

Interim Tier 4 Emissions

What is it? Where did it come from? Why do we have it? Why are manufactures selling these machines? Why does it cost so much? All of these are well respected questions. Let's try and tackle a few of these questions.

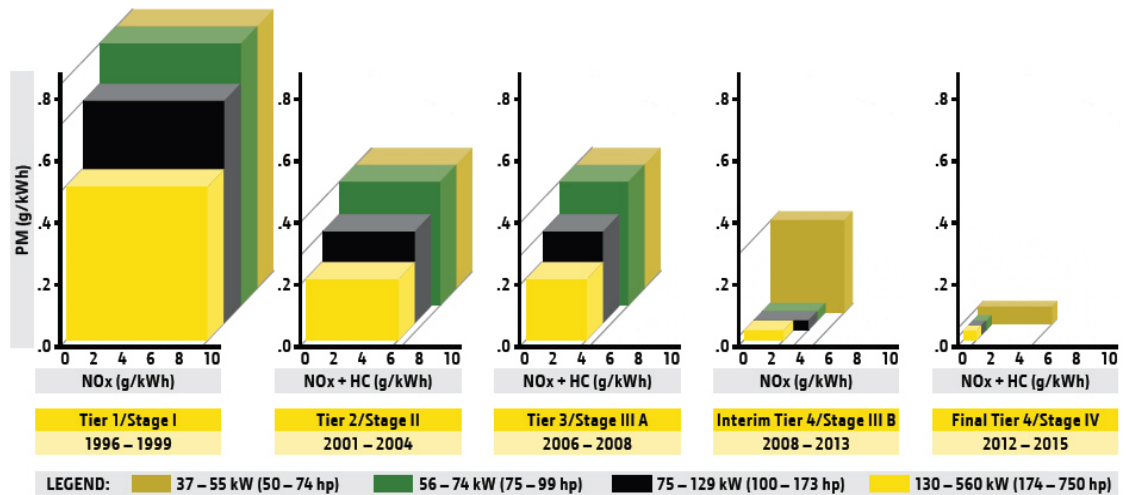
What is it? The Clean Air Act focuses on six common air pollutants found all over the United States. Off-road engine applications focus on three of them, they are Particulate matter known as PM, Ozone, and Nitrogen oxides, known as NOx.

Where did it come from? There were various worldwide events of air pollution that incurred sickness and death that led to the Federal Government establishment of the Original Clean Air Act of 1963. In 1970, Congress established the EPA (Environmental Protection Agency). The EPA is responsible for implementing and enforcing the Clean Air Act. The Federal Clean Air Act describes the goal: Clean the air to protect the health of everyone, including those with weak respiratory systems such as elderly, asthmatic, and infants.

Why do we have it? Or Why Should You Be Concerned About Air Pollution? Well, we could go days without food and hours without water, but we would only last a few minutes without air. On average, each of us breathes over 3,000 gallons of air each day. Stop and think about that for a minute, we take that for granted. We have grown accustomed to growing or purchasing our own food and turning on a faucet to drink water. But few of us ever had to, or have to carry a oxygen tank to breathe.

Why are manufactures selling these machines? In an effort to reduce the NOx and PM pollution from Non Road diesel engines, the EPA regulated a Tier system put in place in 1994 for engines used in most types of construction, agricultural, and industrial equipment. You may know of these standards as the "tier" emission standards, with the most recent emissions standards referred to as "tier3" and "interim tier4."

These standards have required nonroad engine and vehicle manufacturers to substantially reduce particulate matter and nitrogen oxides. This series of charts highlight the magnitude of the reduction.



What makes reducing emissions such a challenge? They make up only 0.3% of the total combustion process. That is like taking 1000 gallons of water and trying to filter 3 gallons of impurities out.

Particulate Matter (PM) and Nitrogen Oxides (NOx) have been the main emissions to be regulated. Hydrocarbon (HC) and Carbon Monoxide (CO) were added later with Carbon Dioxide (CO2) being considered.

Why does it cost so much? Design engineers are charged with the task of designing engines that reduce NOx and particulates. This is not a simple task because reducing NOx increases particulates or smoke, reducing particulates or smoke increases NOx. Think of a camp fire, low flame-more smoke, high flame-more NOx.

