

Tier 4 Final Workshop

Presented by AIS Training Center

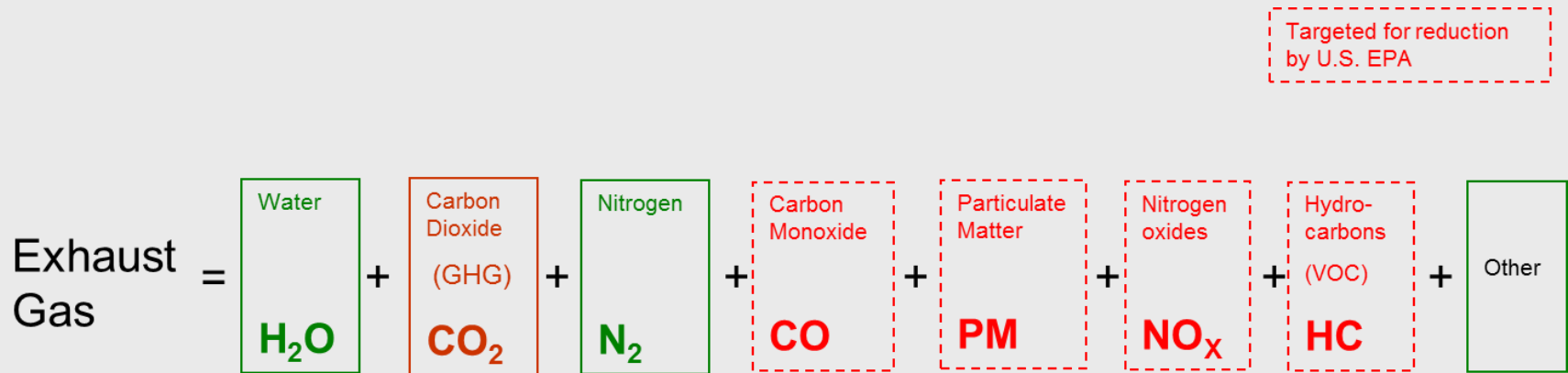
Joe Thompson



Tier 4 Final Workshop

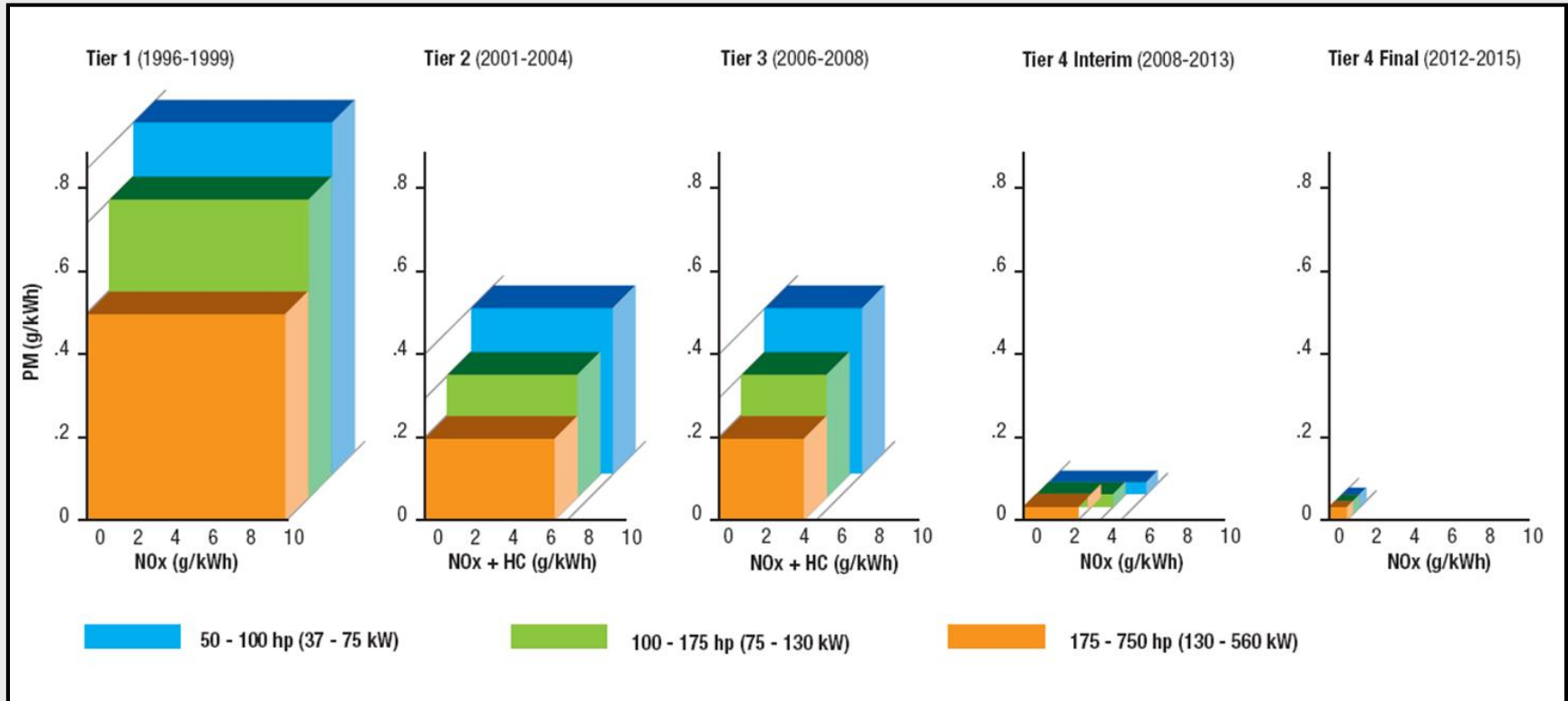
- Regulations
- Tier 4 Interim recap
 - Parts and Functions
- Tier 4 Final
 - Parts and Functions

What comes out of the exhaust pipe



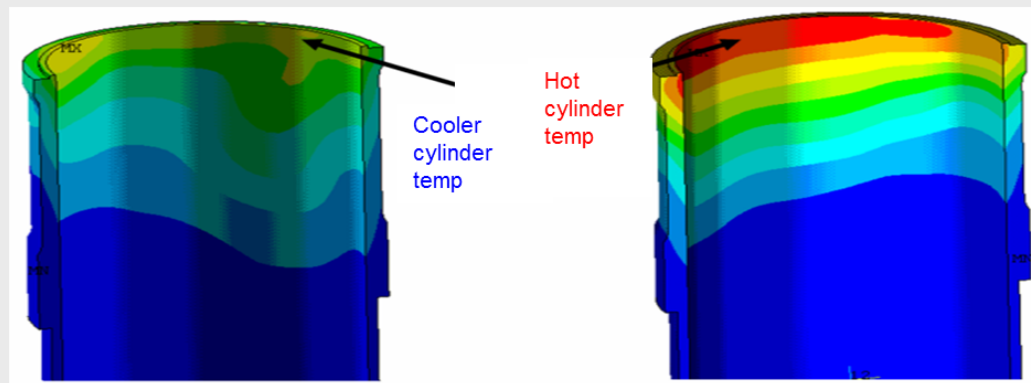
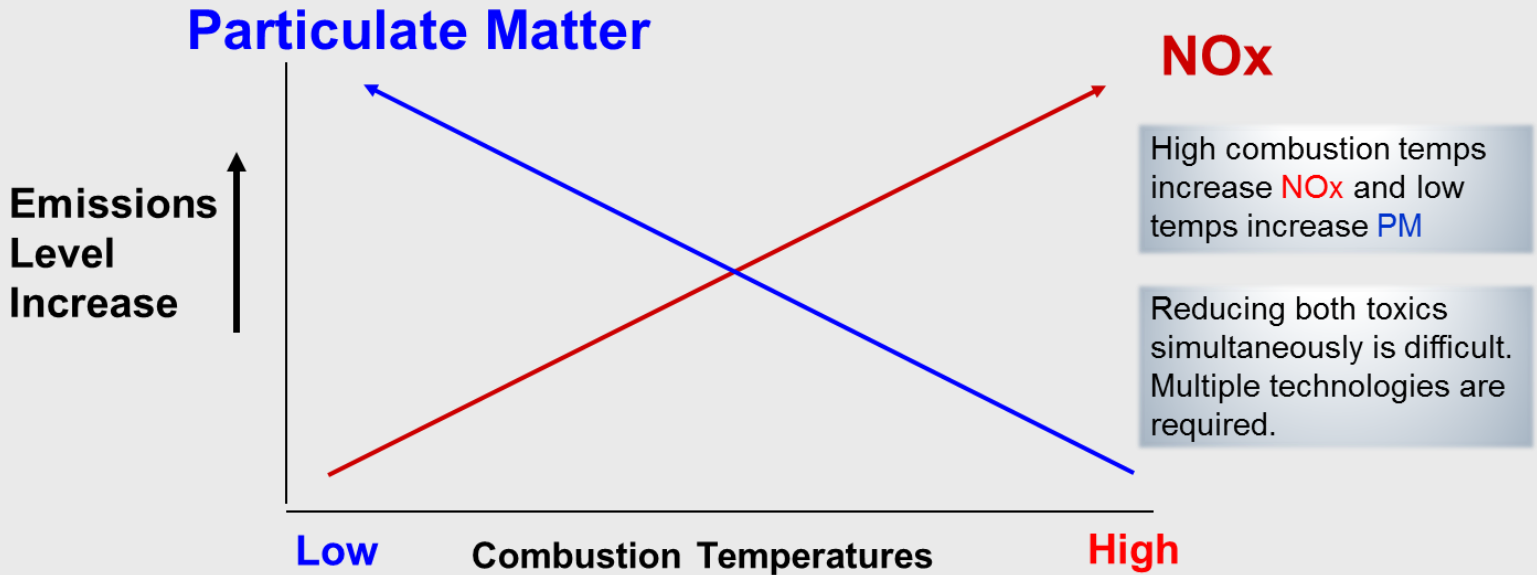
Diesel engines emit nitrogen oxides, particulate matter and air toxins which contribute to serious public health problems according to the U.S. EPA.

