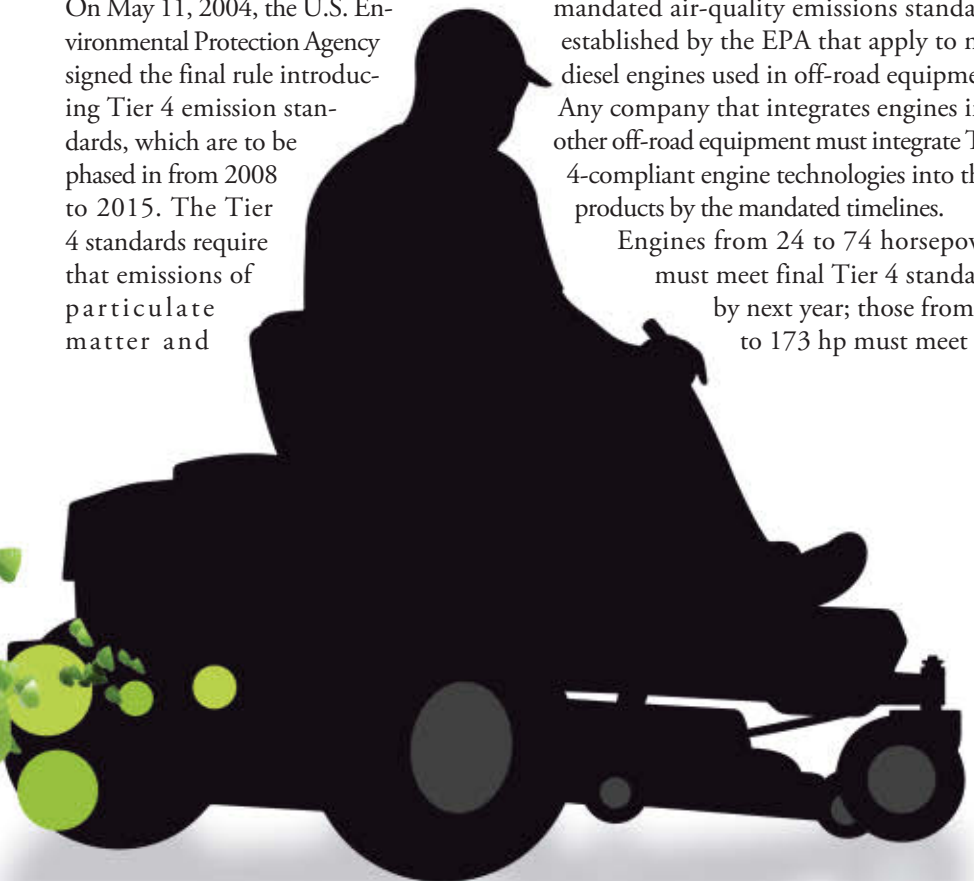
## **The law of the land**

On May 11, 2004, the U.S. Environmental Protection Agency signed the final rule introducing Tier 4 emission standards, which are to be phased in from 2008 to 2015. The Tier 4 standards require that emissions of particulate matter and

nitrogen oxides — as well as emissions of non-methane hydrocarbons, carbon monoxide, sulfur oxides and air toxics — be reduced by 50 to 96 percent compared to existing diesel engines. Such emission reductions can be achieved through control technologies, including advanced exhaust gas aftertreatment.

Tier 4 refers to a defined level of federally mandated air-quality emissions standards established by the EPA that apply to new diesel engines used in off-road equipment. Any company that integrates engines into other off-road equipment must integrate Tier 4-compliant engine technologies into their products by the mandated timelines.

Engines from 24 to 74 horsepower must meet final Tier 4 standards by next year; those from 75 to 173 hp must meet the



standards by 2015; and those from 174 to 751 hp must be compliant by 2014.

The EPA has adopted a comprehensive national program to reduce emissions from future non-road diesel engines by integrating engine and fuel controls as a system to gain the greatest emission reductions. To meet these standards, manufacturers are producing engines with advanced emission-control technologies similar to those expected for highway trucks and buses.

These reductions will provide public health benefits. The EPA estimates that controlling these emissions will prevent 12,000 premature deaths, 8,900 hospitalizations and one million work days lost annually by 2030.



