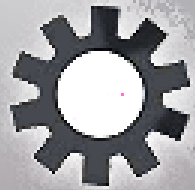


Industry Update PC-11

February 2015



Mid-Atlantic
Equipment Management Association, Inc.



IT'S MORE THAN JUST OIL. IT'S LIQUID ENGINEERING.

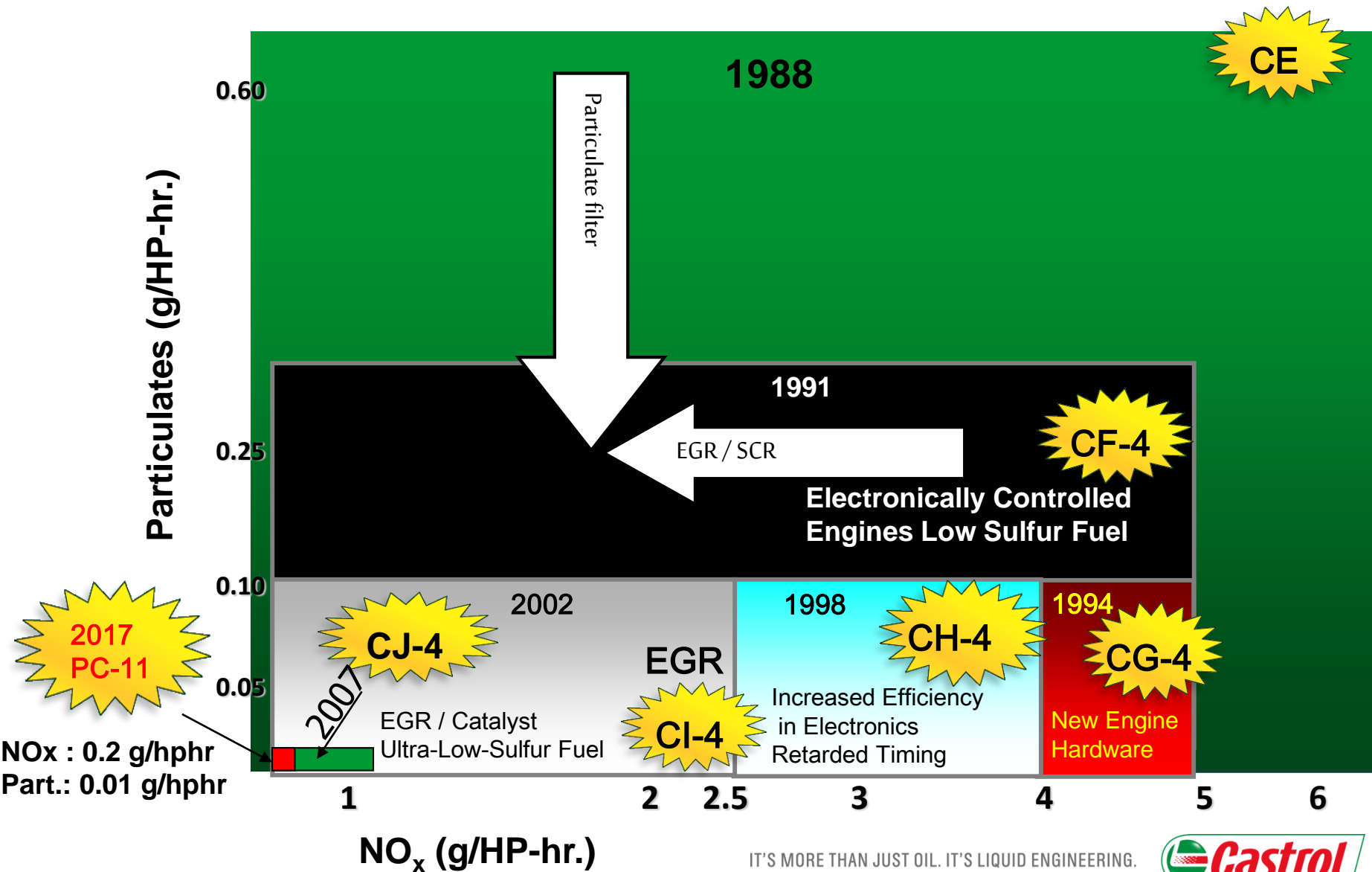


What is PC-11?

- Proposed Category 11 (PC-11) is the next generation of heavy duty diesel engine oils under development, with desired improvements in:
 - Oxidation stability
 - Shear stability
 - Scuffing/adhesive wear protection
 - Aeration benefits

The new category is being driven by changes in engine technology to meet emissions and fuel economy standards set by the EPA for CO₂ and other Green House Gases

Federal On-Hwy Emission Legislation has Driven Changes in Diesel Engine Hardware



IT'S MORE THAN JUST OIL. IT'S LIQUID ENGINEERING.