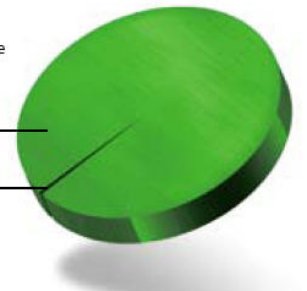
In order to control emission particulates, or smoke, the air to fuel ratio needs to be increased and oil control needs to be improved. It will take more than engine expertise to meet future emissions regulations. It will depend on the successful integration of the entire powertrain: engine, electronic controls, and drivetrain components to maximize performance and fuel economy.

So how much reduction are we seeing with these new engines standards? Take for example the 850B dozer, was equipped with a 6 cylinder, 466 cubic inch engine producing 165 SAE Hp, today, the current 850K iT4 machine is equipped with a 6 cylinder 415 cubic inch engine producing 205 SAE Hp. 1-Tier1 powered dozer would emit the same amount of nitrogen oxide and particulate matter as approximately 100-interim Tier4 powered dozer. Just picture 100- 850K iT4 dozers to 1- 850B dozer. If you stop and think about this for a few seconds, it is a dramatic reduction in emissions from the EPA's 'new engine standards.' By the time Final Tier 4 machines arrive, our job sites will have "Air Filter Machines" running around, and that is not far from a joke.

What horsepower engines are currently interim Tier 4 Certified? Currently 0-74 horsepower and 175 and larger must be iT4 Certified. January 1, 2012 will include 75 - 174 horsepower engines.

99.7% Products of complete combustion

N₂ - Nitrogen
 O₂ - Oxygen
 CO₂ - Carbon dioxide
 H₂O - Water



0.3% Regulated emissions

NOx - Nitrogen oxides, which react in the atmosphere with hydrocarbons to form particulate matter
 CO - Carbon monoxide, a product of incomplete combustion
 SOx - Oxides of sulfur, which contribute to acid rain
 HC - Hydrocarbons, another product of incomplete combustion
 PM - Particulate matter, a non-gaseous product of combustion and atmospheric reactions

Are there any precautions with an iT4 engine? Yes, It is important to note that machines with IT4 engines have a few updated fluid requirements for diesel fuel, engine oil, and coolant. Engine oil type has always been important, but the technologies needed to support Interim Tier 4/Stage III B emissions regulations make it even more essential for years of reliable service and worry-free operation. With the introduction of exhaust filters, the type of engine oil used can have significant impact on the proper functioning and ash service life of these devices. Ash, a byproduct of inorganic solids, will collect in the exhaust filter over time as a result of the combustion process. The use of oils meeting API CJ-4 and ACEA E9 standards, are required in order to reduce ash accumulation and increase exhaust filter life. John Deere PLUS-50™ II is a low ash oil. Older API rated oils contain higher levels of sulfated ash, phosphorus and sulfur. They can accelerate Diesel Particulate Filter plugging and catalyst poisoning, resulting premature failure of the emission control devices.

Ultra Low Sulfur Diesel is required to meet emissions regulations. Using high sulfur or contaminated diesel fuel can cause emissions to be out of compliance, and can damage the exhaust filter and fuel dosing systems.

Similar to oils, the type of diesel fuel can also have a significant impact on emission control devices. The use of diesel fuel with a sulfur content of less than 15ppm (ultra low sulfur diesel or ULSD). Using diesel fuel with a higher sulfur content can damage the exhaust filter or catalyst, creating the need for an increased number of regenerations and leading to early replacement of the exhaust filter.

Can I burn Biodiesel? Biodiesel is a clean burning alternative fuel produced from renewable resources. John Deere was one of the first off-highway engine manufacturers to factory-fill biodiesel in North America using B2, a blend of 2% biodiesel with 98% petroleum diesel. While 5% blends (B5) are preferred for use in the field, biodiesel concentrations up to a 20% blend (B20) can be used in all John Deere engines. Check the operator's manual for specific requirements and regulations pertaining to the use of bio-diesel.