## Manufacturers work to meet Tier 4 emission standards; *superintendents to pay more for mowers.* BY JOHN WALSH

For Toro, Tier 4 engines will require many changes to equipment — including changes to mowers' cooling packages, electronic controllers, exhaust routing and other plumbing.

### Cleaner burning engines

Research, engineering and development costs have and will be spent by engine and turf equipment manufacturers to ensure their ability to meet these emission standards.

“This is a must-do to stay in the game,” says Rachel Luken, a product manager at Jacobsen. “All manufacturers that want to continue to sell diesel engines and powered products must comply.”

Standards for diesel exhaust emissions become more stringent from tier to tier. In previous tiers, the adaptation of new compliant engines into equipment was more streamlined, so implementation costs were typically higher at the engine manufacturer.

“With the upcoming Tier 4 final engines, the weight has shifted to the turf equipment manufacturers,” Luken says. “Many more components and systems external to the engine need to be re-engineered, retooled, reintegrated and retested.”

In terms of diesel engine use, John Deere Golf primarily uses Yanmar in its mowing and

maintenance equipment; Jacobsen uses Kubota to power its 25-plus-hp diesel equipment; and Toro uses a mix of Briggs & Stratton, Kubota, Kohler, Honda, Kawasaki and Subaru.

### A redesign

But final Tier 4 compliance is much more than just an engine change. There are many other subsystems and areas on mowers that it will need to adapt. Compliant turf equipment will be equipped with new engines and exhaust systems with advanced electronic controls, additional filtration or after-treatment and updated cooling systems, to name a few, Luken says. To accommodate these additional and larger components, many frames, chassis and engine compartments require redesign.

For Toro, Tier 4 engines will require many changes to equipment — including changes to mowers' cooling packages, electronic controllers, exhaust routing and other plumbing — but most of those will be unnoticed from a performance standpoint, says Grant Young,

*Continued on page 16*



*Continued from page 15*

senior product marketing manager for Toro.

Tier 4 engines may require some modification to the size of the hood on John Deere equipment because of the added components on the engines, says Tracy Lanier, product manager for John Deere.

Retrofitting equipment to meet the standard isn't an option because of the significant changes required in the engine and exhaust after-treatment systems. Toro doesn't anticipate any retrofit solution that will convert a current product to a compliant Tier 4 product, Young says. However, products purchased before the compliance date are grandfathered in.

### **The financial costs**

The lower emission standards were designed to be enforced in progressive phases over sev-

eral years to provide adequate lead time for the engine and equipment manufacturers to meet them.

"We've been working toward the Tier 4 regulation for many years," Lanier says. "We can't speak about the total cost, but we can say it's a regulation we've been working toward, even before it was signed into law in 2004."

As the market approaches the final Tier 4 regulation, Jacobsen is investing significant resources in product development and portfolio decisions. With each of the product subsystem changes, there are design, development, sourcing, testing, prove-out, production change over and sales-education resources required.

"The cost is an investment in our company's future," Luken says.

Certification to meet the emission requirement must come from engine manufacturers because they have to certify their engines to meet the requirement before selling them to the turf equipment manufacturers, Young says, adding that the total cost for Toro to meet the standard is significant.

The cost to meet that compliance (engineering, technology, etc.) is most often passed onto the equipment manufacturer in the price of the new engine. From there, the equipment manufacturer incurs more costs to commercialize the product. Those costs include additional design and engineering (i.e. cooling system, electronics, etc.) and are included in the final price of the product to golf course superintendents.

Based on significant research in other industries that have been required to meet the Tier 4 standard — such as agricultural and construction equipment — it wasn't uncommon for prices to increase 10 to 18 percent, according to Toro. The estimated costs for added emission controls for most equipment was estimated at 1 to 3 percent as a fraction of total equipment price.

Most noticeably, achieving compliance will appear in the cost of the product. Some of the diesel solutions contain rare earth metals, which are expensive. In addition to the materials, the engineering expense is more costly.

"While specific turf equipment market price implications aren't available yet, an increase can be expected," Luken says.

"Industries that already have gone through

**John Deere has been working toward the Tier 4 standards since before 2004, when it was signed into law, John Deere's Tracy Lanier says.**





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compliance have experienced anywhere from a 10 to 20 percent increase in price,” Young says.