Progression of Regulations

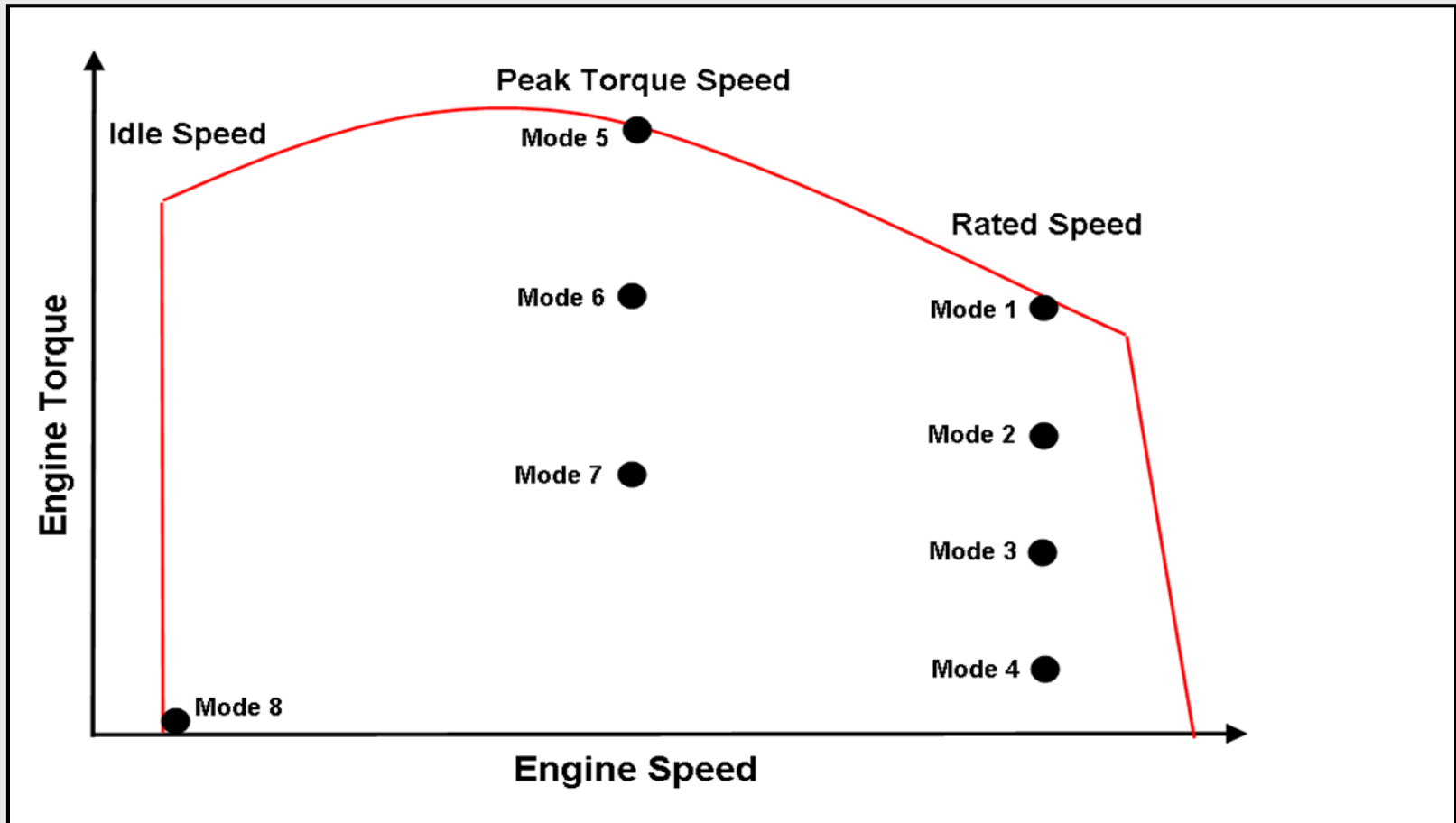


Part of the science

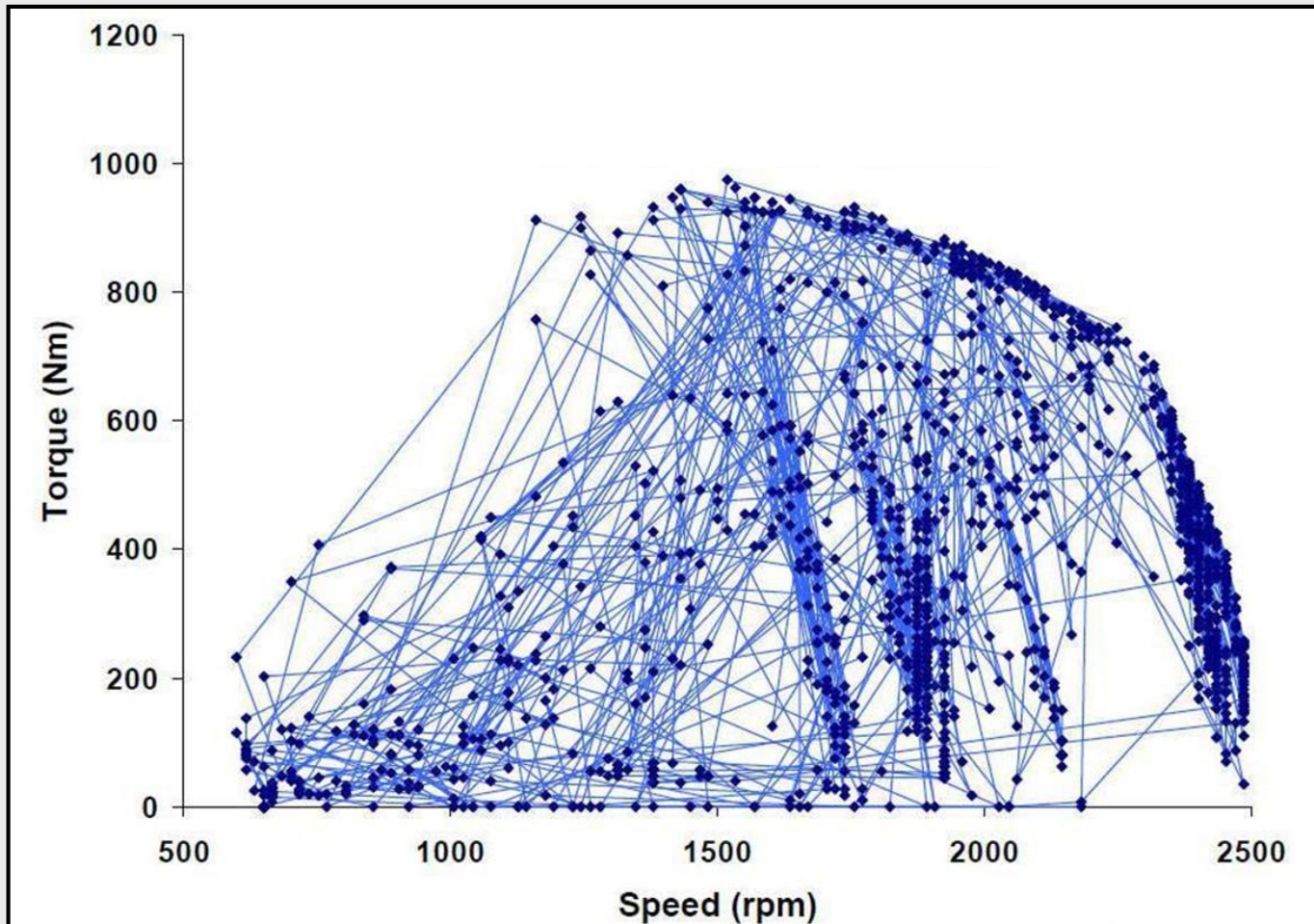
Combustion Temperatures Have OPPOSITE Effect on PM and NOx



Tier 3 Test Points



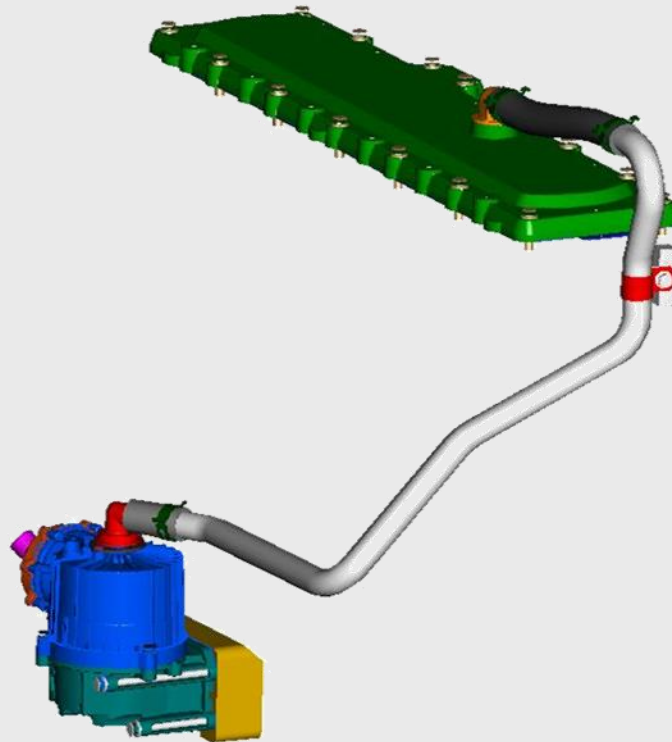
Tier 4 Test Points



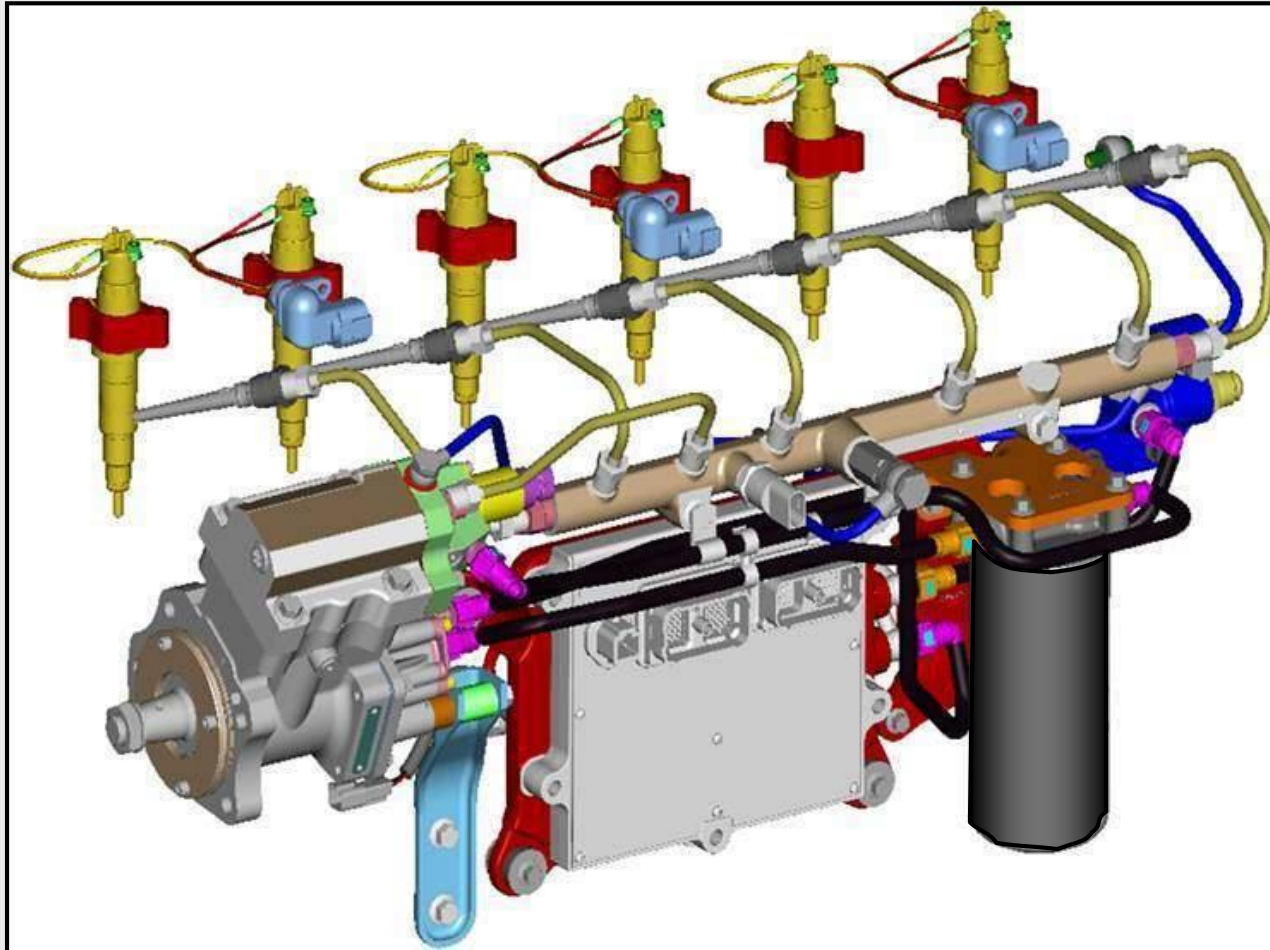
Tier 4 Interim Recap

- Variable Geometry Turbochargers (VGT)
- Open or Closed Crankcase Ventilation (OCV or CCV)
- High Pressure Common Rail (HPCR) fuel systems
- Exhaust Gas Recirculation (EGR)
- Air Throttle Valve
- Diesel Oxygen Catalysts (DOC)
- Diesel Particulate Filters (DPF)

