OVERVIEW
The two compounds in diesel exhaust that have the most impact on the environment are NOx and particulate matter, which is more commonly called “Soot.”
NOx, or Nitrogen oxides, is the generic term for a group of highly reactive gases, all of which contain nitrogen and oxygen in varying amounts. Many of the nitrogen oxides are colorless and odorless. However, one common pollutant, nitrogen dioxide along with particles in the air can often be seen as a reddish-brown layer over many urban areas.
Soot, is the visible exhaust – the black smoke you see coming from the stacks. It’s made up of unburned fuel, carbon, and other solid material.
Beginning January 2007, the Environmental Protection Agency put into place new emission requirements for all diesel engines. These strict regulations greatly reduce diesel emissions. Actually, from 1990 to 2007, the EPA has progressively reduced allowable NOx levels in diesel exhaust a total of 80%.
Today, with the 2007 regulations, the EPA has reduced allowable particulate matter in diesel exhaust a total of 90%. And the difference is not just what you see on the highways, but it’s also in much cleaner air and a healthier environment.
To meet the EPA 2007 levels for particulate matter, all manufacturers turned to an Exhaust After-Treatment System. Beginning 2007, Exhaust Aftertreatment System (ATS) are on every diesel truck sold in US and Canada.

DIESEL PARTICULATE FILTERS (PDF)
Question:
• What do I need to know?
Answer:
• For the most part, they will take care of themselves.
• You do have some control.
ABOUT DPFs

The technology in this After-Treatment System is the Diesel Particulate Filter. You’ll also hear it referred to simply as the DPF. The DPF replaces the old muffler and traps. Instead of exhausting soot into the atmosphere, the DPF traps the soot, and then uses heat to oxidize it. So what exits the exhaust is much cleaner air. The soot is periodically regenerated into clean, carbon dioxide gas and water vapor. The resulting exhaust is clean – no odor or diesel smell. This cleaner exhaust won’t blacken your trailer, and won’t even blacken inside of exhaust stack!

Here’s How It Works.

The DPF is actually a ceramic filter that has thousands of tiny channels. DPF collects soot (particulate matter) created by engine
As the exhaust passes through these channels, soot is trapped along the channel walls and is prevented from exhausting through the stacks, which also protects the environment. Solid matter is trapped..
Periodically, the DPF must remove the soot that has built up along the channel walls. This is called “regeneration.” It’s like a – like a self-cleaning oven
Regeneration is an oxidation process that uses heat to remove the soot from the filter. The regeneration process is actually pretty simple. There are really only two stages: Passive and Active.

There Are Really Only Two Stages Of After-Treatment:

1. Passive
2. Active

“PASSIVE” REGENERATION

Passive regeneration occurs naturally under steady driving, when the engine achieves the required operating temperature. The DPF contains an oxidation catalyst that is coated with precious metals. Under normal highway driving, passive regeneration takes place as the catalyst in the DPF heats up enough to oxidize the soot and turn it into C-O-two. The C-O-two exits through the exhaust stack. Any residues left behind are converted into harmless ash that collects in the DPF canister.
The process is continual, so whenever the vehicle reaches operating temperature, the DPF will begin passive regeneration. This means you don’t have to do anything to make passive regeneration happen, and you won’t notice any differences in how the vehicle operates. In fact, passive regeneration is happening all the time, and you’ll never know it!
“ACTIVE” REGENERATION

Over time, passive regeneration is not enough to prevent soot from building up in the DPF. And that’s when the second stage of cleaning is used. This is called “active regeneration.” When your engine’s computer indicates that the DPF needs cleaning, and if the operating temperature is high enough, it automatically initiates an active regeneration. The system will typically initiate an active regeneration by itself. You may be unaware that there is an active regen in progress.

Active regeneration begins when a small amount of fuel is introduced into the exhaust stream between the turbocharger and the DPF. This fuel is atomized into an extremely fine spray that does not burn. Instead, when it makes contact with the catalyst on the DPF, it generates intense heat – upwards of 1100 degrees Fahrenheit -- that oxidizes any remaining soot on the ceramic filter. CO₂ exits the stacks and ash collects in the canister.

“ACTIVE” REGENERATION – HOW OFTEN?

Depending on your driving, active regeneration may happen as often as once a day. If you do a lot of stop and go, it can happen even more often. Frequency depends on duty cycle and how much soot collects – as often as once a day or every other day. An active regeneration could take up to one-half hour or more.

If you slow down or stop the vehicle after an active regeneration has started, it may be interrupted and might have to start again. So don’t be concerned if the dash indicates that another regeneration is in progress.

Periodically, the DPF will need to be serviced with a professional cleaning to remove the ash that has collected in the canister. This can take as little as 30 minutes.