PC-11 Update



- PC-11 SPLIT INTO TWO CATEGORIES
- TIMING NOT FINALIZED
- WORK UNDERWAY



PC-11A (name TBD)

PC-11A is an upgrade from today's CJ-4

Backward compatible with pre-2017 engines
(on- and off-road)

Same 3.5 cP minimum HTHS viscosity

Applicable grades will be 10W-30 & 15W-40

PC-11B (name TBD)

PC-11B is a new specification but will have the same engine and bench test requirements as PC-11A with exception of HTHS viscosity.

Minimum HTHS viscosity of 2.9 cP which will drive greater fuel economy

Applicable grades will be 10W-30 and 5W-30

So...what is HTHS?

HTHS = **H**igh **T**emperature **H**igh **S**hear viscosity

- This test measures the vis of an oil at 150C under high shear rate conditions, using a high speed bearing immersed in the heated oil
- This test simulates 'real world' conditions in an engine, particularly in the cam and bearing regions
- Provides us with an indication of the ability of the oil to maintain fluid film strength in an engine (stay in grade)

Why two HTHS levels?

- 3.5 HTHS (PC-11A)
FE improvement from 15W-40 to 10W-30 = 1%
- 2.9 HTHS (PC-11B)
Additional 0.8 – 1.0% FE improvement over a 3.5 10W-30
- The challenge of a lower HTHS is the oil needs to be thick enough to maintain separation of critical moving parts
- But thin enough to allow for fuel efficient operation of the engine

Changes in test parameters

- Most current CJ-4 test parameters will remain with some having increased performance levels for PC-11
- There will also be some new additional tests focusing on oxidation and aeration control at high engine temperatures
- Mack T-13 which will measure oxidation control
- CAT C-13 Aeration test
- Some engine temperatures will increase by as much as 10°C or 50°F over previous engine designs

PC-11 Timeline

- Implementation has been pushed back multiple times since the first announcement of the new category
- Currently March 1st 2017 is seen as the first allowable use (FAU) for implementation but is subject to change
- Some OEM's may require implementation sooner
- Some additional test parameters could be added as well (Detroit Diesel DD13 Scuff Test for rings, liners and bearings) to protect against future concerns of lower HTHS

What does PC-11 mean to me?

- No more “one size fits all” engine oil
- Possibly need to carry more than one engine oil with an additional bulk tank
- This will require both shop and maintenance personnel to be aware of the individual equipment requirements
- Outside maintenance services will need to be aware of these changes as well

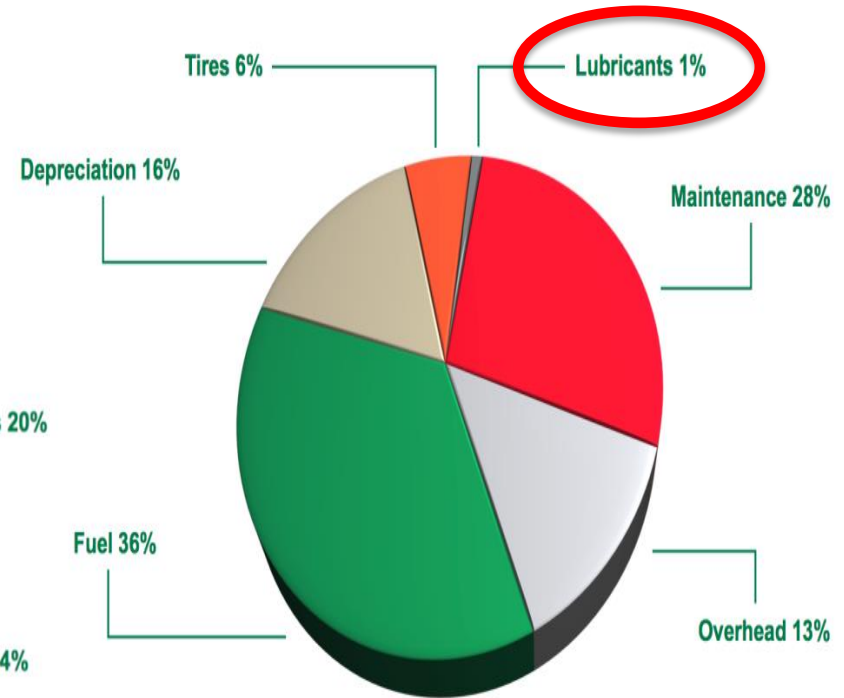
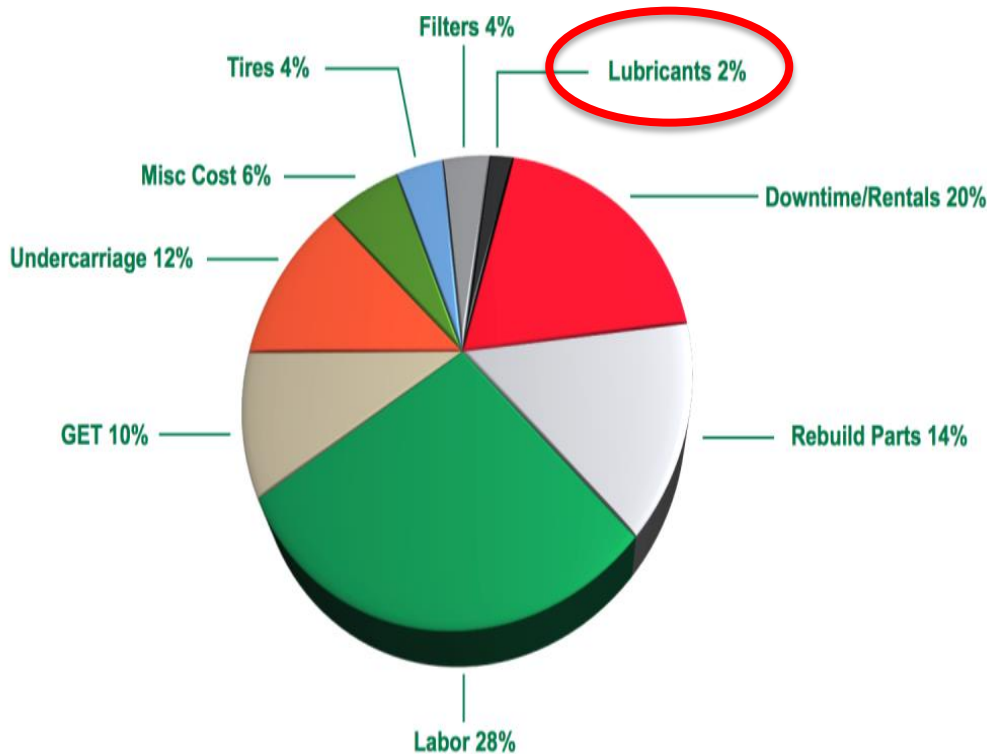
Additional concerns