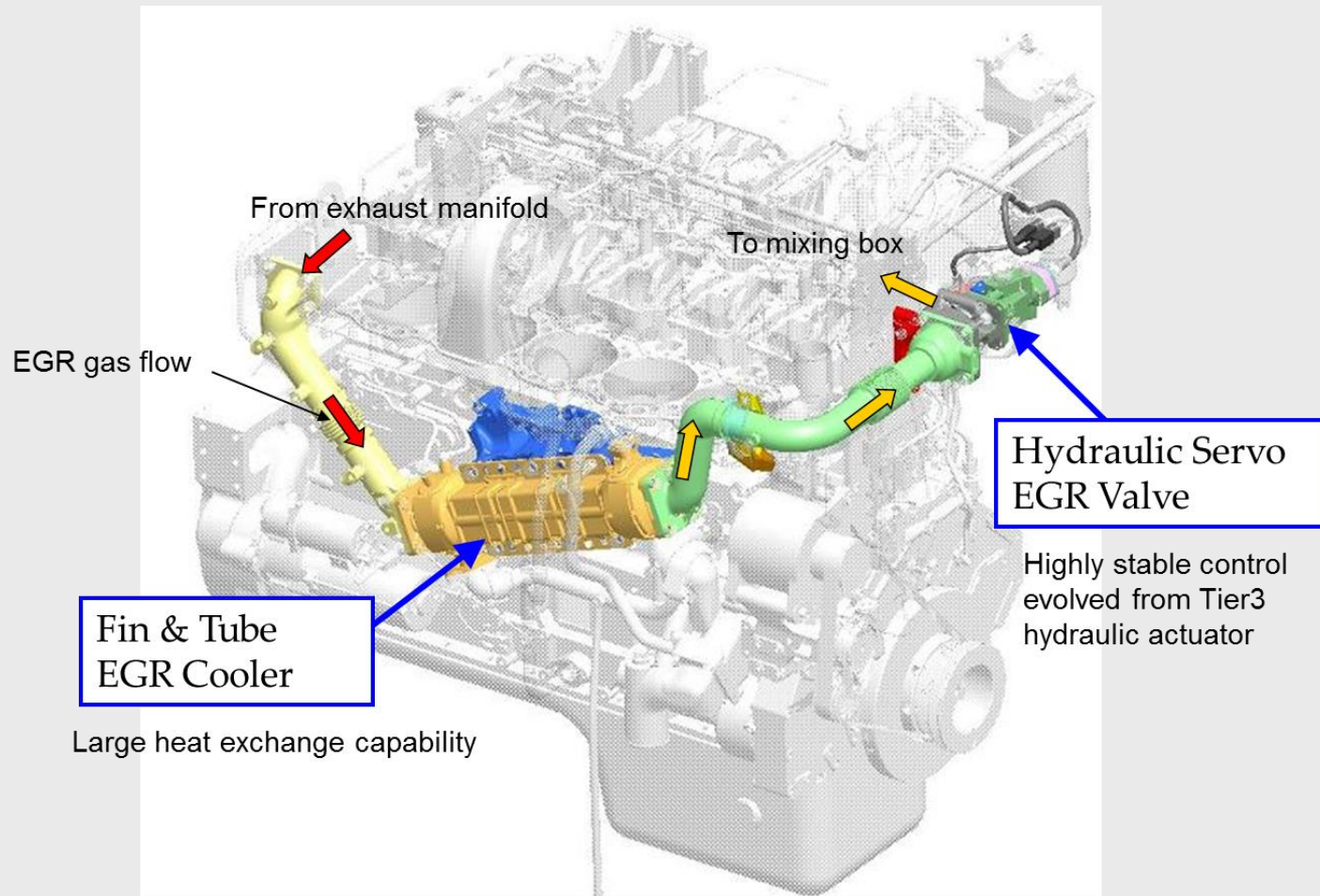
Open or Closed Crankcase Ventilation (OCV or CCV)



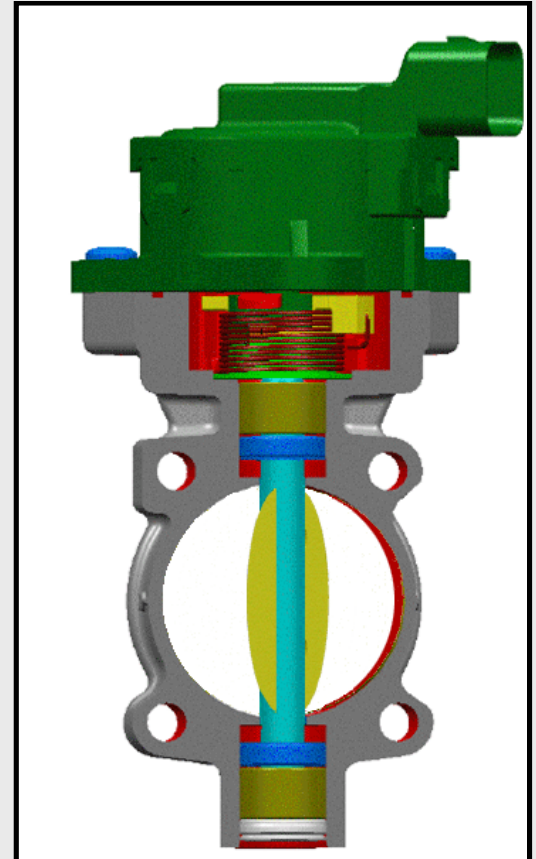
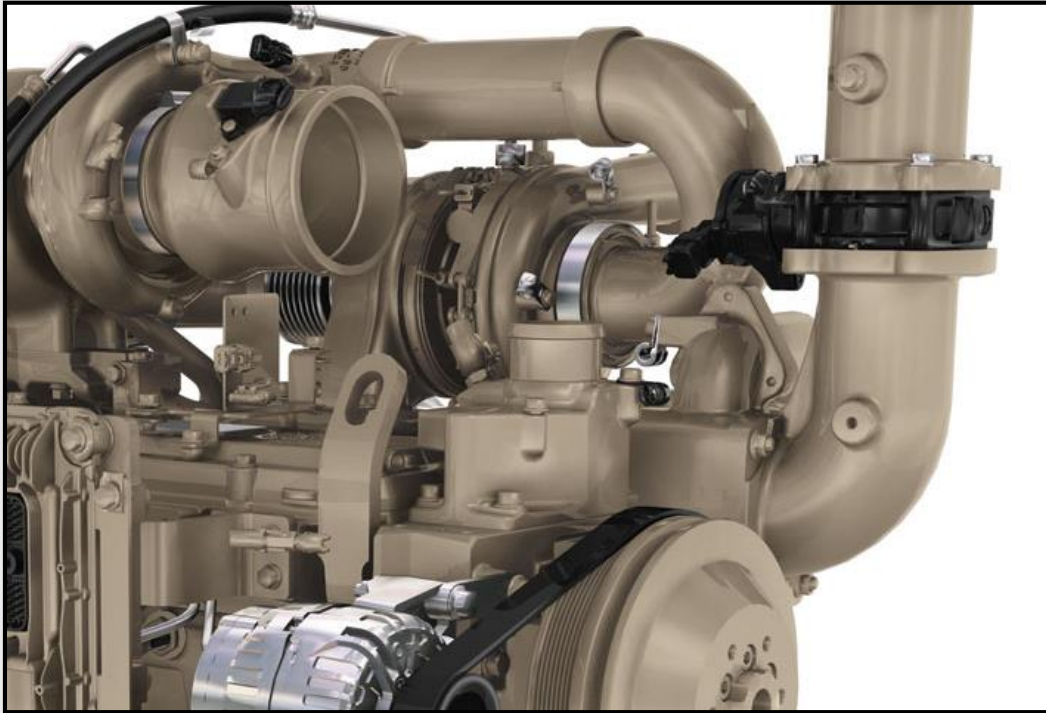
High Pressure Common Rail (HPCR) fuel systems



Exhaust Gas Recirculation (EGR)

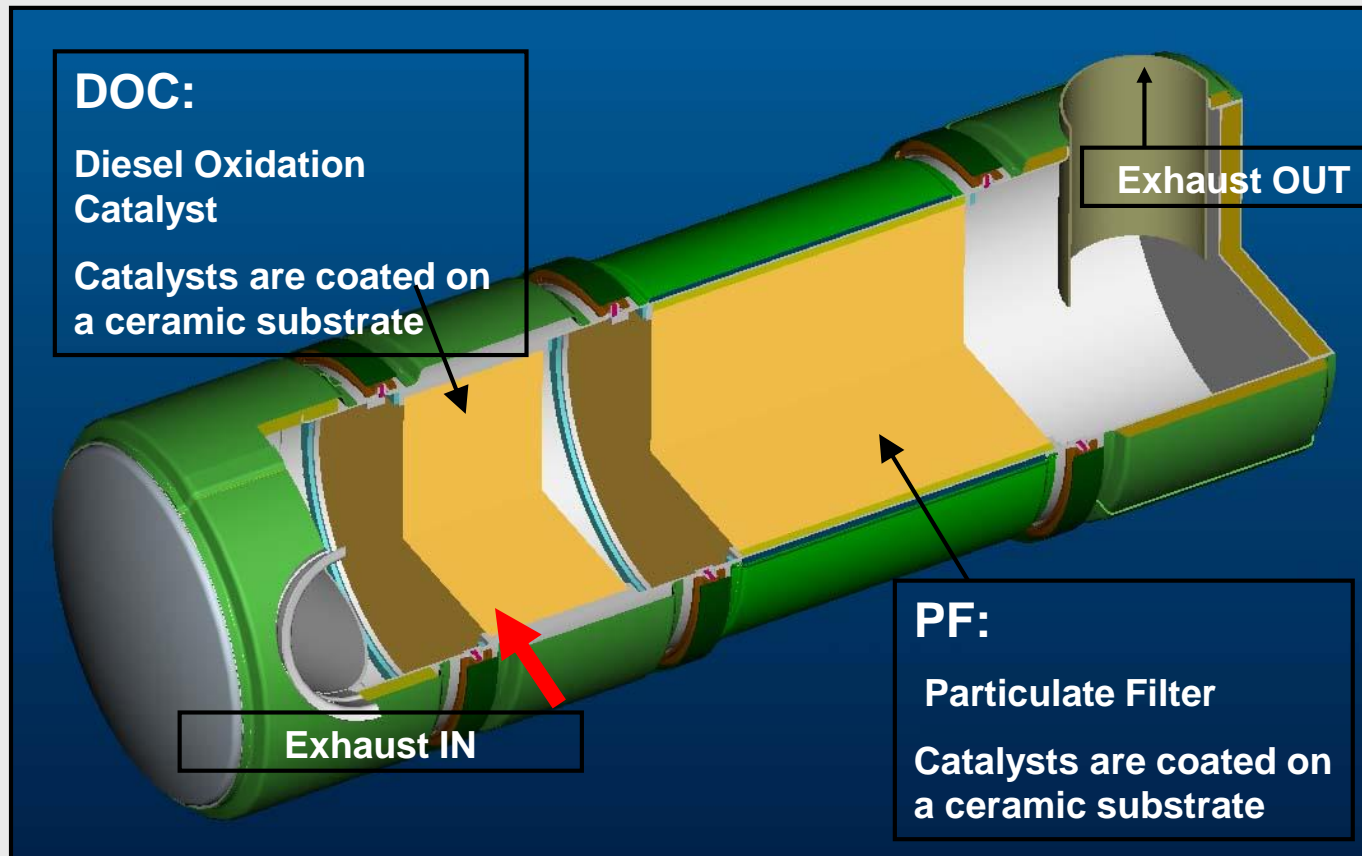


Air Throttle Valve

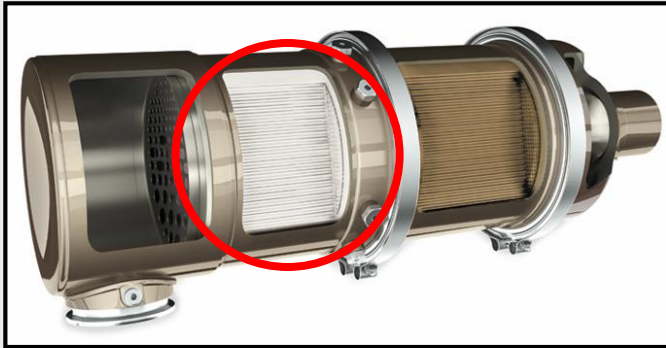


Diesel Particulate Filter (DPF)