**End results**

Tier 4-compliant engines and equipment will require the use of ultra-low sulfur diesel fuel, which has no more than 15 parts per million sulfur. ULSD fuel has been used since 2006 in highway vehicles and is widely available. (For more information about clean diesel fuel requirements, visit [clean-diesel.org](http://clean-diesel.org).)

Tier 4 engines using a diesel particulate

filter will need to be removed and cleaned at about 3,000 to 5,000 hours. No other special maintenance is required. Normal maintenance intervals for oil and filter changes may be extended compared to today’s engines.

Most Tier 4 engines use electronically controlled fuel injection systems that require training and new diagnostic tools, according to Toro. While these capabilities and tools might require additional training, they also have the potential to save time and simplify maintenance. The mechanical aspects of the engine design aren’t significantly different.

According to Toro, Tier 4-compliant equipment will have:

- ▶ all new engine and exhaust systems
- ▶ more sophisticated electronic controls
- ▶ after treatment for removal of nitrogen oxide and particulate matter
- ▶ redesigned frames and engine compartments to accommodate larger engine/exhaust system modules
- ▶ updated cooling systems.

“We wouldn’t expect the customer to see a reduction in performance of their machines,” Luken says. “While the engine is a major part of the machine, there are other factors — for

*Continued on page 18*

**Though the engine may be changing, Jacobsen’s Rachel Luken says not to expect any changes in performance or operation.**



Some diesel fuels aligned with Tier 4 regulations contain expensive rare earth metals, affecting price.

# TIER 4

## EMISSION STANDARDS

### Pros

- ▶ Advancements in fuel injection systems resulting in clean operating diesel engines, which reduces, or virtually eliminates, pollutants into the environment.
- ▶ Improvements in engine noise, sound levels, performance, diagnostic capabilities, making for more operator comfort.
- ▶ Lower operating costs. When fuel combusts more thoroughly, less fuel is needed to run the engine and feedback sensors monitor amount of fuel delivered, improving fuel economy.
- ▶ Better performance. Creating more energy during combustion results in more torque output from the engine.

### Cons

- ▶ Advancements needed in engines and other systems external to the engine (cooling, filtration and electrical) for emission compliance will add expense. As a result, market prices are expected to increase.
- ▶ The level of engine maintenance required will more than likely increase because of new components added to help meet the regulation.
- ▶ Every dollar that engine and equipment manufacturers spend on compliance is one less dollar spent on strategic product development.

*Continued from page 17*

example, the reel cutting unit and attaching systems — that are at the heart of the machines' cutting performance. And, operation of the machines are expected to be similar to today's operation."

Equipment distributors can continue to sell inventories of equipment from the previous generation of technology (Tier 3) until the inventory is depleted. Existing equipment is grandfathered in and doesn't need to be replaced until the normal end-of-life cycle. The Tier 4 requirements apply only to new engines.

Jacobsen believes Tier 4 is about more than just emissions.

"It's about using innovative solutions to make equipment more environmentally friendly while still meeting customer performance, productivity and quality expectations," Luken says. "Additionally, manufacturers, dealers and superintendents should take some time to review and invest in their service capabilities to support these engine advancements." ■

*Walsh is a contributing editor for Golfdom.*



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# THE GREENEST SHOW ON TURF

The WM Phoenix Open was already known as the largest-attended golf event in the world. Now it vies to be known as the greenest, too.

STORY AND PHOTOS BY SETH JONES

**A** new record was set at the Saturday round of this year's Waste Management Phoenix Open. On that day, 173,210 people entered TPC Scottsdale, setting an all-time PGA Tour attendance single-day record.

Perhaps an even more impressive number? The number of trash cans on the golf course that day: zero.

### **Zero Waste Challenge**

The absence of trash cans is a credit to tournament sponsor Waste Management, in conjunction with the hosting organization, Phoenix-area civic group

the Thunderbirds. The groups teamed up to launch what they called the "Zero Waste Challenge" for the tournament. The goal was to divert 90 percent of tournament waste away from the landfill and instead into recycling and composting facilities. According to the WM Phoenix Open, it was the first time ever a PGA Tour event was played without trash cans on the course.

The lack of garbage receptacles was a success. Recycling bins and composting facilities collected all waste, and by the end of the tournament, Waste Management and the Thunderbirds were celebrating a 90.7 percent diversion rate.