- Proper cooling system maintenance is necessary with higher operating temps
- Proper used oil analysis programs will become critical moving forward to trend wear and engine oil health
- Willingness to make **changes** “the way we have always done it” may no longer be the best approach
- Clearly defined maintenance intervals and programs will be needed to minimize equipment downtime and gain the desired life of the engine

Cost concerns with PC-11

Should remain consistent and relative with current maintenance budget spending (lubricants represent a small percentage of cost)

Off-Road

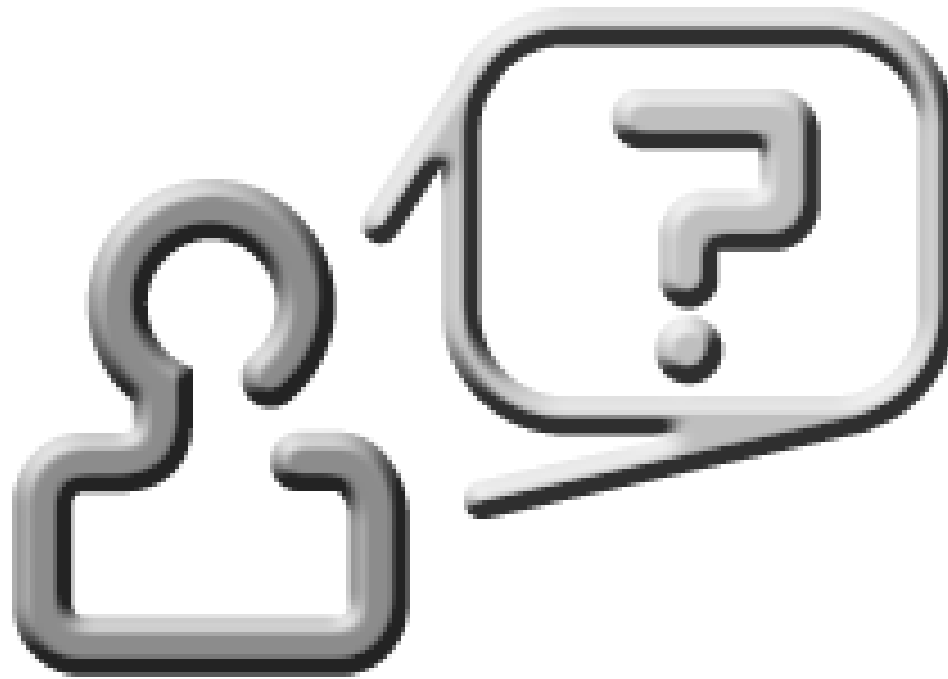


On-Road

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QUESTIONS



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