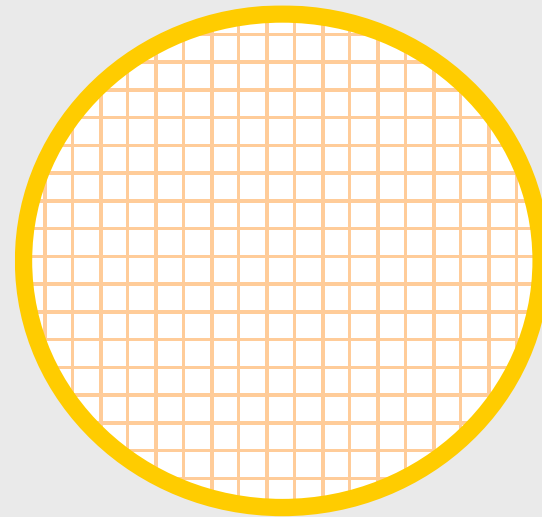
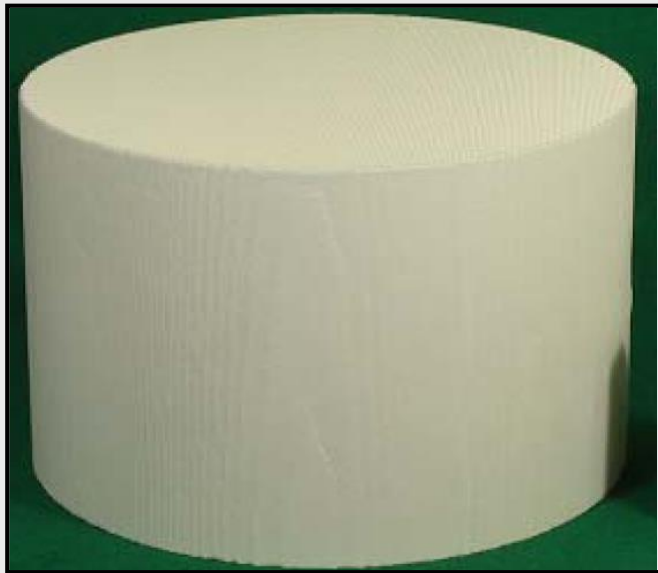
- DOC = Diesel Oxidation Catalyst
- PF = Particulate Filter



Diesel Oxygen Catalyst (DOC)



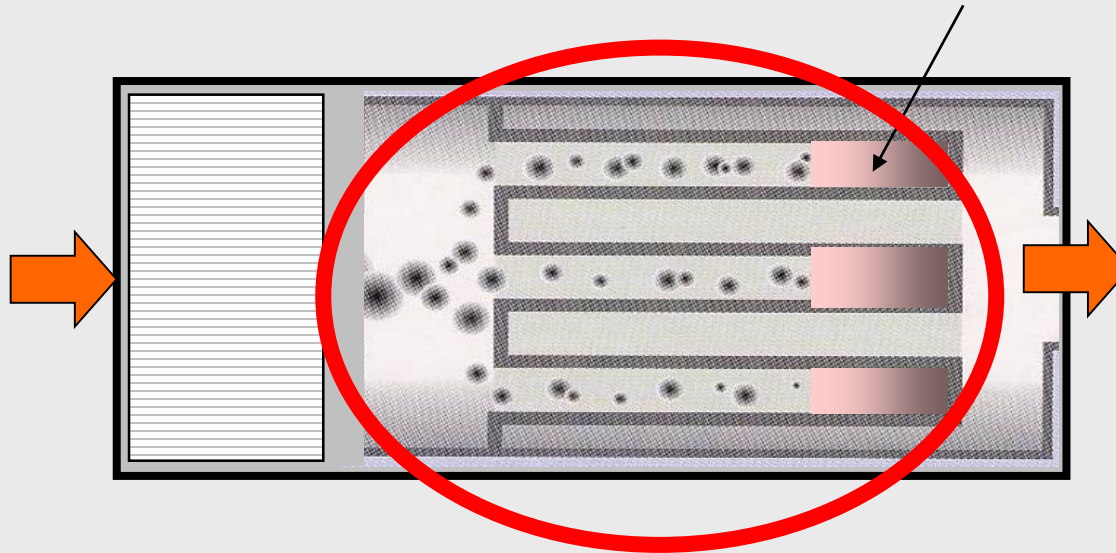
- Cylindrical Shaped
- Ceramic
- Coated with Precious Metals
- Chemical Reaction



400 cells per square inch

Diesel Particulate Filters (DPF)

- Ash included in lube oil is accumulated in DPF
- Periodic ash cleaning required



Regeneration

- Purpose – to remove soot from the filter to prevent plugging
- Accomplished by – Oxidizing the soot to convert it into a gas
- Oxidizing is done by inducing high heat

Types of Regeneration

- Passive
 - Happens with the heat generated by the operation of the engine
- Active
 - Happens when fuel is injected into the exhaust stream to create a chemical reaction to increase to amount of heat
 - There is no flame

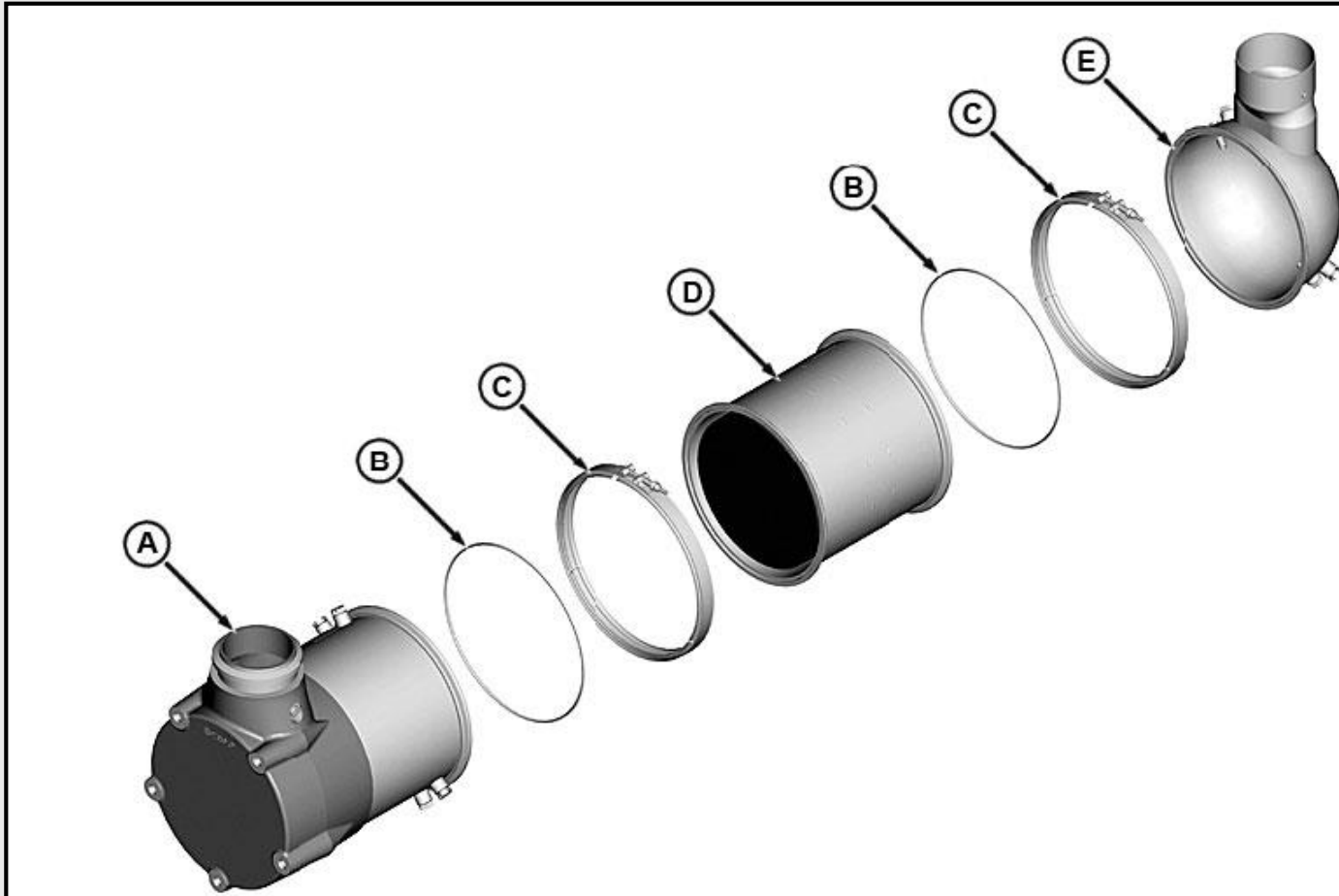
Types of Active Regeneration 1/2

- Automatic
 - Notifies the operator that it is happening
 - Under most conditions, do not disable
 - Will stop automatically (15-30 minutes)
- Parked / Manual Stationary
 - Machine cannot be used
 - Operator must initiate
 - Will stop automatically (40-60 minutes)
 - Happens more often when Automatic is disabled

Types of Active Regeneration 2/2

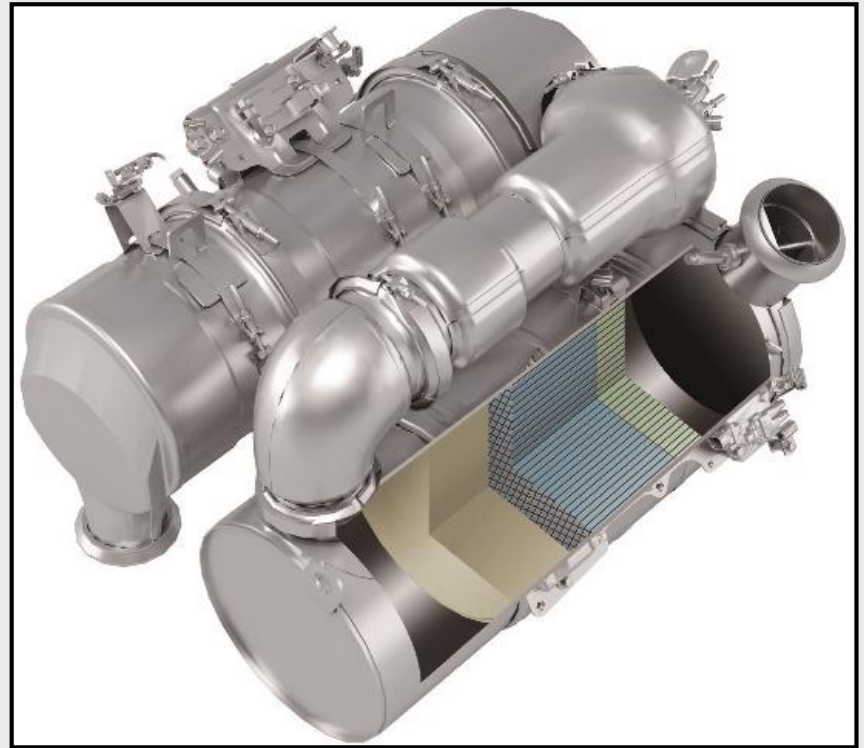
- Service
 - Machine cannot be used
 - Technician must initiate
 - Will stop automatically (45+ minutes)
 - Happens when Automatic is disabled too often or when service work needs to be performed