MORE STOPS = MORE FREQUENT ACTIVE REGEN’S.

“ACTIVE” REGENERATION – WHAT’S ACTUALLY HAPPENING?

During active regeneration, fuel is introduced which can raise temperatures in the exhaust stream to help regeneration. This can take 20-60 minutes and may consume ½ gallon of fuel. A slight whistling is normal.

THE REGEN TEMPERATURE IS ROUGHLY EQUAL TO EXHAUST SYSTEM TEMPERATURES ON A LONG HARD PULL.

“ACTIVE” REGENERATION – WHEN, WHERE, HOW?

The truck can regen all by itself ONLY while moving. If the driver slows or stops the truck, the regen will stop. If a regen is needed while stopped, the driver or a technician must initiate a parked regen.

A PARKED TRUCK CAN’T REGEN BY ITSELF WITHOUT DRIVER INTERVENTION.
“ACTIVE” REGENERATION – HOW WILL YOU KNOW?
You’ll see this message in the Driver Information Display: “Regen In Progress”

“ACTIVE” REGENERATION – WHAT DO YOU NEED TO DO?
Usually, nothing. The vehicle needs to run at operating temperature during the regeneration, so highway driving is best. Just drive as you normally would.
During active regeneration, the exhaust outlet temperature is extremely high. So watch your location if regeneration is about to begin. If you are entering a location where high exhaust temperatures might be unsafe - a crowded work site, a fueling station or a tunnel, etc. - you should cancel the regen.

Here’s how:
Press enter on the DID control stalk to disable regeneration until you are returning to the highway and can enable regen again. Or wait until you’re stopped in a safe location where you can perform a “parked” or “manual” regeneration.
The High Exhaust System Temperature indicator illuminates during active regeneration when the vehicle is stopped or moving at less than 5 miles per hour. This is to remind you to be aware of your surroundings during an active regeneration when the vehicle is stopped or moving slowly.
If an automatic regeneration is stopped, the Request Regeneration Icon will stay illuminated and the message “Manual REGEN Required” will display in the Driver Information Display.

“ACTIVE” REGENERATION – WHAT HAPPENS IF YOU SLOW DOWN?
A tell-tale yellow lamp may come on if the vehicle slows down below 5 mph after operating on the highway and accumulating heat in the DPF. This means “HIGH EXHAUST TEMPERATURE.” It does NOT indicate that there is anything wrong. The lamp will turn off after the temperature is back to normal level or if vehicle speed > 10 mph.

When parking the vehicle and the lamp is on, you should:

KEEP THE VEHICLE AWAY FROM PEOPLE, FLAMMABLE MATERIALS, VAPORS, STRUCTURES.
DISABLING REGENERATION

You may want to disable regeneration if the truck will be soon be in a location where high exhaust system temperature is undesirable (parking indoors to unload).

If regeneration is already underway and you find yourself in a hazardous location, you can cancel the regen.

**Here’s how:**

To disable regeneration, navigate using the Driver Information Display menu and the right-hand stalk controls,

1. Use the controls to scroll to **Aftertreatment**.
2. Press **ENTER**.
3. Scroll to **Cancel REGEN**. Press **ENTER**.
4. Scroll to **Disable REGEN**. Press **ENTER**. The Disable REGEN box will be checked.

Using the Driver Information Display menu and the right-hand stalk controls, scroll down to the after-treatment menu. Select “Cancel REGEN” and then select “Disable REGEN.” This will prevent any regeneration from happening until you ENABLE it again.

When regeneration is disabled, the letters ATS with an X through them will be displayed in the Information display. This means that you are preventing regeneration from taking place – and if this goes on long enough, you will shut down the vehicle.

So as soon as possible, enable regeneration by returning to the after-treatment menu, select CANCEL REGEN, and then choose ENABLE REGENERATION.

You’ll see the X in the enable regeneration box, and the ATS symbol with the line through it will disappear from your display.

**DISABLING REGENERATION – IMPORTANT!**

If the Regen has been disabled, the Driver Information Display shows an “X” through ATS (AfterTreatment System) on the bottom row.

**IMPORTANT:**

**RE-ENABLE REGEN AS SOON AS POSSIBLE. IF YOU DON’T, YOU MIGHT DISABLE THE TRUCK AND IT WILL NEED TO BE TOWED.**
ENABLING REGENERATION

1. Scroll to **Cancel REGEN**. Press **ENTER**.
2. Scroll to **Enable REGEN**. Press **ENTER**. The Enable REGEN box will be checked.

When regen is enabled, the ATS icon will no longer appear in the display.

WHEN REGENERATION IS NEEDED

The solid amber DPF Regeneration request indicator on the instrument panel indicates that the DPF is becoming full. This is the normal operation status for the DPF.