HPCR (High Pressure Common Rail) fuel systems are operating at higher pressures. High pressures have higher heat. When this fuel is cooled backed down, moisture will be created. Fuel contamination can quickly destroy fuel system components. It is imperative that clean fuel be maintained at all times. Moisture or water and dirt can be introduced by poor fuel quality, careless fuel handling, or by condensation as the fuel system cools down. Refilling the fuel tank at the end of each day can help minimize contamination from condensation. Microorganisms can and do live in fuel if water is present. These microorganisms need only a minute amount of water to flourish. Important: Do not mix diesel engine oil or any other type of lubrication oil (for example: Automatic Transmission Fluid (ATF)) with diesel fuel.

Since diesel fuel can vary greatly depending on the refinery it was derived from, using fuel additives can be a valuable safeguard for protecting the fuel system. Generally, fuel additives are used for the following reasons: to improve the ability of fuel flow at low temperatures, to improve the lubricating qualities of the fuel, to clean injectors, to improve engine starting, to protect against rust and corrosion, to increase filter life and to help minimize microbial growth. John Deere-approved fuel conditioners containing detergent/dispersant additives are required when using blends of B20 or greater and are recommended when using lower biodiesel blends. Interim Tier 4/Stage III B engines generate more heat and require up to 40 percent more heat rejection.

What is regeneration? The exhaust filter is integrated into the engine design to provide a simple and reliable solution for reducing particulate matter (PM). A single engine control unit (ECU) manages both the engine and exhaust filter, via an exhaust temperature management (ETM) system, to regenerate (clean) the exhaust filter when sufficient heat cannot be generated to passively clean the filter.

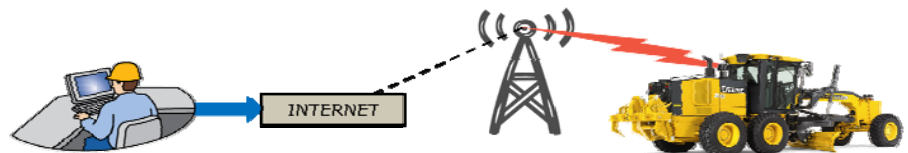
Passive regeneration — John Deere engines and exhaust filter components are designed for uninterrupted operation using passive regeneration, a natural cleaning process where engine exhaust temperatures are sufficient enough to oxidize the PM trapped in the exhaust filter. The process occurs during normal engine operating conditions, which is the most fuel-efficient way to clean. Passive regeneration does not impact machine operation or require operator involvement.

Active regeneration — If conditions (temperature, speed and load) for passive regeneration cannot be achieved, then PM must be removed using active regeneration, an automatic cleaning process. For a short duration, this requires injecting a small quantity of fuel in the exhaust stream and elevating exhaust temperatures to clean the filter.

Remember, active regeneration cleaning occurs only when passive regeneration is not possible based on temperature, load and speed. It serves as a backup system. In most cases, active regeneration does not impact machine operation or require operator involvement. Parked or stationary regeneration may be necessary if active regeneration is overridden by the operator, or in rare instances when the engine does not reach normal operating temperatures because of lighter loads, reduced speeds or cool ambient conditions for extended periods of time.

These machines are nowhere near the 420 crawler, nor do we use the same tools to troubleshoot and repair.

Today along with machine technology we have telematics technology as well. With a current JDLINK Ultimate subscription which is free for the first 3 years on a new machine, we have "three modes of diagnostic functionality". We have remote diagnostic trouble code mode, remote recording mode and remote programming mode.



Be assured that Plasterer Equipment is equipped and ready to sell and service these machines. Deere has established Dealership New Model Qualifications over a decade ago, what does this mean to me you might ask? Parts- stocking critical parts that can be replaced in 2 hours or less, Essential Tools- all essential tools must be onhand at our dealership, Training- at least 2 Qualified Technicians are required for each store location. Plasterer Equipment takes training to the next level, for example we are required to have 8 technicians total, by end of summer 2011 we will have a total 25 technicians Qualified to work on iT4 engine, and will incur over 1000 hours of iT4 training in our Service Department alone.

Here at Plasterer Equipment, we're on it and we get it.

Useful web links for additional information: <http://www.epa.gov/air/caa/> http://www.deere.com/en_US/rq/emissionsinfo/tier4/index.html

And visit us at www.plasterer.com