DPF Servicing



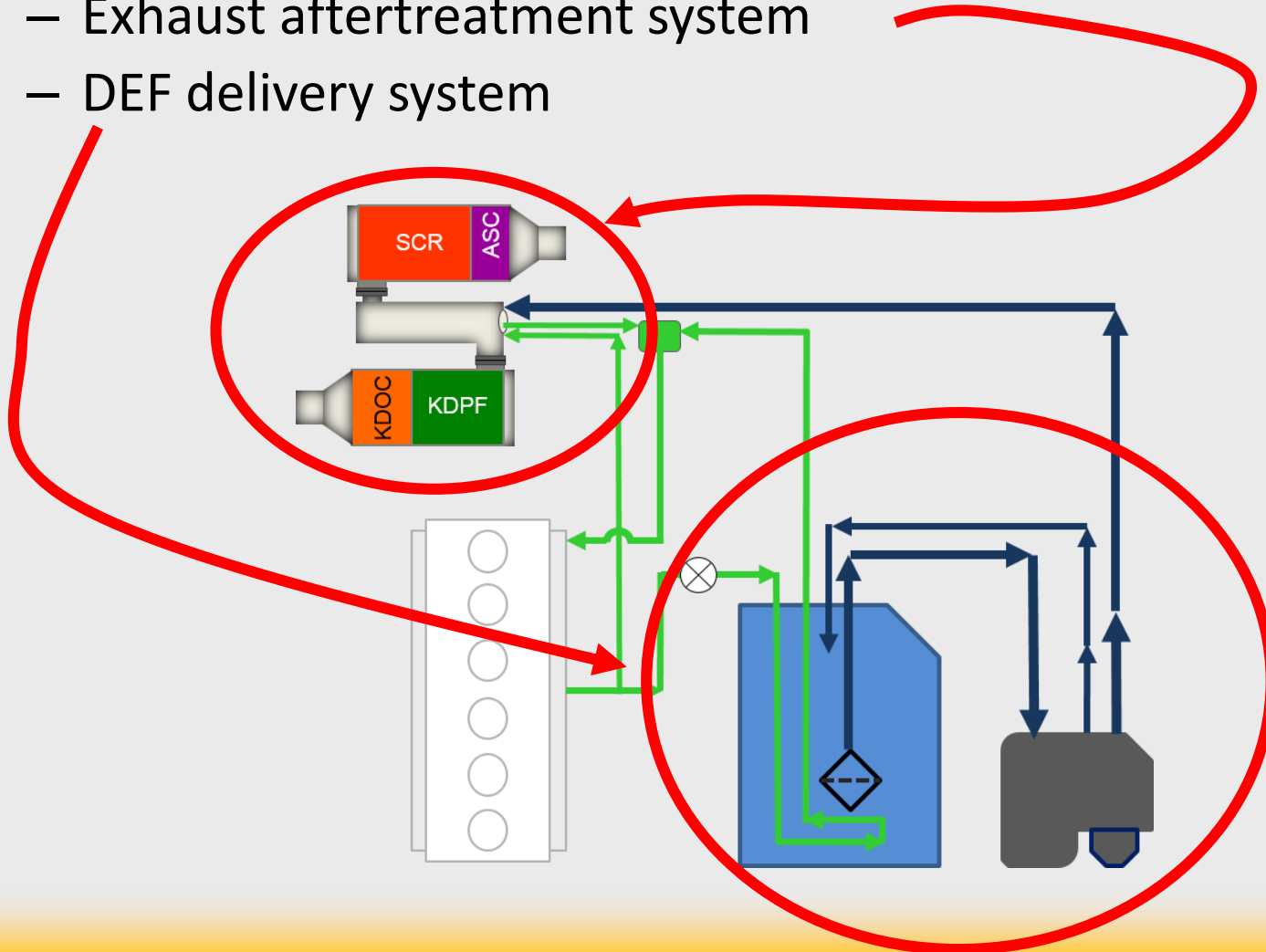
Tier 4 Final

- Mostly same parts as Tier 4 Interim, depending on horsepower
- Some engines do not use a DPF
- Almost all engines use Selective Catalytic Reduction (SCR)

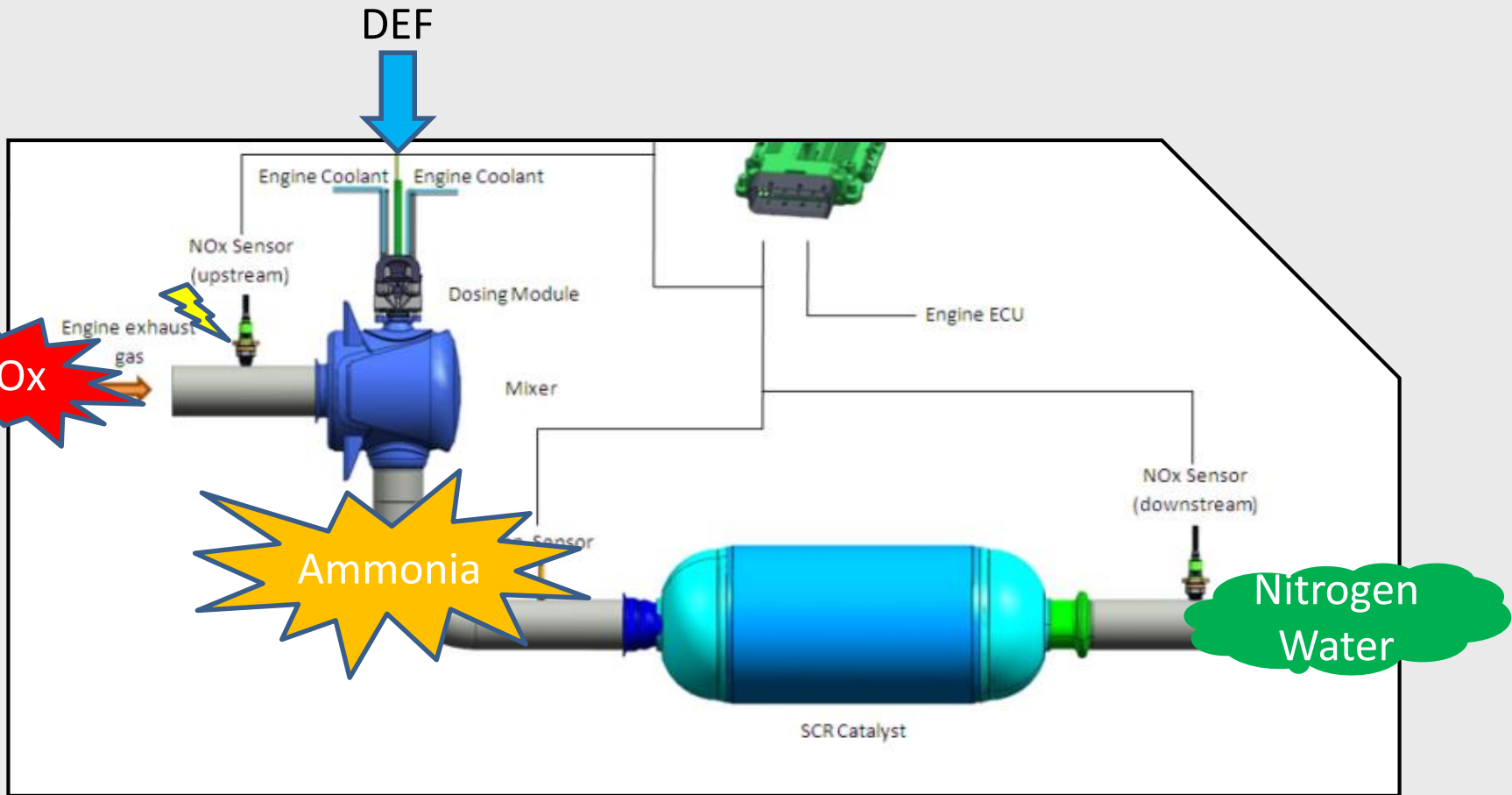


The SCR System

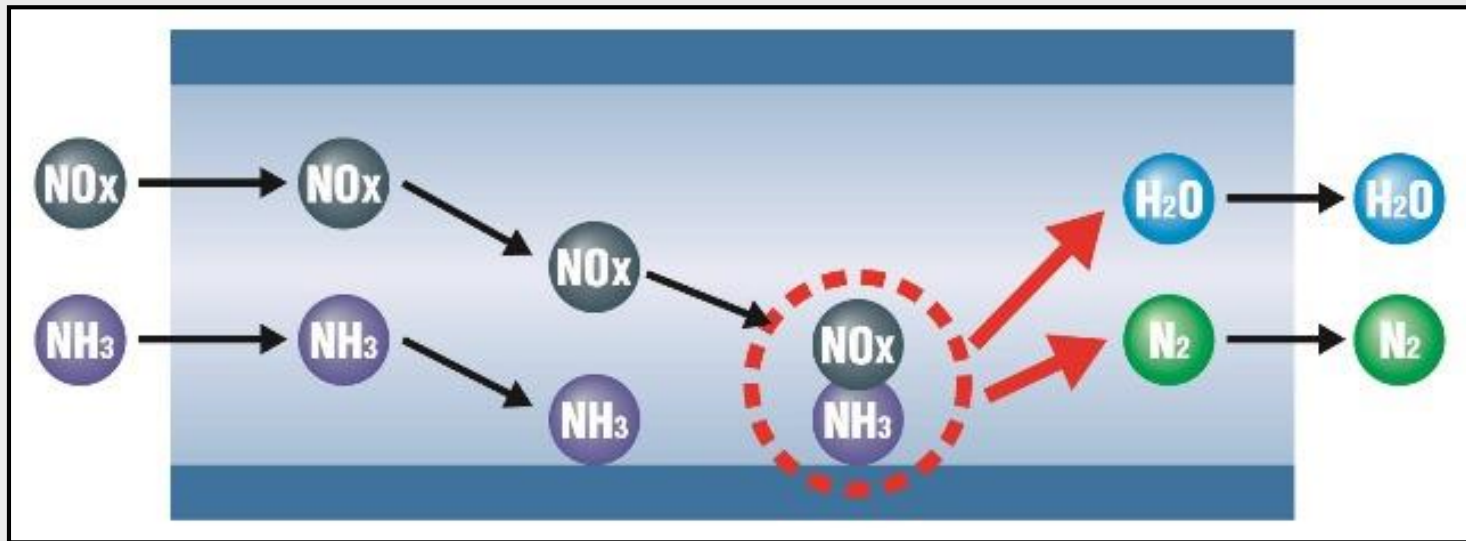
- The system can be classified into two major assemblies
 - Exhaust aftertreatment system
 - DEF delivery system