You’ll see “REGEN In Process, Enter to Delay” displayed in the DID. Proceed with normal operation for an automatic regeneration, or press enter on the DID control stalk to disable the regeneration until you can stop at a safe location to perform a “parked” regeneration, or you can enable regeneration again once you’re getting back on the highway.

**IF...**

1) The truck has been operated too long with regen disabled, or
2) If the DPF needs cleaning

You’ll see this yellow warning light in the lower left-hand corner of the dash.

If the truck has been operated with insufficient opportunities for regen, or if regen has been disabled and the system becomes full, another yellow warning light will illuminate.

This symbol depicts a filter and the exhaust stream and indicates operator intervention is needed.

WHEN YOU SEE THIS LAMP YOU HAVE 3 OPTIONS:

1) Drive at uninterrupted highway speeds for a while and make sure **Regen is enabled**.
2) Before the end of the day, perform a **Parked Regen**. (Requires that the vehicle is programmed to allow this option).
3) Before the end of the day, let a technician perform a **Parked Regen**.
WHAT HAPPENS IF YOU DO NOTHING?

If you operate the truck without taking action, the yellow “Regen Needed” icon will begin to flash.

If you continue to operate the truck without taking action, the YELLOW “CHECK” light will illuminate.

If you still continue to operate the truck without taking action, the “STOP ENGINE” light will illuminate. The engine may shut down. A technician will then need to regenerate the filter.

If the amber DPF Regeneration Request light is flashing the DPF is full. The DPF may have reached this status from being disabled for too long. You should stop the vehicle in a safe location when you can and perform a parked regeneration.

A flashing amber Regeneration Request indicator, combined with the amber Check light, is telling you that the DPF is over full and engine performance is reduced. This can happen if you have disabled regen and fail to enable it again.

At this point, an automatic regeneration is not possible. You will need to pull over immediately and perform a parked regeneration or take the vehicle to an authorized Volvo service center.

A flashing Regeneration Request indicator in combination with the Stop light means the soot level in the DPF is critically high and a serious engine or DPF problem has occurred. This can happen if you have disregarded earlier warnings and continued to operate the vehicle with regen disabled.

At this point, the vehicle will be in shut-down mode, and the engine will be significantly de-rated. When this happens, you must stop the vehicle as soon as it is safe to pull over. You will not be able to drive the vehicle until it is serviced by an authorized Volvo technician.

**USUALLY OCCURS ONLY IF THE DRIVER IGNORES THE WARNINGS FOR HOURS, OR SOMETIMES DAYS.**
PERFORMING A PARKED REGEN

There will be times that you’ll need to perform a manual or “parked” regeneration. This may be because you cancelled a regen, or an automatic regen had started, but was interrupted when you stopped the vehicle.
To perform a parked regen, make sure the vehicle is stopped, engine running, with the parking brake applied
Park the vehicle away from people, or any flammable materials, vapors, or structures.

• Using the stalk controls and the DID, select:
  • Aftertreatment (ENTER)
  • Request parked REGEN (ENTER)
• Always refer to the operator’s manual.
• Note: a parked regen will consume about twice as much fuel as an active regen while moving. Remember never to perform a manual or “parked” regeneration where people or combustible items may be near the exhaust outlet. Do not perform a parked regen when you’re in a fuel depots, inside a warehouse or other buildings, near low-hanging branches, and so on.

A FEW MORE THINGS TO REMEMBER ...

ULTRA LOW SULFUR DIESEL

• To comply with federal regulations, you must fill trucks ONLY with the new emission systems at diesel pumps labeled, “ULTRA LOW SULFUR DIESEL.”
• Widely available since October 2006.
• Only 15 parts per million sulfur.
• Prevents fouling of the DPF.

NEW ENGINE OIL

• The oil industry has developed an improved oil specification for the new 2007 engines.
• Volvo recommends use of oils meeting Volvo VDS-4 (API CJ-4) specification on new and older Volvo diesel engines.
• This replaces the API CI-4 specification.
  VDS-4 has lower ash, sulfur, and phosphorous content.
• Improved wear protection
• Deposit / oil consumption control
• Soot-related viscosity control
• Prevention of viscosity loss from shearing
• Used oil low-temperature pumpability
• Oil protection from thermal and oxidative breakdown
PERFORMANCE

• Drivers who’ve driven engines equipped with Volvo’s new emission engines with diesel particulate filters say they perform better than ever.
• Cruise rpm is 1300-1500 rpm on Volvo engines.
• Peak torque is available at 1100 rpm.
• The engines are more responsive with sudden applications of throttle.

The examples shown are for Volvo trucks. However, other manufacturers follow many of the same procedures, with perhaps slightly different terminology.

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