Aftertreatment System



The Chemical Reaction



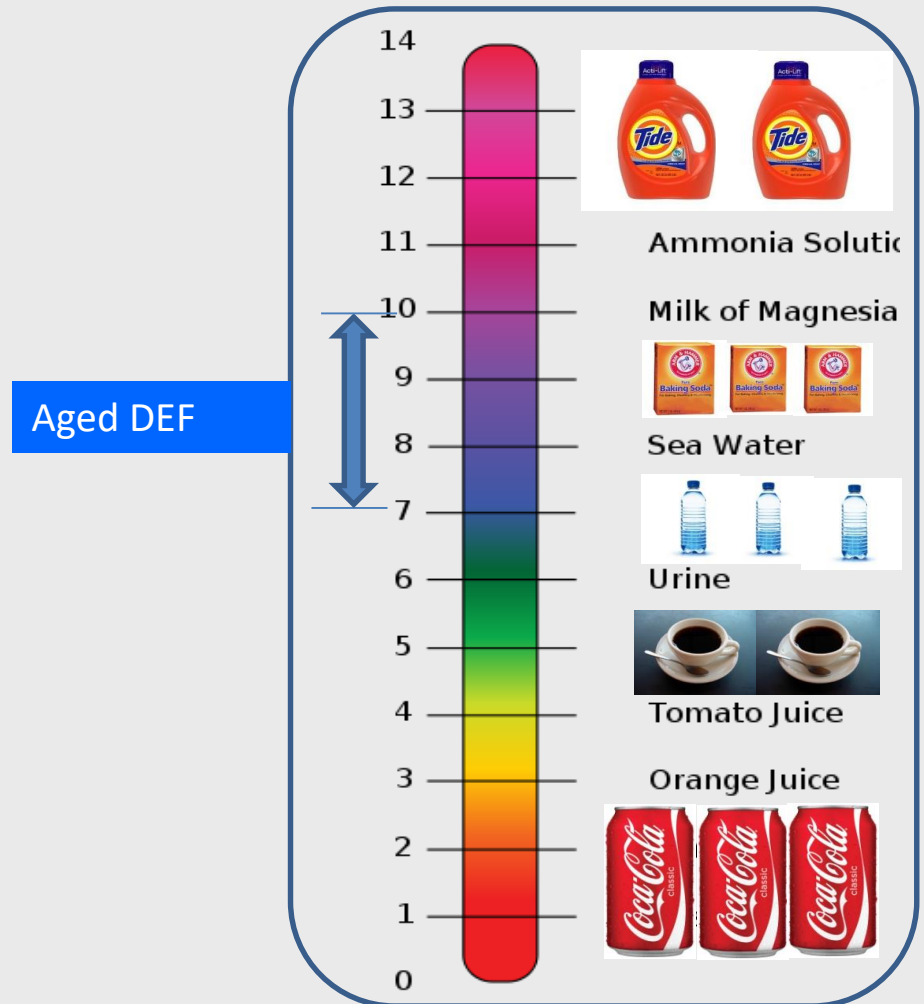
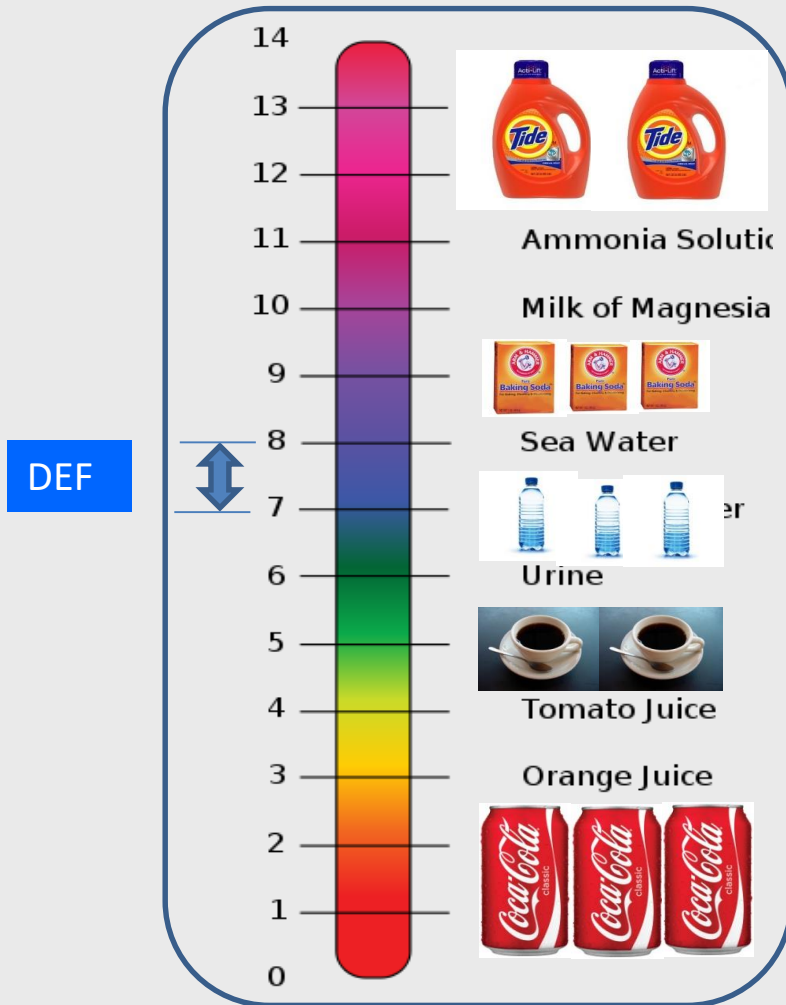
Diesel Exhaust Fluid (DEF)

- Adblue is a brand
- Freeze Point = -11°C (12°F)
- Not effected by freezing and thawing
- Recommended storing between -11°C and 30°C (12°F and 86°F)

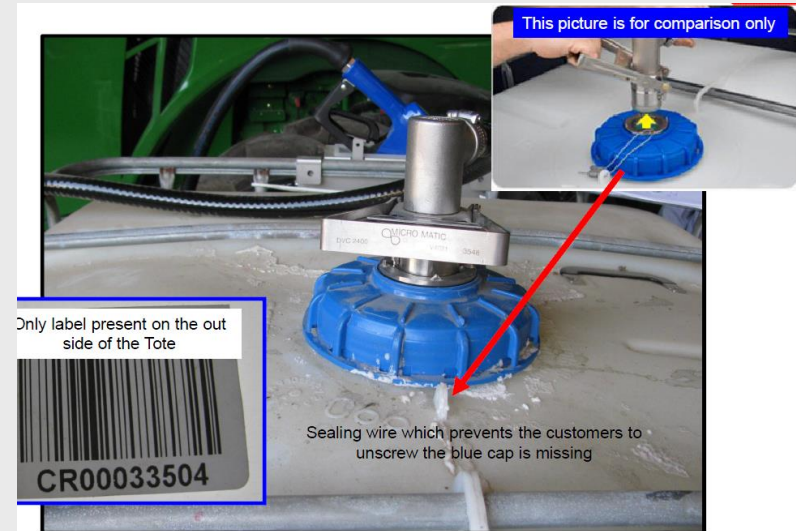
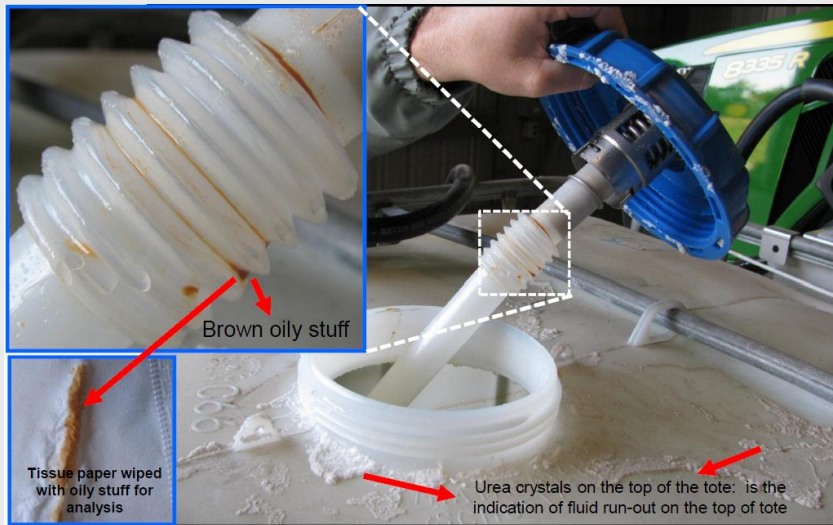


What is the shelf life of DEF?

Technically Speaking -



How should DEF be stored? In Sealed Containers!



- Open containers allow:
 - Contamination
 - Water Evaporation
 - Ammonia Release

To avoid Downtime:

- Keep containers sealed!

Where should I store DEF?

Wherever it is convenient to your operation!

- By the fuel barrel
- By the oil
- In the shop
- In the field
- At the job site
- Other



Does direct sunlight harm DEF?



What do I do if I park my vehicle for an extended amount of time?

- A rule of thumb is handle DEF how you handle the other vehicle fluids.

Fuel

Oil

Coolant



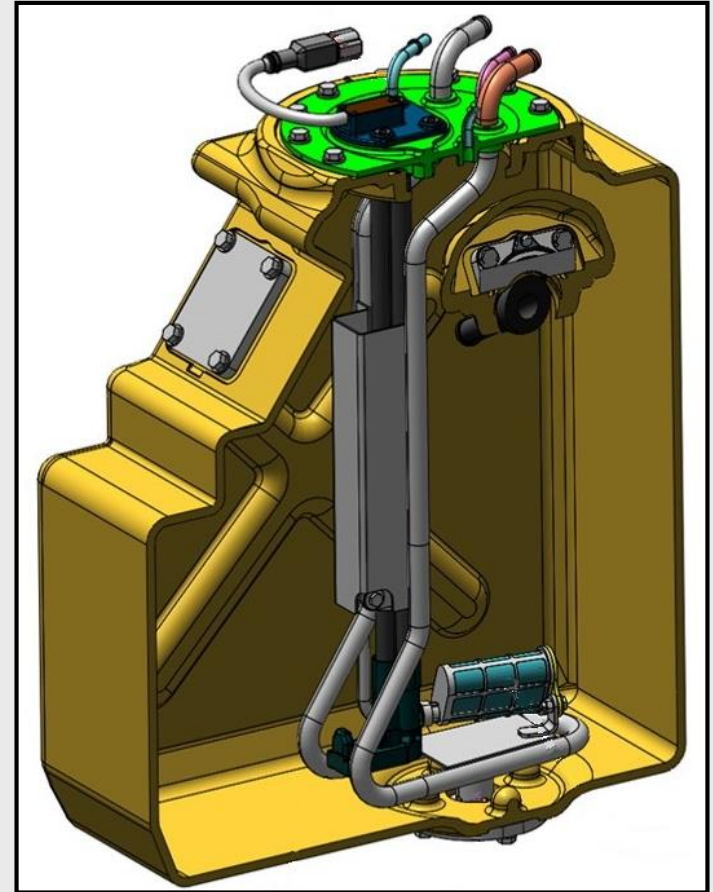
Summary

- Store in sealed containers.
- Shelf life is not a major concern.
- Think about DEF similar to the other maintenance fluids you use today.
- Purchase amounts that can be used in a reasonable amount of time.
- Store where it is convenient to your operation.



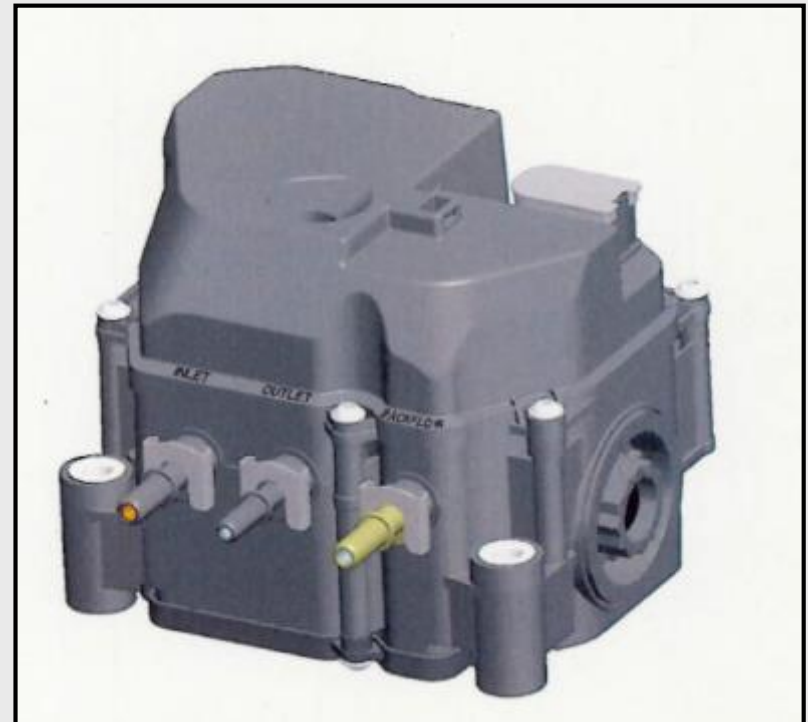
DEF Tank

- Stores the DEF
- Contains:
 - Heater (Electric or Coolant)
 - Level Sensor
 - Temperature Sensor
 - Quality Sensor
 - Suction tube
- Size varies by application



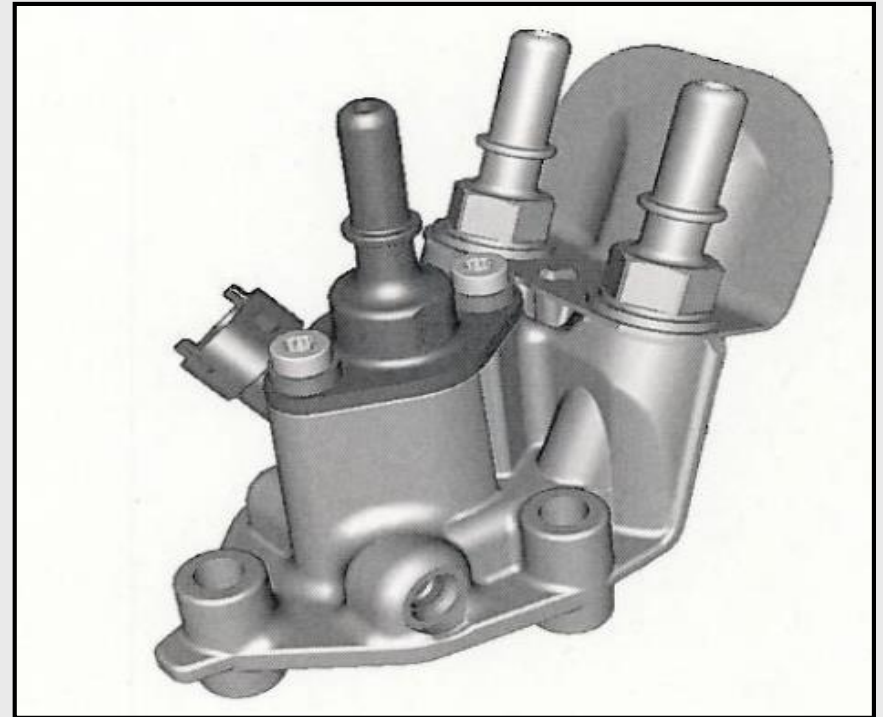
Pump Module

- Pressurizes the system to 70-130 PSI
- Evacuates the DEF from the lines after engine shuts off to prevent line freezing
- Contains a filter that is a service item

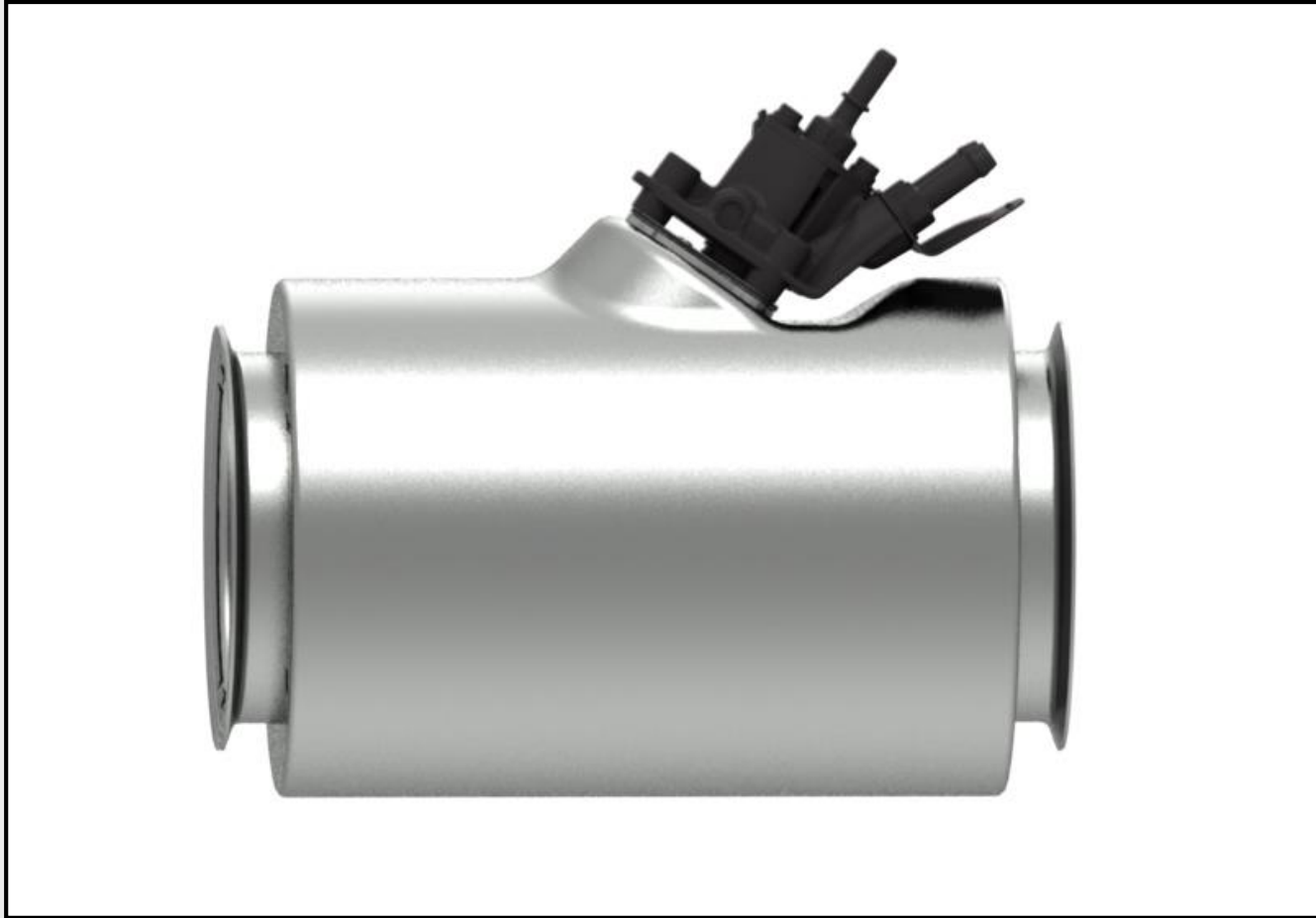


DEF Nozzle

- Injects the DEF into the exhaust stream at the diffuser
- Coolant lines for heat or cooling as required
- Need not operate at very cold temperatures for a while (>70 minutes)

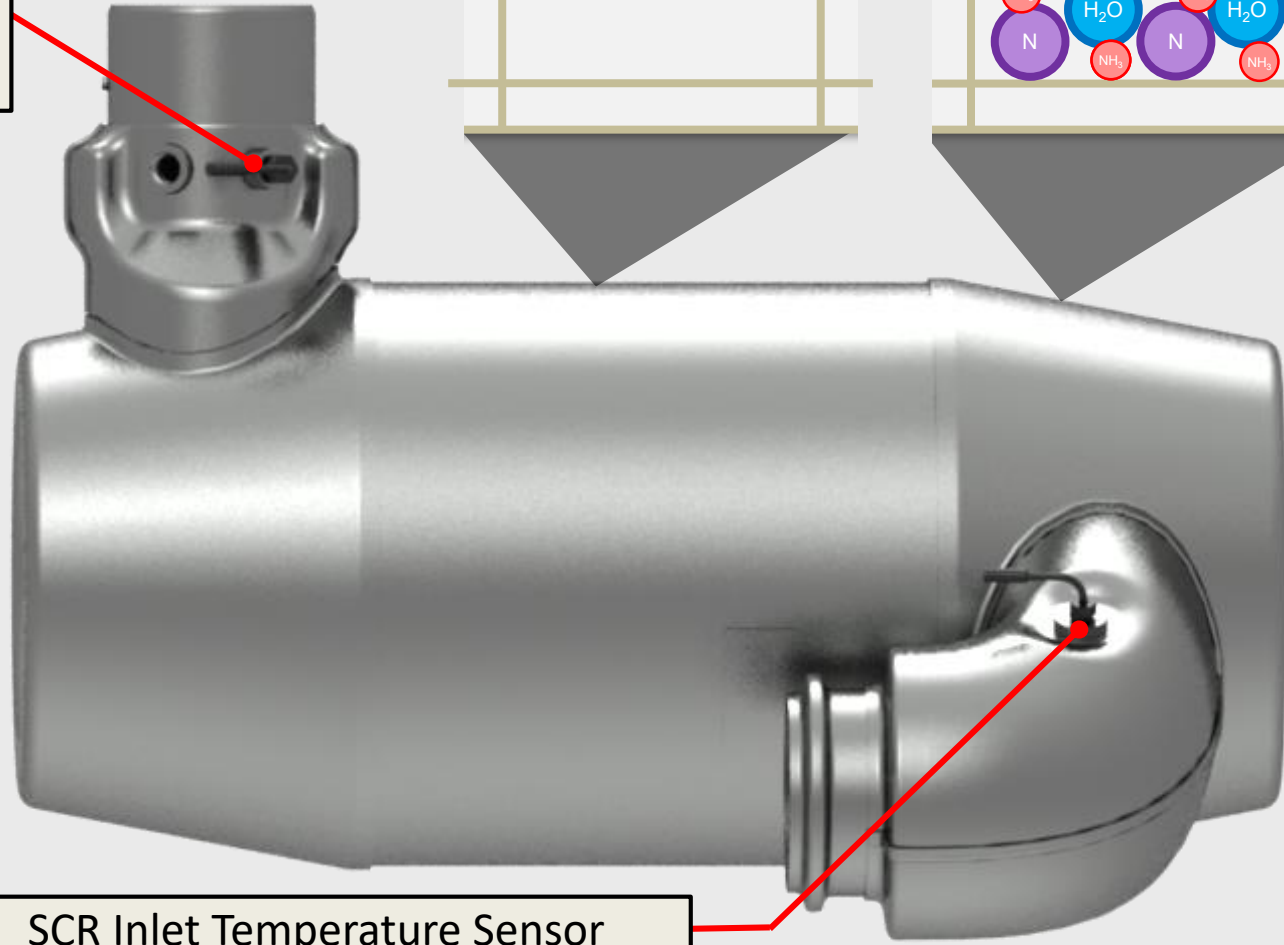


Catalyst and AOC



Catalyst, AOC and Sensors

SCR Outlet Temperature Sensor



SCR Inlet Temperature Sensor

NOx

What can you, the end user do?

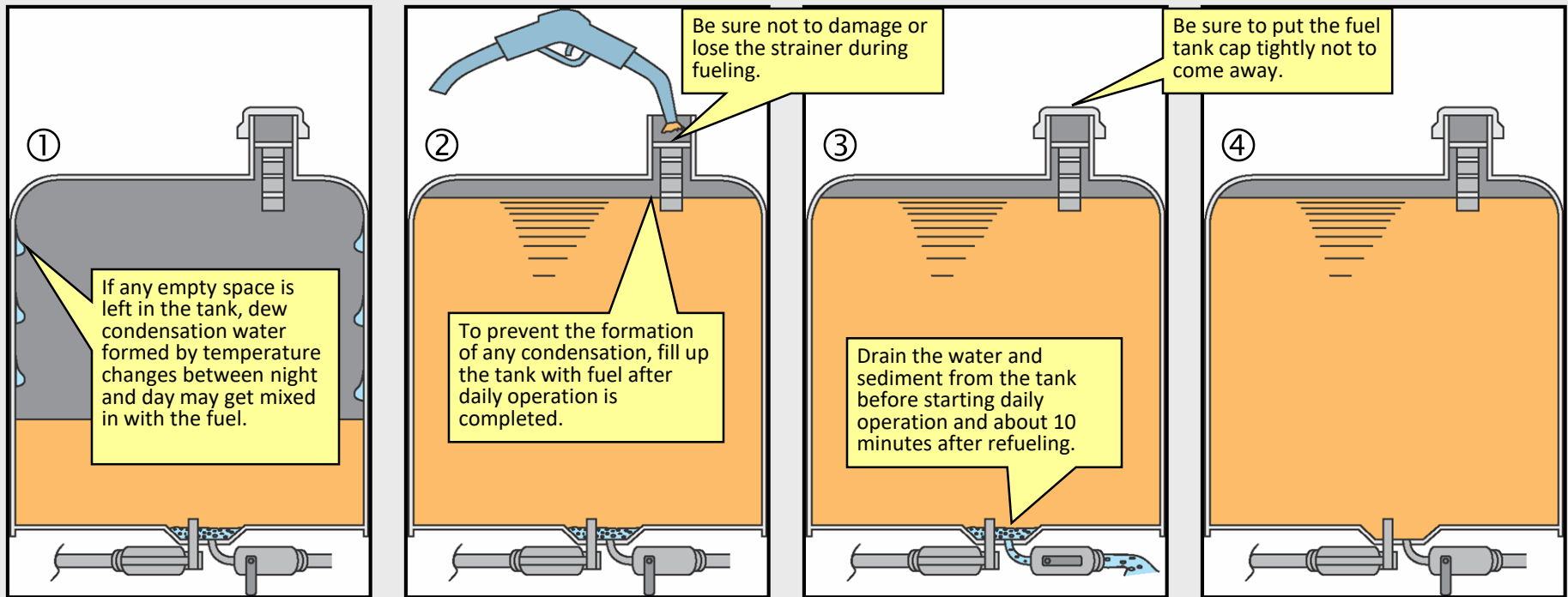


Monitoring the Fuel – The Fuel Chain



- Refinery
- Transport
- Bulk Storage
- Delivery
- Tank Storage
- Transport to Application
- Application Fueling

What can you, the end user do?

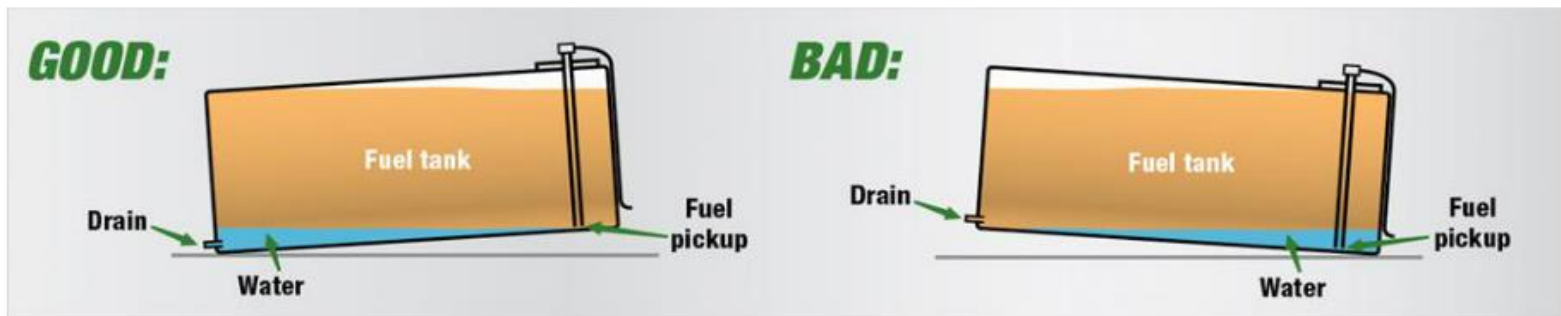


What can you, the end user do?



Maintaining & Improving Fuel Quality - Storage

- Keep Tanks Full
- Use Drain Valve on Bottom Tank to Remove Impurities
- Allow New Fuel 24 hours to Settle
- Completely Drain Tank & Rinse with Fresh Diesel – Annually
- Minimize Direct Sunlight or Heat
- Store in Containers Not Made of Copper, Lead, Zinc, Tin, Brass or Bronze

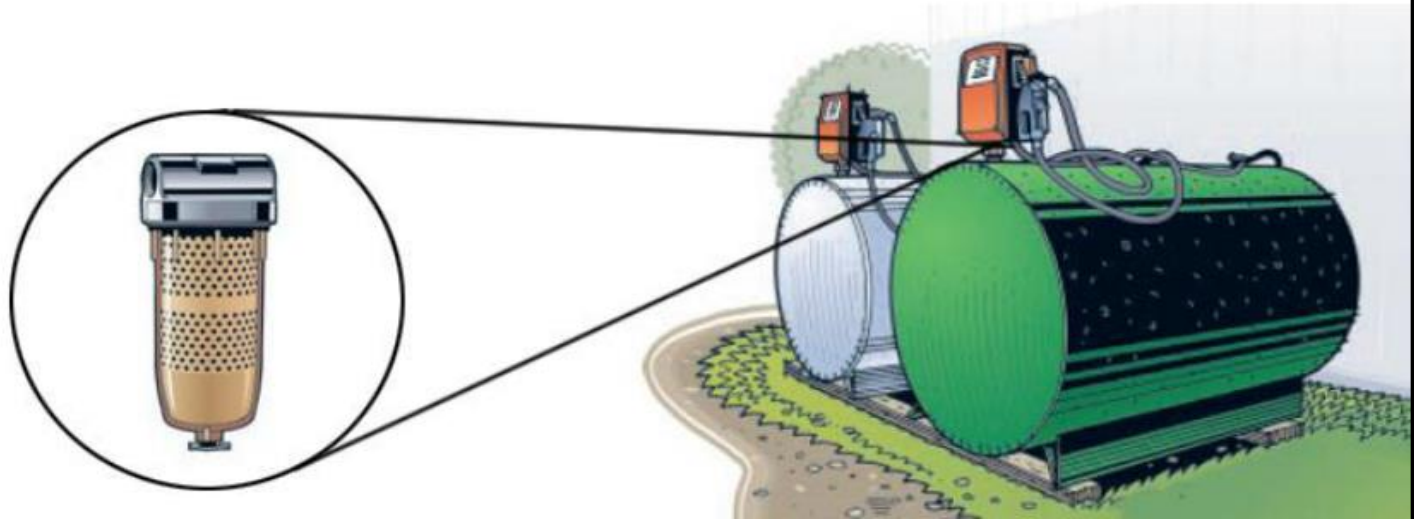


What can you, the end user do?



Maintaining & Improving Fuel Quality - Filtration

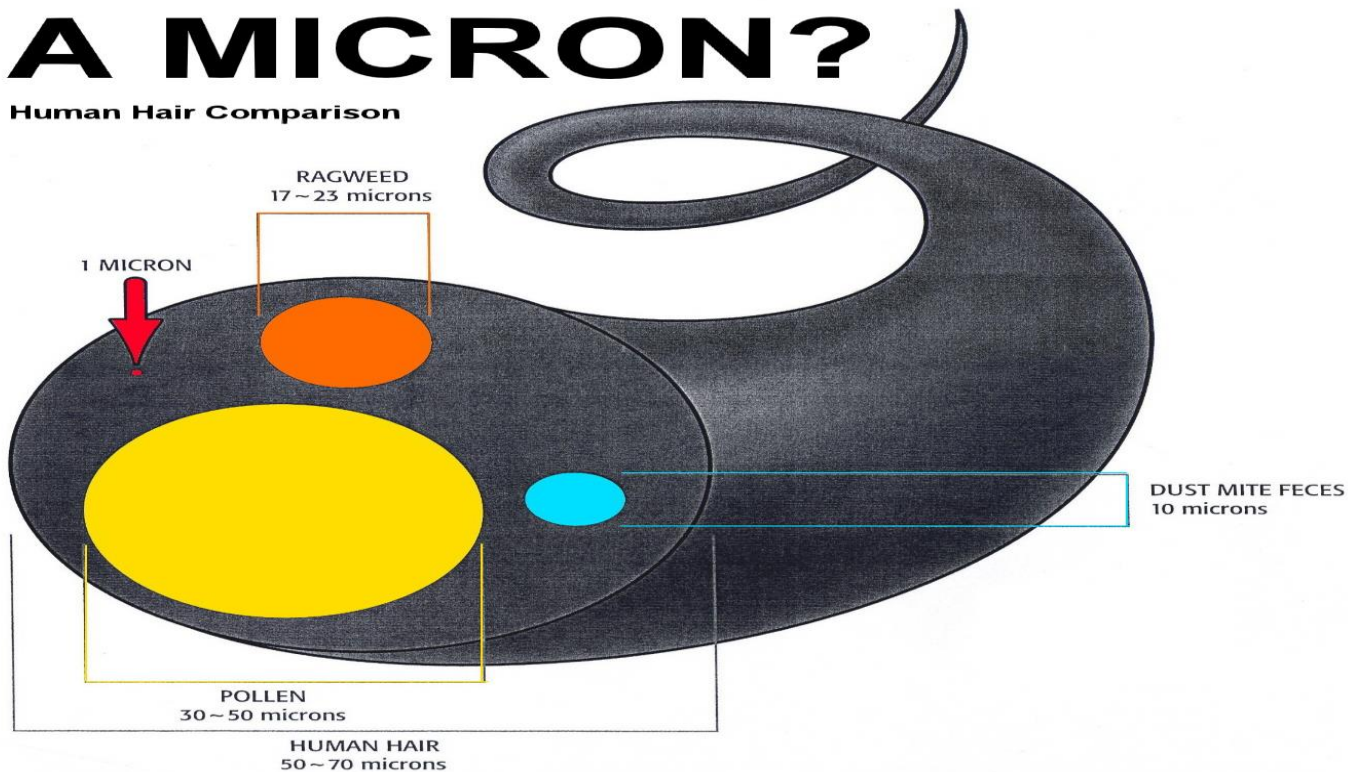
- Storage Filtration
 - Well Serviced Filter Between Pump & Nozzle
 - Particulate Filters



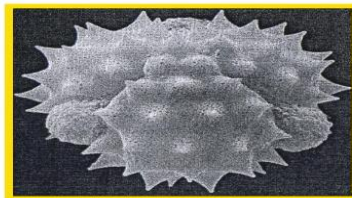
How small is.....

A MICRON?

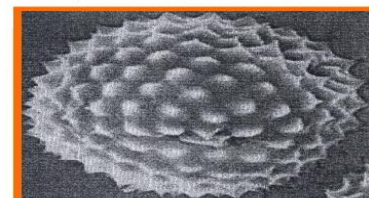
Human Hair Comparison



DUST MITE CARCASS
250 microns

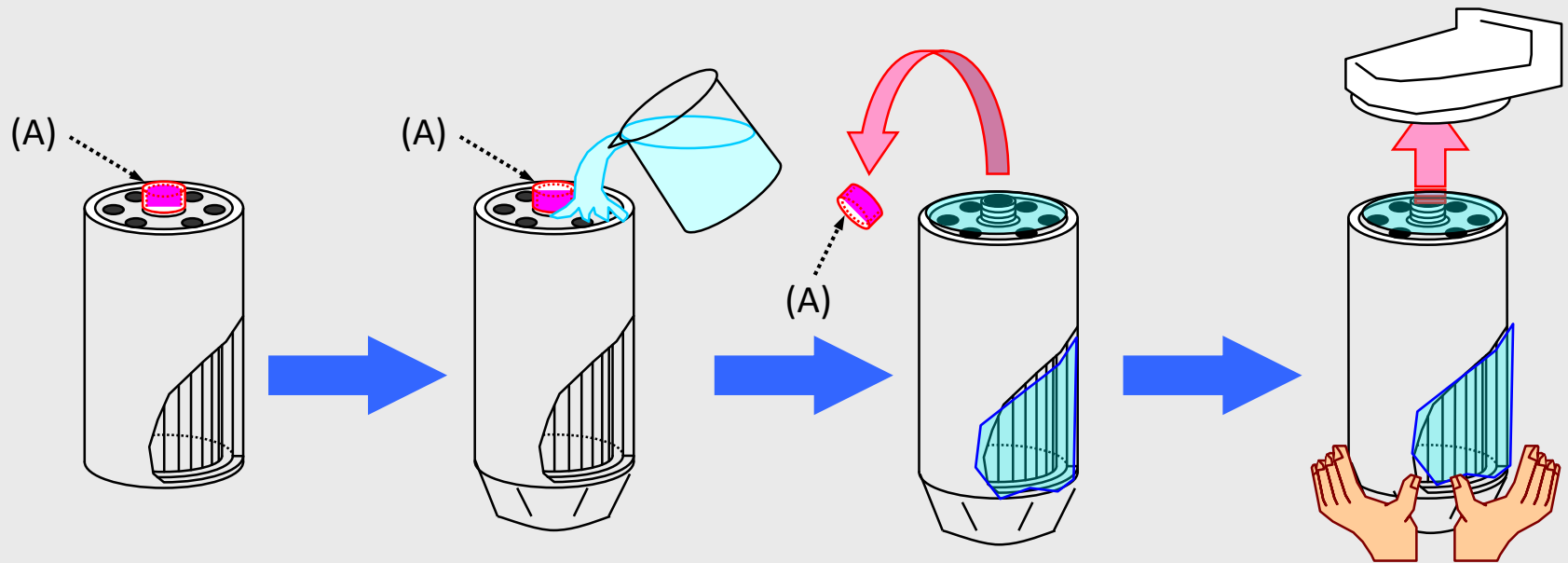


POLLEN
30 ~ 50 microns



RAGWEED
17 ~ 23 microns

Prefilling the Pre-filter



FUEL-PROTECT Diesel Fuel Conditioner

- Boosts Cetane number for faster, smoother, fuel efficient starting
- Aggressive Detergents and dispersants clean and keep clean injectors – helps prevent injector erosion, prevents emissions deterioration due to deposits, and cleans entire fuel system
- Lubricity Improver for added protection and reduced fuel injection and pump wear when using Ultra Low Sulfur Diesel (ULSD) fuel
- Moisture Control improves water tolerance and helps minimize microbial growth
- Maintains fuel pump warranty
- Minimizes smoking
- Compatible with all diesel fuels
- Summer and Winter Formulas – Winter Formula lowers Cold Filter Plugging Point (CFPP) and Pour Point improving cold weather fuel flow



End of

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